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BOTANICAL SOCIETY OF AMERICA

From July 7 through 11, Botany took Chicago by storm with the biggest botanical event on the continent since the St. Louis International Botanical Congress eight years ago. It was also the first time in three decades that the American Society of Plant Physiologists (now Plant Biologists) met with the Botanical Society. Many of the meeting highlights and awards are summarized in the "News from the Society" section.

The real highlights of this issue, however, are our two feature articles. The first is a brief history of botany at one of our premier institutions – Cornell University. This is an expansion of the paper Lee Kass gave last year at our Centennial Meeting in Chico. I found it fascinating and asked Lee to share her work with an article for *Plant Science Bulletin*. What botany department would be better to feature in these pages than the one that gave the Society its first President, George F. Atkinson in 1907, and will serve us with our next President (Karl J. Niklas, President-elect, 2007) one hundred years later? In addition to writing, revising, and re-revising this article, Lee took the time to organize an excellent and well-attended symposium on Botany in Chicago at this year's meeting. We hope to feature many of the presentations from this symposium in future issues.

Our second article also features a premier botany department. While the department of Botany and Microbiology at the University of Oklahoma has not had the same historical impact on Botany as Cornell, in recent decades it has provided invaluable leadership to the Society as we made the transition to running independent meetings and creating a professional business model. Wayne Elisens was our program director (1997-1999) as we moved from meeting annually with AIBS to running independent BOTANY meetings and Scott Russell was our first web-master and President 2002-3 during the period of hiring an executive director and establishing the business office in St. Louis. But that is not the story for now. In 2001 Gordon Uno (who chairs the Society's Education Committee) became chair of the Department at Oklahoma and began a concerted effort to strengthen and grow the botanical component of this dual department. In our second feature Gordon shares some of the strategies he employs, and concerns he sees, for building botany in colleges and universities today.

-Editor

Landmarks and Milestones in American Plant Biology: The Cornell Connection

ABSTRACT: Cornell University faculty, staff, students, graduate students and post-docs made landmark contributions to American plant biology. Twenty-four were recognized by their election to the U.S. National Academy of Sciences (Sections of Botanical Science, Chemistry or Genetics). Four who studied plants were recognized with a Nobel Prize (J.B. Sumner, G.W. Beadle, R. Holley, B. McClintock); eighteen served as President of the Botanical Society of America (BSA); twenty were BSA Merit Award winners and five received BSA Centennial Awards. The landmarks and milestones of Cornell "botanists" are presented.

Introduction

The Botanical Society of America's Centennial in 2006 inspired us to examine the contributions made to American plant biology by Cornellians in the years since William Trelease (Cornell BS 1880) chaired the organizing committee and became President of the antecedent Botanical Society of America (BSA) (1895-1905). Colleagues, who attended our presentation at the BSA Centennial in Chico, California (Kass 2006), encouraged us to

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publish an account of our findings to catalyze faculty and students at other colleges and universities to examine the contributions of botanists at their institutions. We are pleased to have the opportunity to do so in the *Plant Science Bulletin*, co-founded by Harriet Creighton—Cornellian and past BSA president (1956) (Kass 2005).

When the current BSA was reorganized in 1906, from three pre-existing organizations (Smocovitis 2006), Cornell Professor of Botany George F. Atkinson (Cornell PhB 1885) was elected its first President (1907, Table 1). From the time Cornell University opened its doors in 1868, faculty and students in the Department of Botany have made pioneering contributions to American plant biology. This is reflected in Ewan's (1969) *Short History of Botany in the United States*, published on the occasion of the Eleventh International Botanical Congress, held in Seattle, Washington. (It was the second time the congress occurred in the United States in over 40 years.) Interestingly, Cornell University had hosted the Fourth International Congress of Plant Sciences in Ithaca, New York in 1926, the first year it was held in the Americas (Kass 1999). L.H. Bailey (appointed first Professor of Horticulture at Cornell in 1888) was concurrently President of the Congress, the AAAS, and the BSA in that year (Table 1).

An examination of the biographical entries in *American Men of Science* (*AMS*), from its first publication in 1906 through the seventh edition in 1944, also provided context for this study. James McKeen Cattell published and edited this directory of scientists and prefixed a "star" (*, asterisks) by the "subject of research for about 1000 of the entries." In 1906 he noted, "The star means that the subject of the biographical sketch is probably among the leading thousand students of science of the United States; but its absence does not necessarily mean that the subject of the sketch does not belong in that group." Cattell continued to assign new stars to approximately 250 men and women of science in each of the five later volumes, and his son Jacques (Cattell 1944a, b) continued the practice through the seventh edition, 1944, the year of his father's death. In editions five through seven (1933-1944), an index number after the star indicated the edition of the book in which the first star was assigned. Cattell identified the most "eminent American Scientists of the day" and these scientists used his stars to order themselves, thus his system played a "major role in the American Scientific community" (Sokal 1995). Another perspective on the highly coveted "star" is offered by Rossiter (1982, p. 289), "There were two awards whose value was apparent to all in the 1920s and 1930s: a 'star' in the *AMS*, and the supreme accolade, the Nobel Prize." Although women had won suffrage by the 1920s, they were clearly concerned about their opportunities for advancement and employment, yet few stars were affixed to women in botany during these years. Only six women were starred in botany between 1906 and 1944 (Rossiter 1982, p 293); two were Cornellians and one of these won an unshared Noble Prize in 1983.

Although Cornell botanists made many contributions before 1906, in the interest of brevity, and in celebration of the BSA Centennial, we begin our story with Atkinson and concentrate on Cornell's Departments of Botany and herbaria; reserving the extensive contributions of Cornell's earlier botanists for another time.

Contributions from Cornell's First Notable Department of Botany (1868-1921)

Prentiss and Atkinson's Department of Botany

George F. Atkinson (1854-1918), first president of the reorganized BSA, studied with Albert N. Prentiss, Cornell's first Professor and Chair of Botany (1868-1896). Prentiss had also influenced students who studied the local flora (David Starr Jordan, Cornell's

first MS 1872; William R. Dudley, Cornell BS 1874, MS 1876), and inspired many who became notable botanists (Joseph C. Arthur, Cornell DSc 1886; Frederick V. Coville, Cornell AB 1887; W.R. Dudley; Charles F. Millspaugh, in residence 1871-73; Willard W. Rowlee, Cornell BL 1887, DSc 1893; and W. Trelease) (Tables 1, 2, 3).

Atkinson replaced William R. Dudley (1849-1911), who had been an undergraduate instructor at Cornell (1874) and the first Assistant Professor in its Department of Botany (1876-1883). David Starr Jordan, the department's first instructor in botany, became the founding president of the newly established Leland Stanford Jr. University, where he appointed Dudley as one of their first professors of Botany in 1892. (Most of Dudley's herbarium followed him to Stanford and is currently at CAS). Upon the death of Prentiss in 1886, Atkinson became head of Cornell's Department of Botany, until his death in 1918. That same year, Atkinson was elected to the US National Academy of Sciences (NAS) (Table 2). Within a few years, his former department (by then in the College of Arts and Sciences) would close and the New York State College of Agriculture's (NYSCA) Department of Botany (established in 1913) would continue Cornell's pioneering contributions (see below).

Distinguished for his research with fungi, Atkinson was also a respected teacher of General Botany and Zoology. He encouraged young botanists, both male and female. Three of his more notable students were Elias J. Durand (Cornell AB. 1893, ScD. 1895), Benjamin M. Duggar (1872-1956; Cornell PhD 1898) and Margaret Clay Ferguson (1863-1951; Cornell AB 1899, PhD 1901), all of whom were starred in *AMS* (Table 3).

Duggar, instructor (1896-1900) and assistant professor (1900-1901) in Cornell's Department of Botany, would soon head the first Department of Plant Physiology (1907-1912) in the NYSCA at Cornell. He was appointed by L.H. Bailey, who had succeeded Isaac P. Roberts as Dean of the College of Agriculture (1903) and had secured funds from New York State to establish the New York State College of Agriculture at Cornell University in 1904. Plant Physiology merged with the new Department of Botany (established 1913), when Duggar left Cornell for Washington University, in St. Louis, Missouri. Duggar was awarded a star in Plant Physiology in the first edition of *AMS* (1906, Table 3) and published the first text on the subject of *Fungous Diseases of Plants* in 1909. He was President of the BSA (1923), General Secretary and Chairman of the Executive Committee for the Fourth International Congress of Plant Sciences (1926), and edited its Proceedings (Duggar 1929). In 1948, at age 71, Duggar reported the first broad-spectrum antibiotic, Aureomycin, produced by *Streptomyces aureofaciens*. At the 1956 Golden Jubilee celebration of the BSA, Duggar, along with four other Cornellians, received one of the society's first Merit Awards (Table 4). He was acknowledged for outstanding research in plant physiology, plant pathology, and mycology, and for providing inspiration, and high standards of scholarship to many students.

One of those students, Margaret C. Ferguson, while pursuing a doctorate in botany with Atkinson, had also conducted a study of the common edible mushroom under the direction of Duggar, during 1900-1901. In 1902, she published the first successful method for germinating spores of *Agaricus campestris*. Previously, French scientists held the secret for successful germination of this fungus. Starred in Botany in the second edition of *AMS* (1910), Ferguson was also the first woman elected Vice President of the BSA (1922) and the first woman elected its President in 1929. She was head of the Botany Department of Wellesley College, Wellesley, Mass., and encouraged many students to become botanists. Harriet B. Creighton, for example, was awarded a graduate assistantship in Cornell's Department of Botany, in 1929, on Ferguson's recommendation (Kass 2005).

Contributions from Cornell's NYS College of Agriculture: Department of Botany (1913-1964) & L.H. Bailey Hortorium (1935-1999)

More Notable Botany Departments

Liberty Hyde Bailey(1858-1954), as Dean (1903-1913) of the NYSC at Cornell, established many new departments related to botanical sciences and served as the Director of the Cornell Agricultural Experiment Station until 1913. Dean Bailey appointed former students and colleagues, from Cornell and elsewhere, to professorships in his newly established departments (Coleman 1963; also see below). Bailey reported the first detailed study of plant growth under artificial light (1893). He published over 1,000 articles and technical and popular books, the more influential being his *Standard Cyclopedia of Horticulture* (1914-1917), *Manual of cultivated plants* (1924, 1st ed.; revised 1949), and *Hortus Second* (1941) with his daughter Ethel Zoe Bailey (1889-1983). *Hortus Third* (1976) was revised and expanded by the staff of the L.H. Bailey Hortorium. In addition to serving as an officer of the BSA (Table 1), Bailey was also honored with a star in botany in the first edition of *AMS* (1906), and elected to the NAS in 1917. In 1935, at Cornell University, Bailey and his daughter Ethel Zoe

established the L.H. Bailey Hortorium (BH), one of the first U.S. herbaria of cultivated plants, and, by the 1950s, one of the foremost palm herbaria of the world. Bailey was the Hortorium's first director and daughter Ethel Zoe was appointed the first curator.

One of Bailey's final duties as dean of the NYSCA was to recall Professor Karl McKay Wiegand (1873-1943) from Wellesley College in 1913, to head the newly established Department of Botany in the NYSCA, and to invite Rollins Adams Emerson to head the Department of Plant Breeding (1914), which Bailey had established in 1907 (with H.J. Webber as its first head). Wiegand had earned his PhD at Cornell in 1898 and was appointed assistant then instructor there from 1894 through 1907. While there, he met and married Ella Maude Cipperly (Cornell AB 1904). Wiegand was then appointed Professor of Botany at Wellesley College (1907-1913) and was soon recognized with a star in Botany in the second edition of *AMS* (1910). He was elected President of the BSA in 1939.

Wiegand's Department of Botany

Wiegand hired many notable botanists (Figure 1) who brought honors to his department by their inspirational teaching, pioneering research, and technical and educational publications. The staff in Wiegand's newly established Department of Botany included Assistant Professor Lewis Knudson (who was transferred from the former Department of Plant Physiology, when Duggar left Cornell) and five instructors, among whom were: Arthur J. Eames, graduate of Harvard University (who was transferred from Atkinson's Department of Botany); Wiegand's spouse, Maude C. Wiegand, former Instructor in Botany at Wellesley College; Otis Freeman Curtis (Cornell PhD 1916), later assistant professor (1917) then professor (1922) of Plant Physiology, and William J. Robbins (Cornell PhD 1915) who later became Head of the Department of Botany at the University of Missouri, where he pioneered experiments on tissue culture. Soon after, Robbins became Dean of their Graduate School, later on Director of the New York Botanical Garden, and ultimately President of Fairchild Tropical Garden. In addition, Wiegand had six assistants; the most notable is Laurence H. MacDaniels (Cornell PhD 1917), who with Eames wrote an influential text in plant anatomy (Table 5). MacDaniels later served as head of Cornell's Department of Floriculture and Ornamental Horticulture (1940-1956).

Figure 1. Cornell's Department of Botany Faculty (1931)
Top row, left to right: Karl M. Wiegand, Walter C. Muenscher, E.M. Weller (visitor), Edwin F. Hopkins, R.B. Thompson (visitor), Lester W. Sharp.
Bottom row, left to right: Arthur J. Eames, Loren C. Petry, Donald Reddick, Otis F. Curtis. (Courtesy of L.H. Bailey Hortorium Archives)

Wiegand's first research project at Cornell was to continue his graduate student project, a study of the local flora, in collaboration with A.J. Eames (1881-1969), and in cooperation with graduate students, staff, and other faculty members. This resulted in The Flora of the Cayuga Lake Basin, New York (1925, Table 5), which was an expansion of Dudley's (1886) Cayuga Flora published 40 years previously. The plant specimens that Wiegand's group collected were an important resource for documenting the local flora, and the NYSCA Department of Botany Herbarium was an outcome of this project. When Atkinson's former department was closed, around 1921, Wiegand arranged for the transfer of the previous Department of Botany herbarium [based originally on the important collections of Horace Mann Jr. (1844-1868)] to the NYSCA Department of Botany. Wiegand then merged his department's herbarium with the earlier herbarium to form CU (named Wiegand Herbarium, in 1951, after Wiegand's death in 1942). In 1977, the herbaria of CU and BH were merged. Thus Cornell's world-renowned herbaria—The original Cornell University Herbarium, The Wiegand Herbarium, and The Bailey Hortorium Herbarium—were finally one.

One of Wiegand's more notable students, Bassett Maguire (Cornell PhD 1938), later a staff member of the New York Botanical Garden, directed the first of 42 expeditions to the sandstone Guayana Highland of northern South America (Howard and Moon 1990).

Eames was soon recognized with a star in Botany in the fourth edition of *AMS* (1927). He served the BSA as secretary (1927-1931), Vice President (1932), and President (1938), and was honored with one of the first BSA Merit Awards (1959) for his "sustained researches on the morphology and

anatomy of vascular plants and for his noteworthy contributions to our knowledge of floral development and evolution." One of Eames' notable students is Natalie Browning Whitford (Cornell MS 1943, PhD 1947) (see Natalie W. Uhl below).

The staff of Wiegand's Department of Botany was enlarged with appointments of notable botanists, Jacob R. Schramm, Loren C. Petry, Walter C. Muenscher, and Lester W. Sharp. Schramm (1885-1976) joined Wiegand's department in 1915 as Assistant Professor of Botany (Professor 1917-1925). He was editor-in-chief of Botanical Abstracts from 1921-1925 and founder and first editor-in-chief of Biological Abstracts [now Biosis] (1924-1937), first issued in December 1926. Schramm had been secretary of the BSA (1918-1922), elected Vice President (1923) and later its President in 1925. He was starred in Botany in the third edition of AMS (1921) and was honored with the Botanical Society of American's Merit Award (1969) for his studies of the "ecology of the black mining wastes of the Pennsylvania anthracite region," and for his work as editor of Biological Abstracts.

Petry (1887-1979), a paleobotanist and distinguished teacher, was hired at Cornell in 1925. Vice-President of the BSA in 1937, and starred in Botany in the sixth edition of AMS (1938), he was also honored with a BSA Merit Award as an "unusually effective botanical teacher, who has skillfully guided the careers of thousands of students in the right direction, and a wise and generous counselor in scientific affairs" (Tables 1, 3, 4). Petry's most notable student was Harlan P. Banks (Cornell PhD 1940) (see below).

Muenscher (1891-1963, Cornell PhD 1921), known as the "Wizard of Weeds," and an eminent American scientist (Table 3), received a BSA Merit Award in 1960 for "many distinguished contributions, especially his books on weeds, aquatic plants, poisonous plants and garden herbs (Table 5). His lifelong devotion to all phases of botany has stimulated the lives and careers of his numerous students." Many readers of this article may recall keying out their first early spring wild flowers or woody plants using Muenscher's books.

Sharp (1887-1961), a graduate of the University of Chicago, joined Wiegand's department as an instructor in 1914 (Professor in 1920). Sharp was the major professor of Barbara McClintock (Cornell BS 1923, MA 1925, PhD 1927; Nobel Laureate 1983), and Harriet Creighton (Cornell PhD 1933), and was on the PhD committees of R.A. Emerson's students, George W. Beadle (Cornell PhD 1930; Nobel Laureate 1958) and Marcus M. Rhoades (Cornell PhD 1932).

Two years after McClintock arrived at Cornell, Sharp published the first edition of his world-renowned textbook, Introduction to Cytology (1921). McClintock, who would become Sharp's most notable graduate student and the Department of Botany's most famous alumna, used this text while enrolled in Sharp's cytology class the same year it was issued. The third edition of Sharp's cytology book (1934) included unpublished research of his distinguished students, McClintock and Creighton. Sharp's keen wit and non-conformist outlook produced such works as Eoörnis pterovelox gobiensis (1928), a spoof on scientific inquiry and pompous investigators, and A Nuclear Century (1931) his poetic address upon retiring as BSA President (Table 1, see Kass 2005). Sharp served as Secretary of the 1926, Fourth International Congress of Plant Sciences Program Committee (Schramm was Chair) and was a member of the Executive Committee. Within a few years he was elected Vice President (1929) and President (1930) of the BSA, and was a member of the editorial board of the American Journal of Botany (1932-1937). He was awarded a star in Botany, in the fourth edition of AMS (1927), and was honored with a BSA Merit Award (1958) for his contributions, which "made plant cytology a significant field of botany."

Cooperation with Emerson's Department of Plant Breeding:Golden Age of Plant Cytogenetics at Cornell

Many students majoring in other departments at Cornell studied with faculty in the Department of Botany; most notable were students who came to work with R.A. Emerson (1873-1947), head of Cornell's Plant Breeding Department (1914-1942). Emerson had established a school of plant genetics at Cornell, a milestone comparable to T.H. Morgan's school of Drosophila genetics at Columbia University (Kass, Bonneuil & Coe 2005). Barbara McClintock (1902-1992), as an instructor in the Department of Botany (1927-1931), provided guidance and leadership to Emerson's students, G.W. Beadle, M.M. Rhoades, and post-doctoral National Research Council Fellow Charles R. Burnham (1929, 1930) (Figure 2), and in her own department to H.B. Creighton (see also Kass 2007). Rhoades, a 1962 BSA Merit Awardee, and a student in Plant Breeding and Botany at Cornell during the Golden Age of maize genetics, has reviewed the cooperative efforts that this group of students had made towards furthering the field of plant cytogenetics (Rhoades 1984, Kass **& Bonneuil 2004).**

We will mention only a few of McClintock's landmark publications, which Rhoades (1984) emphasized (see Kass & Bonneuil 2004). While McClintock was still a graduate student, she and L.F. Randolph (Cornell PhD 1921) published the first report of a

Figure 2. Maize Researchers, Cornell University Emerson Garden, 1929
Left to right: Charles R. Burnham (National Research Council Fellow), George W. Beadle (kneeling, PhD 1930), Marcus M. Rhoades (PhD1932), Professor Rollins A. Emerson (Head, Department of Plant Breeding), Instructor Barbara McClintock (PhD 1927). (Courtesy of W.B. Provine)

triploid corn plant and described the behavior of its chromosomes (Randolph & McClintock 1926, see Kass 2003). By June of 1929, Instructor McClintock had published the first ideogram of corn chromosome morphology illustrating the 10 haploid chromosomes in the first mitotic division of the microspore (McClintock 1929; see Kass 2003). By 1930, McClintock had published the first cytological description of pachytene chromosomes in corn; the movement of the chromosomes (in a translocation heterozygote) provided an explanation for semi-sterility in a strain of corn plants that Burnham had brought with him from Wisconsin. With botany student Henry E. Hill, McClintock published the first paper linking a gene to a chromosome in corn, using cytological methods and trisomic ratios (McClintock & Hill 1931, see Kass & Bonneuil 2004).

But McClintock's most noted early contribution is the paper she published with graduate student Harriet Creighton in 1931, on the first demonstration of crossing over at the cytological level (McClintock 1931, Creighton and McClintock 1931, see Kass 2005). Creighton's crossing-over paper was the basis for her PhD dissertation (1933), which was suggested by McClintock. Their landmark study provided additional proof for T.H. Morgan's chromosome theory of heredity, for which he won a Nobel Prize in 1933 (Coe & Kass 2005).
Creighton (1909-2004) left Cornell in 1934 and later became head of the Botany Department at Wellesley College. She retired as Ruby F.H. Farwell Professor Emerita. Creighton was the third woman President of the BSA in 1956 (Vice-President, 1955), and the first woman elected secretary of the BSA (1950-1954). She was editor of the Plant Science Bulletin (1958) and made many behind-the-scenes contributions to botanical education. Even after retirement, she was recognized for her contributions to botanical science with the Large Gold Medal of the Massachusetts Horticultural Society (1985) (Kass 2005).

More notable plant scientists

Even before McClintock was recognized for her Nobel Prize winning research, she was starred in Botany in AMS (1944) and, soon after her major papers on mobile genetic elements and gene expression were published, the BSA honored her with their 1957 Merit Award (Kass 2007). In addition to McClintock and those students mentioned previously, the Department of Botany boasts many other influential and prominent students of the botanical sciences. For example, in 1934, Adriance S. Foster (Cornell BS 1923, see Hirsch & Kirchanski 2006) became the first plant anatomist in the newly reorganized Department of Botany, University of California, Berkley; Sterling Emerson (Cornell BS 1922), son of R.A. Emerson, became Professor at the California Institute of Technology and a member of the NAS; Chester A. Arnold (Cornell PhD 1928) was Curator of Fossil Plants at University of Michigan; Paul R. Burkholder (Cornell PhD 1929) pursued quantitative studies on auxins and was elected to the NAS in 1949; Stanley J. Smith (Cornell MS 1939) was Curator of Botany, New York State Museum, Albany, NY; Arthur W. Galston (Cornell BS 1940), Professor of Plant Physiology, Yale University, is the author of notable plant biology textbooks, and has made pioneering studies on plant hormones and plant growth and development; and Natalie W. Uhl, (Cornell PhD 1947), Professor Emerita, L.H. Bailey Hortorium, Department of Plant Biology, and a BSA Centennial winner, co-authored with John Dransfield (1987) the celebrated Genera Palmarum: A Classification of Palms Based on the Work of Harold E. Moore, Jr., recently revised (in press). Furthermore, in addition to Creighton, Cornellians served as Secretary of the BSA (Table 1).

Expansion of Cornell's Department of Botany

Soon, other professors joined Cornell's Department of Botany and made notable contributions to their fields. Among these was Daniel Grover Clark (Cornell PhD 1936) who with O.F. Curtis authored a well-known textbook on plant physiology (Table 5). Harlan P. Banks succeeded Petry in 1949 and became head of the department after Knudson stepped down in 1952. Banks authored many influential publications in the field of paleobotany, concentrating on the evolutionary history of early land plants (Banks 1970). He served as BSA

President and Treasurer (Table 1), received a BSA Merit Award (1975) for distinguished teaching of undergraduate and graduate students and for numerous contributions to our knowledge of early land vegetation, and was elected to the NAS (Table 2). Frederick C. Steward, first to show that a single cell from a vegetative plant can be cultured to produce a whole plant, joined the department in 1950, was elected to the Royal Society (the national academy of sciences of the UK) in 1957, and honored with a BSA Merit Award (1961). (McClintock was elected a Foreign Member of the Royal Society, in 1989.) Tables 1-4 include additional Cornell plant scientists or geneticists who have made notable contributions to their fields. A few share joint appointments in the current Department of Plant Biology (see below).

A New Vision for Botany at Cornell: A Department of Plant Biology

With the creation of a Division of Biological Sciences within NYSCA at Cornell in 1964, members of the Department of Botany, which Bailey had established in 1913, joined with a few faculty members from the Departments of Zoology and Plant Breeding to form a new unit called the Section of Genetics, Development and Physiology (GDP, established 1965; and CU herbarium became a separate unit within NYSCA; Table 6); Cornell's formerly distinguished Department of Botany had disappeared! In 1965, Barbara McClintock returned to this new Section as one of the first Andrew Dickson White Visiting Professors-at-Large. She visited the campus once or twice a year for the next 10 years, hosted by geneticists Adrian M. Srb, Bruce Wallace (Table 2) and Section Chair Harry Stinson.

New faculty interested in plant growth and development soon joined the Section (we mention only a few)—Andre T. Jagendorf (Cornell BS 1948; hired 1966), L.H. Bailey Professor Emeritus, was responsible for discoveries on biochemical reactions in photosynthesis; he provided experimental evidence for hydrogen ion gradients across membranes as an energy intermediate, a hypothesis proposed by Mitchell (and for which Mitchell was awarded a Nobel Prize). Roderick K. Clayton, who unraveled mysteries of how light energy is trapped, joined the Section in the same year (retired 1983). Jagendorf and Clayton were elected to the NAS (Table 2). Recently (July 2007), Jagendorf received one of the first Fellow of the American Society of Plant Biology (ASPB) Awards, granted in recognition of distinguished and long term contributions to plant biology and service to the Society. In 1977, the name of the Section of GDP was changed to Botany, Genetics and Development (BGD), which more accurately reflected the interests of its members (and CU herbarium merged with BH herbarium; see Table 6). Earlier (1971), NYSCA had been renamed The New York State College of Agriculture and Life Sciences at Cornell (CALS). By 1980, the Section was separated into a Section of Plant Biology and a Section of Genetics and Development. New faculty members were recruited for positions in the Section of Plant Biology. Karl J. Niklas, L.H. Bailey Professor, was hired to fill the position vacated by Banks in 1978. Niklas, former editor-in-chief of the *American Journal of Botany* (1995-2004) and a BSA Merit Award winner (1996), authored several books including *The Evolutionary Biology of Plants* (1997) and recently received a BSA Centennial Award. He is currently BSA President elect (Table 1). June B. Nasrallah, who had received her PhD (1977) in the former Section of Genetics, Development and Physiology, with Professor Adrian M. Srb (a former student of G.W. Beadle), was hired in 1985. J. Nasrallah was recently elected to the NAS for her exemplary studies on self-incompatibility in *Brassica*, joining other Cornell plant biologists who have received such distinction (Table 2). She occupies the first Barbara McClintock Professorship in the Department of Plant Biology (CALS).

The Legacy of Liberty Hyde Bailey

When the Division of Biological Sciences was dissolved in 1999, the Section of Plant Biology and the L.H. Bailey Hortorium Herbarium were joined. The circle was completed and Cornell's Departments of Botany and herbaria were once again united in a single Department of Plant Biology (Table 6), currently chaired by William L. Crepet, a recent BSA Merit Awardee.

Cornell's Notable Botanists

Nobel Laureates

At the 1957 BSA Banquet, retiring President Harriet Creighton suggested that we make clear that botany includes the study of all plants and that we "call ourselves botanists with some pride in our voices." We are proud to recognize four Nobel Laureate Cornellians who have made major contributions to science using plants as their research organisms. (We remind our readers that fungi were still considered plants until 1968.) Barbara McClintock received an unshared Nobel Prize in Physiology or Medicine (1983) for her "discovery of mobile genetic elements" (Indian corn); George W. Beadle, shared a Nobel Prize in Physiology or Medicine (1958) for the "discovery that genes act by regulating definite chemical events" (Bread mold); Robert W. Holley (Cornell PhD 1947) shared a Nobel Prize in Physiology or Medicine (1968) for the "interpretation of the genetic code and its function in protein synthesis" (yeast); and James B. Sumner shared a Nobel Prize in Chemistry (1946) "for his discovery

that enzymes can be crystallized" (Jack Bean meal).

It is interesting to note that Sumner's first publication of the crystallization of urease extracted from Jack Bean meal [*Canavalia ensiformis* (L.) DC], in 1926, provided a further demonstration that the urease enzyme is a protein. His work was based on the research of his graduate student Viola Arvin Graham, who provided the initial *Experimental proof of the protein nature of urease* for her PhD (1925), awarded the previous year. In his Nobel Prize acceptance speech, Sumner acknowledged the collaborative efforts of "V.A. Graham," giving no indication that Graham was a woman.

Cornellian-National Academy of Sciences members, BSA Merit/Centennial Awardees and American Men of Science Honorees

Between 1902 and 2003 a considerable number of Cornellians, who conducted research with plants, were elected to the United States NAS (Table 2). In the early years, members were elected to specific sections of the NAS (i.e. Botany) on recommendations from Academy members in that section. Many academy members were also former officers of the BSA (Table 1) and were starred in AMS (Table 3).

The Botanical Society of America celebrated its 50th Golden Jubilee Anniversary in 1956, by awarding Certificates of Merit to 50 botanists in all botanical fields. As BSA President in 1956, Harriet Creighton presented these honors to four former Cornellians: B.M. Duggar, A.J. Eames, W.J. Robbins, and G.W. Beadle. In that year, a study based on the seventh edition of AMS (1944) revealed that Cornell University ranked in the top three American Universities in graduating PhDs in Botany (Greulach 1956). Sixteen percent of the botanists newly starred in the seventh edition of AMS, had graduated from Cornell University (Table 3, see Cattell 1944).

In the second 50 years of the BSA, 16 additional Cornellians were presented with BSA Merit Awards (Table 4). And in 2007, a Cornell University plant biologist has been privileged to accept this tribute (Table 4). The 100th anniversary of the BSA was celebrated at BOTANY 2006, in Chico, California, with 100 plant biologists receiving Centennial Awards. Five Cornellians were so honored: W. Hardy Eshbaugh (Cornell BA 1959), Jack B. Fisher (Cornell BS 1965, MS 1966), Karl J. Niklas, Dominick J. Paolillo, Jr. (Cornell BS 1958), and Natalie W. Uhl (Cornell PhD 1947), (Figure 3). We are also proud that V. Betty Smocovitis (Cornell PhD 1988), the BOTANY 2006 keynote speaker and botanical historian, received her botanical training in Cornell's Section of Plant Biology.

We can conclude that modern plant taxonomy has caused a diaspora for the former plant kingdom, having some of its past members now dispersed throughout other kingdoms of the natural world. Yet, as Creighton suggested, we can still be proud of all researchers who work with plants, fungi, and bacteria (and study their history), even though they may not currently consider themselves *Botanists*.

Figure 3. BSA Centennial Award winners with William L. Crepet, Chair of their Department of Plant Biology, Cornell University. Left to right: Dominick J. Paolillo, Jr., W.L. Crepet, Karl J. Niklas, and Natalie W. Uhl. (photo by Ed Cobb, 9 June 2007)

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Table 1. Cornellians who served as Officers of the Botanical Society of America (1907-present)

President:

George F. Atkinson	1907
William Trelease	1918
Joseph C. Arthur	1919
Benjamin M. Duggar	1923
Jacob R. Schramm	1925
Liberty H. Bailey	1926
Margaret C. Ferguson	1929
Lester W. Sharp	1930
C. Stewart Gager	1936
Arthur J. Eames	1938
Karl M. Wiegand	1939
William J. Robbins	1943
Adriance S. Foster	1954
Harriet B. Creighton	1956
Arthur W. Galston	1968
Harlan P. Banks	1969
W. Hardy Eshbaugh	1988
Karl J, Niklas (President Elect 2007)	2008

Treasurer:

Harlan P. Banks	1965-1967

Vice-President:

Benjamin M. Duggar	1912
Benjamin M. Duggar	1914
Margaret C. Ferguson	1922
Jacob R. Schramm	1923
Lester W. Sharp	1929
Arthur J. Eames	1932
Karl M. Wiegand	1935
Loren C. Petry	1937
William J. Robbins	1938
Paul R. Burkholder	1945
Adriance S. Foster	1948
Harriet B. Creighton	1955
Arthur W. Galston	1967
Harlan P. Banks	1968

Secretary:

Jacob R. Schramm	1918-1921
Arthur J. Eames	1927-1931
Loren C. Petry	1933-1936
Paul R. Burkholder	1940-1944
Harriet B. Creighton	1959-1954

Table 2. Cornellian members of the U.S. National Academy of Sciences (affiliated with plant sciences at Cornell).

William Trelease	1902	Paul R. Burkholder	1949
Liberty H. Bailey	1917	Robert W. Holley	1967
George F. Atkinson	1918	Adrian M. Srb	1968
Benjamin M. Duggar	1927	George F. Sprague	1968
Rollins A. Emerson	1927	Sterling H. Emerson	1970
Lewis J. Stadler	1938	Bruce Wallace	1970
William J. Robbins	1940	Roderick K. Clayton	1977
George W. Beadle	1944	Harlan P. Banks	1980
Barbara McClintock	1944	Andre T. Jagendorf	1980
Milislav Demerec	1946	Gerald R. Fink	1981
Marcus M. Rhoades	1946	Steven D. Tanksley	1995
James B. Sumner	1948	June B. Nasrallah	2003

Table 3. Cornellians recognized as eminent plant scientists in American Men of Science (1906-1944) and first honored with a Star in Botany (or related fields of [1]Agriculture, [2]Plant Physiology, [3]Mycology or [4]Plant Pathology).

Joseph C. Arthur	1906	Margaret C. Ferguson	1910
George F. Atkinson	1906	Karl M. Wiegand	1910
Liberty H. Bailey [1]	1906	Rollins A. Emerson	1921
Frederick V. Coville	1906	Jacob R. Schramm	1921
William R. Dudley	1906	Herbert H. Whetzel [4]	1921
Benjamin M. Duggar [2]	1906	Arthur J. Eames	1927
Elias J. Durand [3]	1906	Lewis Knudson	1927
Beverly T. Galloway	1906	Lester W. Sharp	1927
William A. Kellerman	1906	Otis F. Curtis	1933
Charles F. Millspaugh	1906	William J. Robbins	1933
Williard W. Rowlee	1906	Loren C. Petry	1938
Mason B. Thomas	1906	Paul R. Burkholder	1944
William Trelease	1906	Adriance S. Foster	1944
Herbert J. Webber [2]	1906	Barbara McClintock	1944
C. Stuart Gager	1910	Walter C. Muenscher	1944

Table 4. Cornellians honored with Botanical Society of America Merit and Centennial Awards (http://www.botany.org/awards_grants/detail/bsamerit.php).

Merit Awards:			
George W. Beadle	1956	Bassett Maguire	1990
Benjamin M. Duggar	1956	W. Hardy Eshbaugh	1992
Arthur J. Eames	1956	Karl J. Niklas	1996
William J. Robbins	1956	Dominick J. Paolillo, Jr.	1998
Barbara McClintock	1957	Jack B. Fisher	2003
Lester W. Sharp	1958	William L. Crepet	2007
Loren C. Petry	1959		
Walter C. Muenscher	1960	Centennial Awards:	
Frederick C. Steward	1961		
Marcus M. Rhoades	1962	W. Hardy Eshbaugh	2006
Jacob R. Schramm	1969	Jack B. Fisher	2006
Arthur W. Galston	1970	Karl J. Niklas	2006
Harlan P. Banks	1975	Dominick J. Paolillo, Jr.	2006
David W. Bierhorst	1979	Natalie W. Uhl	2006

Table 5. Landmark Books in Botanical Sciences by Cornell Faculty in the Department of Botany (1913-1964), New York State College of Agriculture.

SHARP, L.W. 1921 (1st ed.). Introduction to Cytology. McGraw-Hill Book Co, Inc. NY (2nd ed. 1926; 3rd ed. 1934)
MUENSCHER, W.C. 1922 (1st ed.). Keys to Woody Plants. Cornell Publications Printing Co., Ithaca, NY (6th ed. 1950, expanded by E.A. Cope, 2001)
EAMES, A.J. and L.H. MacDANIELS. 1925 (1st ed.). An Introduction to Plant Anatomy. McGraw-Hill Book Co, Inc. NY (2nd ed. 1947)
WIEGAND, K.M. and A.J. EAMES. 1925 (issued 1926). The Flora of the Cayuga Lake Basin. Cornell University Agricultural Experiment Station Memoir 92. Ithaca, NY (Additions and Corrections 1939)
MUENSCHER, W.C. and L.C. PETRY. 1928 (1st ed.). Keys to Spring Plants. W.C. Muenscher, Ithaca, NY (7th ed. ca. 1976)
MUENSCHER, W.C. 1935 (1st ed.). Weeds. The Macmillan Co. New York, NY (2nd ed. 1955, revised 1980, with new forward and appendices by Peter A. Hyypio)
CURTIS, O.F. 1935 (1st ed.). The Translocation of Solutes in Plants. McGraw-Hill Book Co, Inc. NY
EAMES, A.J. 1936 (1st ed.). Morphology of Vascular Plants, Lower Groups. McGraw-Hill Book Co, Inc. NY
MUENSCHER, W.C. 1939 (1st ed.). Poisonous Plants of the United States. The Macmillan Co. New York, NY (revised ed. 1951)
SHARP, L.W. 1943 (1st ed.). Fundamentals of Cytology. McGraw-Hill Book Co, Inc. NY
CURTIS, O.F. & D.G. CLARK. 1950 (1st ed.). Introduction to Plant Physiology. McGraw-Hill Book Co, Inc. NY
EAMES, A.J. 1961 (1st ed.). Morphology of the Angiosperms. McGraw-Hill Book Co, Inc. NY
KINGSBURY, J.M. 1964. Poisonous Plants of the United States and Canada. Prentice-Hall, Englewood Cliffs, NJ

Table 6. Brief Chronology of Botany Departments & Herbaria at Cornell University (1868-1999)

1865	Cornell University, founded
1868	Cornell University, opened
1868	Original Department of Botany, Cornell University (1868-1922)
	Albert N. Prentiss, Head (1868-1896)
	George F. Atkinson, Head (1896-1918)
	Willard W. Rowlee Head (1918-1922)
1870	Original Department of Botany Herbarium established, based on collections of Horace Mann, Jr.
1904	Cornell University College of Arts and Sciences established; Department of Botany, including its herbarium, housed in this college
1904	New York State Legislature established the College of Agriculture at Cornell (1904),
	L.H. Bailey, Dean (1903-1913), NYS College of Agriculture at Cornell (NYSCA)
1907	Department of Plant Breeding, established by Bailey
	Department of Plant Physiology (1907-1912), established by Bailey
1913	Department of Botany (1913-1964), established by Bailey,
	Karl M. Wiegand, Head (1913-1941)
	Department of Plant Physiology fused with Department of Botany
1920s	College of Arts and Sciences Herbarium joined with NYSCA Department of Botany Herbarium
1935	L.H. Bailey Hortorium Herbarium, established as an Independent unit of NYSCA
1951	Department of Botany herbarium named Wiegand Herbarium
1964	Division of Biological Sciences (DBS) (1964-1999), established within NYSCA
1965	Section of Genetics, Development and Physiology (GDP, 1965-1977; DBS)
	Wiegand Herbarium (1965-1977) becomes Independent Unit within NYSCA, R.T. Clausen, Curator
	Laboratory of Cell Physiology, Growth & Development (1965-1973) becomes Independent unit within NYSCA,
	F.C. Steward, Head
1971	NYSCA renamed College of Agriculture and Life Sciences at Cornell (CALS)
1977	GDP name changed to Section of Botany, Genetics & Development (BGD, 1977-1980; DBS)
	Bailey Hortorium and Wiegand Herbarium merge, become a unit within DBS/CALS (1977-1999)
1980	BGD name changed to Section of Plant Biology (1980-1999; DBS/CALS)
1999	DBS and all its sections DISSOLVED
	DEPARTMENT OF PLANT BIOLOGY, CALS (formed from previous Section of Plant Biology & joined with the L.H. Bailey Hortorium; W.L. Crepet, Chair)

The Struggle for Botany Majors

In the Fall Semester of 2001, when I became Chair of the Department of Botany and Microbiology at the University of Oklahoma, we had 11 Botany majors (and 291 Microbiology majors). After a long recruitment campaign, I'm happy to report that we currently have 40 majors. In addition, we have approximately 20 Botany minors who populate our courses. While the number of Botany majors still lags far behind that of Microbiology majors, I'm proud of this accomplishment but worried about the long-term future. In the next paragraphs I'll outline what I think has helped to increase the number of Botany majors in our Department, but I don't think there is anything surprising about our recruitment techniques—it's essentially about being proactive in engaging students multiple times in multiple ways.

At the University of Oklahoma, there is no planned Biology degree; students major in Botany, Microbiology, or Zoology, although they can construct an individualized Biology degree through the College of Arts and Sciences (only a handful of students ever use the individualized option). For years, we have had to explain our (Botany's) existence to the Regents of the State of Oklahoma who monitor the number of graduates in degree programs. While our Department has produced enough Ph.D.s in Botany to keep us out of the "low performance" category, we haven't had enough undergraduate majors or Masters degree students to keep us from having to report to the Regents about our attempts to recruit students.

What wasn't working in the past was an acceptance of "the way it was." Before I became Chair, if students wanted to major in Botany, great; if they didn't, that was the way it was. As a consequence, we had no formal activities to cultivate students who expressed interest in Botany. Also, for many years, when teaching assistants were assigned within the Department, I would first let other faculty choose graduate students they wanted as teaching assistants in their class. For my Introductory Botany course, I took the students who weren't chosen. While many of these students "last picked" were good teaching assistants, many were not because they had limited teaching experience or just weren't motivated or able to teach. Looking back, that arrangement made no sense in terms of recruitment; we were placing the best teaching assistants in laboratories with only 2 or 3 students instead of our basic class with hundreds of students (600-800 students per year). This Introductory Botany course satisfies a general education requirement in science (with a laboratory) but is also our "majors" Botany class.

Now, as part of our overall recruiting effort, I pick the TAs I think will best interact with undergraduate students—those TAs who are interested in teaching students and who might be good Botany ambassadors and role models with whom younger students can interact—and place them in the basic Botany course. TAs are now challenged to find students who would be good majors (based on interest and performance) and are encouraged to speak with undergrads on an individual basis about majoring in Botany. In fact, I establish a "quota" for all instructors in all our Introductory Botany courses—I expect instructors to talk with students who have shown some talent and interest in Botany. For most of our faculty (and all of our grad students), this was the first time they had ever thought about recruiting students. Many faculty were clueless about the need to recruit students to Botany; they had little understanding about how faculty positions at OU are awarded to those departments with high student enrollments.

We are also fortunate to have a finishing graduate student who is an excellent instructor and who really enjoys working with undergrads. More importantly, he is an advocate for Botany and a highly effective recruiter for students who aren't sure what major they would like to choose. We have placed this individual in basic lab courses and in our general interest courses, and he has proven to be an important source of new majors for us. In addition to this grad student, we have been fortunate to have three other TAs and two teaching postdoctoral fellows who were excellent recruiters—much better than faculty. These people are key to successful recruiting because undergraduates interact with them on a much more personal level than they do with faculty.

As another part of our strategy for increasing majors, we modified the requirements for our Botany major. For years, we had been teaching several general interest courses (Plant Care and Cultivation, Ecology and Environmental Quality, and Economic Botany). These are popular courses that students often take as a second course in Botany after gaining (or strengthening) their interest in plants in our basic course. However, none of these popular courses counted toward a Botany degree. In our new major, all three courses can be applied for major credit, however, students must still take traditional, lab-based, hard-core Botany courses to fulfill their degree (please see our website for information about our major requirements). The advantage is, of course, that students don't feel that they have wasted credit hours, and we capitalize on engaging students when they are one step closer to fulfilling degree requirements in Botany.

We also changed major support course requirements for the major. We used to require our students to take two semesters of physics, both four hours. All of our students found these eight hours to be very difficult and not particularly relevant to their Botany coursework or careers. Students often identified this two-semester series as one reason they chose not to major in Botany or dropped out of Botany. Botanists now require students to take one course in physics and one of the following: a second course in physics, a course in biochemistry, or a course in statistics. This option has provided great flexibility to our students who seem to appreciate the choices and who can now choose a second support course that may be more relevant to their future work.

Because we had hundreds of students taking our introductory Botany course each year, we had access to a huge pool of potential majors and minors, however, we never capitalized on this pool. We had a minor in Botany in place for many years, but we never emphasized it before. In hope of increasing the number of students in our upper-division classes, we now advertise and promote the minor in all of our courses. Students who are "afraid" of mathematics (and other support courses) but who are interested in plants can receive a minor by taking 15 hours of Botany classes, nine of which have to be at the upper-division level. These students help increase the size of our upper-division courses, which are enjoying their largest enrollments in many years.

The Botanical Society at OU is a student-run organization of undergraduates (with some graduate students) who are Botany majors, minors, or other students interested in plants. Under the guidance of two faculty mentors, we have re-invigorated our Botanical Society, which now holds monthly meetings, organizes field trips, grows plants as a money-making project, and holds social events, including semi-annual picnics at my house. These activities are wonderful opportunities for students to bond in a non-classroom setting and to meet faculty in a relaxed environment, which, in turn, benefits the students in the courses they are taking together. We find that the social aspects of being a Botany major are extremely important in keeping students in our program.

My perception (based on anecdotal information) is that students who have chosen to major in Botany were already interested in the sciences but had switched to Botany after considering other science majors or teaching biology as a career, or they were simply interested in plants and decided to major in Botany because the courses they took confirmed their interest. Students seem to respond very favorably to attention, and our contact with them became the "tipping point" in their decision to become botanists. Overall, regardless of initial student interest, it still takes tremendous effort to recruit a student to major in Botany. We are constantly encouraging students to take additional Botany courses and to consider Botany as a major or minor. But we are now actively engaged in the process and no longer passively hoping that students will come to us.

Unfortunately, we are moving into a new era at the University of Oklahoma where students have several alternative courses, including two new introductory Biology courses, from which to choose for their general education science requirement. This means that fewer students will be directly exposed to plants in an intensive and extensive manner in our general Botany course. It remains to be seen how these alternative courses will affect the recruitment of future Botany majors. Wish us luck!

-Gordon Uno, Department of Botany and Microbiology, University of Oklahoma, Norman, OK.

News from the Annual Meeting

Forum Keynote Address
Naturally Right by Design: Bring Learning and School to Life

Stephanie Pace Marshall, President
Illinois Math and Science Academy

Dr. Marshall began her address by acknowledging that while she is not a botanist, she has a love and passion for mind-shaping and frequently uses botanical metaphors. For instance, education is like an aspen grove - - many seemingly independent stems but all connected at the root. The root for education is what we know about human learning and how it is constructed. We learn by building upon our prior knowledge and we must be cognizant of this when we interact with student or the general public. Our task, challenges Marshall, is to make the story we know, botany, accessible to the public and our students and to use it to design human systems.

The story we tell about our science was the theme of the rest of Marshall's address. But first she reminded us of what the ancient Greeks knew well. Every story is really two stories. There is the overstory - - the obvious plot (the facts we are trying to teach or explain) and the understory - - the hidden and mysterious, the implied. Furthermore, the understory

is most powerful because it tells us how to feel about ourselves. How important is the story, she asked? Consider a "debate" between a scientist and a creationist. "Narrative trumps data every time!" The media understands understory, and that is why they are so effective. Our challenge as scientists and educators is to be mind-shaping thorough our storytelling – particularly the understory, and by that mind shaping we can be world-shaping.

Unfortunately, claims Marshall, we are telling a profoundly dysfunctional story of science in our schools. False proxies for learning have replaced meaningful learning and our reductionist approach to science tells the understory that science is for a select few, not open to most students, and that there is no room for "normal" people. Think about this, she challenged. Are any of these the understory you tell your students? These ARE the understories that many science teachers tell.

1. You are born either smart or not – it's in your genes, especially for math and science.
2. Really smart students are good at taking tests.
3. Everyone must learn in the same time and way.
4. You can tell how smart you are by how you do on a test.
5. Learning occurs in school; outside of school doesn't count.
6. Competition is essential for success; don't help others because that will disadvantage you.
7. Learning is a solitary activity; trying to learn with friends is distracting and doesn't work.
8. Learning is serious; you can't have fun and be learning.
9. Passion, emotion and intuition are distractions and not worth while.
10. Your goals and dreams are probably not realistic and you will probably outgrow them.
11. One person cannot make a difference in the world.

There is another whole set of understories, however, that we should try to incorporate into the story we tell of science.

1. Your brain can grow when its challenged, the more you challenge yourself the more you will learn.
2. Intelligence is not a single numer , fixed at birth. We all have multiple intelligences.
3. Learning is a social activity – you'll have more fun too.
4. Understanding big ideas and solving meaningful problems is real learning; tests are important but do not determine our potential in life.
5. You are a unique learner, in your own way and time. Take risks and pursue with passion.
6. We are all works in progress and will never be finished.
7. Never loose sight of your dreams.
8. We are all connected – every living thing interfaces with all others.

It is important, Marshall says, that we learn to replace the question "What did you learn?" with the question "How did you learn?" She relayed the example of a young boy from rural Illinois who attended the Illinois School against the advise of all of his friend and relatives. According to the boy, no scientists had ever come from his home town and his parents, teachers, friends, and relatives all told him not to bother with applying because he wasn't good enough and wouldn't be accepted. But he applied and he WAS accepted! During their first year all students are required to take inquiry-based math and science courses and all students must plan their own inquiry. This, related Marshall, is where most students realized that although they had "aced" all their previous courses in school, they had not "aced" learning. She asked her young student what he was interested in? "I don't know" was the not unexpected reply. She further inquired if there was anything he was wondering about or that had been puzzling him lately? Yes actually. The local newspaper had reported the discovery of human bones recently - - the apparent victim of an ax murder. "How did they know this?" he asked.

That was the beginning of a wonderful inquiry. Through home he had access to a variety of bones and a variety of implements to "test" hypotheses. He learned about DNA, genetics, biology, and anthropology. I was invited to go to the Field Museum in Chicago. He later acknowledged that as he started climbing the steps up to the Field Museum, he suddenly realized that "I am a scientist. Scientists do come from Greenfield, Illinois!" Today that young scientist is a Rhodes Scholar studying plants in Tanzania!

"We have students sitting in our schools who have yet to be invited to be scientists," says Marshall. What we have to do is "transform" education - - not "reform" it. "Adding wings to a caterpillar does not make a caterpillar fly", says Marshall. That is a re-form - - "adding on" to education to "be competitive" in math and science. "Shallow thinking coming out of shallow programming (a curriculum that is a mile wide and an inch deep)makes people superstition prone" and skeptical of science and scientists. "Becoming a butterfly is transformational." The transformation to meaningful learning will help science advance the human condition, not just make some of us more competitive than others. The transformation to well-designed problem-based learning with concepts embedded into the

problems will draw students to science and math and place these disciplines in the center of the human landscape.

Dr. Marshall is the author of the recent book: *The Power to Transform: Leadership that Brings Learning and Schooling to Life*, 2006, Jossey-Bass Publishing.

-summary by M. Sundberg, Editor

Vision and Change in Biology Undergraduate Education
A View for the 21st Century

Judy Skog and Terry Woodin of National Science Foundation sponsored a discussion Tuesday afternoon about the future of teaching undergraduate biology. The room was full to over-flowing, with more than 100 botanists taking part. This was one of a series of conversations that a cross-directorate working group plans to host to identify the issues that scientists and biology educators feel are critical to a modern, sound science curriculum. Possible outcomes of these conversations include a report outlining needs and a program to help meet these needs. Further information and an additional opportunity to contribute to the conversation is below.

The National Science Foundation understands that although the major focus of biology, understanding life, remains unchanged, there have been breakthrough discoveries that have changed the nature of some of the questions we are asking and new technologies have changed our capacity to answer these questions. In addition, undergraduate science, technology, engineering, and mathematics (STEM) education is changing. New technologies are emerging, learning theory is evolving, and increasingly students are pursuing higher education in non-traditional ways.

The Directorates of Biological Sciences and Education and Human Resources at NSF have formed a working group to solicit input from key scientists and biology educators to identify the most critical issues and exchange ideas and discuss suggestions for addressing these issues.

WE HAVE AN OPPORTUNITY TO ENSURE THAT BOTANISTS ARE HEARD AND THE PLANT SCIENCES ARE CONSIDERED!

Below is a response form containing the six questions that the working group have identified to initiate the discussions. Please complete it and return it to: psb@botany.org or mail it to: Marsh Sundberg, Editor, Plant Science Bulletin, Department of Biology, Emporia State University, Emporia, KS 66801. I will accumulate the responses and forward them as a packet to the working group.

Vision and Change in Biology Undergraduate Education Questionaire

Full Name _____

Full Address _____
_____
_____

Student _____ Faculty _____ Non-academic Scientist _____

1. What should be the main goals of the 21st century undergraduate biology science curriculum and how do these goals translate into desired outcomes?

2. How do we design a curriculum to achieve these goals, and what is the best way to deliver that curriculum?

3. How do we best prepare our faculty and structure our departments and institutions to achieve these goals?

4. Which questions should have the highest priority?

5. Are there questions that should be added?

6. Who should be involved in these conversations?

Awards

THE GRADY L. WEBSTER AWARD

This award was established in 2006 by Dr. Barbara D. Webster, Grady's wife, and Dr. Susan V. Webster, his daughter, to honor the life and work of Dr. Grady L. Webster. The American Society of Plant Taxonomists and the Botanical Society of America are pleased to join together in honoring Grady Webster.

The BSA component of the award, the Grady L. Webster Structural Botany Publication Award recognizes the most outstanding paper published in the American Journal of Botany or other publication over a two-year period.

This year marks the first time that the Webster Award is made by the Botanical Society of America. This year's $1000 award is made to: **Barbara A. Ambrose**, **Silvia Espinosa-Matías**, **Sonia Vázquez-Santana**, **Francisco Vergara-Silva**, **Esteban Martínez**, **Judith Márquez-Guzmán**, and **Elena R. Alvarez-Buylla** for their paper entitled, "*Comparative developmental series of the Mexican triurids support a euanthial interpretation for the unusual reproductive axes of* Lacandonia schismatica *(Triuridaceae).*"

The Botanical Society of America's MERIT AWARD

The Merit Award is the highest honor given by the Botanical Society of America. It is given in recognition of outstanding contributions to the science of botany. This year we are pleased to honor:

Dr. Bruce Baldwin, University of California Berkeley

Dr. Bruce Baldwin is recognized for his contributions in plant systematics. Beginning in graduate school, Dr. Baldwin studied one of the icons of island biogeography, the Hawaiian Silversword Alliance. His dissertation work using chloroplast DNA was one of the pioneers on island plant groups and confirmed that this morphologically diverse group represented a single colonization event from ancestors in North America. Baldwin reconfirmed these results using nuclear genes, the internal transcribed spacer (ITS) region. His development of ITS for plant phylogenetic study is perhaps his most widely recognized contribution. Less well-known outside of California is that Dr. Baldwin has made major contributions to plant floristics, through his efforts editing the Jepson Desert Manual and the 2nd edition of the Jepson Manual of California plants. For his many contributions to the systematics of Asteraceae, Hawaiian plant biogeography and evolution, and advances in molecular systematics, the BSA is pleased to recognize Dr. Bruce Baldwin with its highest award.

Dr. William Crepet, Cornell University

Dr. William Crepet is recognized for his contributions in paleobotany, especially the reproductive structures of seed plants. Dr. Crepet's early work on interpreting the development of Cycadeoidea reproductive structure led to a better understanding of the enigmatic fossil group Bennettitales. However, for many, his most important contributions come from his ability to connect fossil and extant plants through phylogenetic study. This is especially true for his contributions to knowledge about fossil angiosperm floral structure, particularly ancient pollination syndromes and their role in flowering plant diversification. For his many contributions to paleobotany and plant phylogeny, the BSA takes pride in recognizing Dr. William Crepet with its highest award.

Dr. Edith Taylor, University of Kansas

Dr. Edith Taylor is recognized for her contributions in paleobotany. Her work has focused on the structure and evolution of fossil plants. Her detailed investigations have permitted the interpretation of functional and ecological aspects of plants, including phloem development, plant/insect interactions, and tree growth and adaptation to high latitudes. For over two decades she has brought to light the diversity of plants once living in present day Antarctica. The wealth of information from these studies has shed light on plant diversity at high latitudes in the southern hemisphere, plant biogeography and evolution, and climate history. For her many contributions to paleobotany, Antarctic paleoclimatology, and the biology and evolution of fossil plants, the BSA is delighted to recognize Dr. Edith Taylor with its highest award.

Charles Edwin Bessey Award (BSA in association with the Teaching Section and Education Committee)

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

Dr. James Wandersee, Louisiana State University - Jim is the LeBlanc Alumni Association professor in the College of Education at LSU, focusing on

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

Darbaker Prize

The Darbaker Prize is given each year in memory of **Dr. Leasure K. Darbaker**, for meritorious work in the study of microscopic algae.

Dr. JoAnn Burkholder, Center for Applied Aquatic Ecology, University of North Carolina State University is the 2007 awardee. The award recognizes excellence in research on microalgae over a two-year period (2005-2006). The committee recognizes the breadth of your many important contributions toward understanding harmful dinoflagellates, including the environmental factors affecting these algae, their effects on other organisms, and interspecific differences among the algae.

Lawrence Memorial Award

The Lawrence Memorial Fund was established at the Hunt Institute for Botanical Documentation, Carnegie Mellon University, to commemorate the life and achievements of its founding director, Dr. George H. M. Lawrence. Proceeds from the Fund are used to make an annual Award in the amount of $2000 to a doctoral candidate to support travel for dissertation research in systematic botany or horticulture, or the history of the plant sciences.

The recipient of the Award is selected from candidates nominated by their major professors. Nominees may be from any country and the Award is made strictly on the basis of merit - the recipient's general scholarly promise and significance of the research proposed. The Award Committee includes representatives from the Hunt Institute, The Hunt Foundation, the Lawrence family, and the botanical community.

The Lawrence Memorial Award for 2007 goes to **Mr. Jimmy K. Triplett**, a student of Dr. Lynn G. Clark at Iowa State University. For his dissertation research, Mr. Triplett has undertaken study of woody bamboo genus *Pleioblastus*. The proceeds of the Award will help support his travel to Japan for field work and herbarium research.

SPECIAL AWARD

Dr. Christopher Haufler, BSA Past President
The Botanical Society of America presented a special award to **Dr. Haufler** expressing gratitude and appreciation for outstanding contributions and support for the Society. Chris has provided exemplary contributions to the Society in terms of leadership, time and effort.

SPECIAL AWARD

Dr. Kent Holsinger, out-going BSA Treasurer, University of Connecticut
The Botanical Society of America presented a special award to **Dr. Holsinger** expressing gratitude and appreciation for outstanding contributions and support for the Society.

SPECIAL AWARD

Dr. Pamela Diggle, BSA out-going Council Representative, University of Colorado
The Botanical Society of America presented a special award to **Dr. Diggle** expressing gratitude and appreciation for outstanding contributions and support for the Society.

Conant "Botanical Images" Student Travel Awards

This award provides acknowledgement and travel support to BSA meetings for outstanding student work in the area of creating botanical digital images.
C. Matt Guilliams, San Diego State University - First Place - $500 Botany 2007 Student Travel Award
Jessica Budke, University of Connecticut - Second Place - $250 Botany 2007 Student Travel Award
Nicole M. Hughes, Wake Forest University - Third Place - $100 Botany 2007 Student Travel Award

Isabel Cookson Award (Paleobotanical Section)
Established in 1976, the 2007 Isabel Cookson Award, recognizing the best student paper presented in the Paleobotanical Section

Heather Sanders of Ohio University, is the 2007 award recipient for the paper entitled "*Upside down auxin suggests the evolutionary origin of isoetalean rhizomorphs*" Her co-authors were Gar W. Rothwell and Sarah Wyatt

George R. Cooley Award (Systematics Section and the American Society of Plant Taxonomists)
George R. Cooley award for best contributed paper in plant systematics. The ASPT's Cooley Award is given for the best paper in systematics given at the annual meeting by a botanist in the early stages of his/her career. Awards are made to members of ASPT who are graduate students or within 5 years of their post-doctoral careers. The Cooley Award is

given for work judged to be substantially complete, synthetic and original. First authorship required; graduate students or those within 5 years of finishing their Ph.D. are eligible; must be a member of ASPT at time of abstract submission; only one paper judged per candidate.

This year's award was given to **Ann Willyard** of University of South Dakota for her talk entitled "*Integrating phylogenetic and population genetic approaches: A case study using* Pinus washoensis". Co-authors were **Aaron Liston** and **RC Cronn**

Katherine Esau Award (Developmental and Structural Section)
This award was established in 1985 with a gift from Dr. Esau and is augmented by ongoing contributions from Section members. It is given to the graduate student who presents the outstanding paper in developmental and structural botany at the annual meeting.

This year's award goes to **Mackenzie Taylor**, from University of Tennessee, for her paper "*Fertilization timing and the pollen tube pathway in Cabombaceae (Nymphaeales).*." Her co-author was **Joseph H. Williams**

Margaret Menzel Award (Genetics Section)
The Margaret Menzel Award is presented by the Genetics Section for the outstanding paper presented in the contributed papers sessions of the annual meetings.

This year's award goes to **Keith Adams**, University of British Columbia, for the paper "*Subfunctionalization of genes duplicated by polyploidy in response to environmental stress*." Co-author was **Zhenlan Liu**.

Maynard Moseley Award (Paleobotanical and Developmental and Structural Sections)
The Maynard F. Moseley Award was established in 1995 to honor a career of dedicated teaching, scholarship, and service to the furtherance of the botanical sciences. Dr. Moseley, known to his students as "Dr. Mo", died Jan. 16, 2003 in Santa Barbara, CA, where he had been a professor since 1949. He was widely recognized for his enthusiasm for and dedication to teaching and his students, as well as for his research using floral and wood anatomy to understand the systematics and evolution of angiosperm taxa, especially waterlilies. (PSB, Spring, 2003). The award is given to the best student paper, presented in either the Paleobotanical or Developmental and Structural sessions, that advances our understanding of plant structure in an evolutionary context.

Samuel F. Brockington, from the University of Florida, is the 2007 Moseley Award recipient, for his paper "*Differing patterns of MADS-box gene expression associated with shifts in petaloidy within Aizoaceae (Caryophyllales)*" Co-authors were Mike Frohlich, Paula J. Rudall, Douglas E. Soltis and Pamela S. Soltis.

Edgar T. Wherry Award (Pteridological Section and the American Fern Society)
The Edgar T. Wherry Award is given for the best paper presented during the contributed papers session of the Pteridological Section. This award is in honor of Dr. Wherry's many contributions to the floristics and patterns of evolution in ferns.

This year's award goes to **Renee A. Lopez-Smith**, Southern Illinois University, for her paper; " *Sperm cell architecture and the neck canal in diploid and tetraploid* Ceratopteris *cytotypes: does size matter?*" Her co-author was Karen Renzaglia.

Developmental & Structural Section Best Student Poster Award
Q. Sun, University of California Davis for his paper "*Cell wall composition and porosity of intervessel pit membranes in grape stems and possible mechanisms of systemic movement of* Xylella fastidiosa*, causal pathogen of Pierce's disease of grape.*"

Ecology Section Award, Best Student Presentation
Teresa M. Woods, from the Kansas State University, for the paper "*Multiple reproductive modes contribute to fitness homeostasis of the invasive* Lespedeza cuneata *(Fabaceae)*" Co-authors were David C. Hartnett and Carolyn J. Ferguson.

Ecology Section Award, Best Student Poster
Mauricio Diazgranados, of Saint Louis University for the poster "*Testing the conservatism of the ecological niche of the* Espeletia *complex*"

Ecology Section Student Travel Awards
Cassandra Boadway, Grand Valley State University, Advisor: Dr. Gary Greer for her Botany 2007 presentation entitled: "*Growth and Nodulation in* Trifolium repens *and* Glycine max *in Response to* Ailanthus altissima *Extracts*".
John Geiger, Florida International University, Advisor: Dr. Suzanne Koptur for his Botany 2007 presentation entitled: "*Experimental seed and seedling performance of the endangered vine* Ipomoea microdactyla *Griseb. (Convolvulaceae).*".
Daniel Hewins, Rider University, Advisor: Dr. Laura A. Hyatt for his Botany 2007 presentation entitled: "*Jack of All Trades: Biological Invasion Facilitated By Use of Multiple forms of Nitrogen*".

Genetics Section Student Poster Award
The Genetics Section Poster Award is given for the best student poster at the annual meetings.

This year's award is given to **Richard Stokes** , University of Cincinnati, for the poster " *A novel approach to study gene flow between color forms of the tetraploid species* Erythronium americanum" Co-author for the poster was **Theresa Culley**.

Genetics Section Graduate Student Research Awards
The 2006 recipient of the Genetics Section Graduate Student Research Awards, each of which provides $500 for research funds and an additional $500 for attendance at a future BSA meeting, is: **Michael Anthony**, Portland State University.

Historical Section Student Participation Award
This award was established in 2007 to highlight excellence in the area of historical presentations at the Botanical Society of America meetings. It is given to the student or students presenting historical papers in any section or symposium. The first award goes to Witt Taylor of Arizona State University and S. Y. Smith of the Royal Holloway University of London for the arrangement of the "*A Symposium in Honor of Sherwin Carlquist*".

Phycological Section Student Travel Award
Chang Jae Choi, University of Wisconsin, Advisor: Dr. John A. Berges for the poster entitled; "*Contrasting features of cell death in response to oxidative stress in marine and freshwater chlorophyte algae*"

Physiological Section Student Prizes - Best Paper
Uromi Goodale, Yale University, for her talk "*Use of Non-destructive landscape ecophysiology tools in Shi-Lanka*."
Mohammed Abdul, Texas A&M, for his talk "*Impact of high nighttime temperature on rice growth, development, and physiology*."

Physiological Section Li-Cor Prize
Jason Kilgore, of Michigan State University, for his poster "*Influence of cold tolerance on upper elevation range limits in isolated mountain islands* Ponderosae" His co-author was **Frank W. Telewski**.

Phytochemical Section Student Travel Award
Cassie Majetic, University of Pittsburgh, for the poster "*Geographic patterns of floral scent-floral color association in* Hesperis matronalis *(Brassicaceae) and their implications on female fitness*" Her co-authors **Robert A. Raguso** and **Tia-Lynn Ashman**.

Pteridological Section Student Travel Awards
Ms. Melanie Link-Perez, Miami University, Advisor: Dr. R. James Hickey - for her Botany 2007 presentation entitled:
"*Morphological Variation and Geographical Distribution of* Adiantopsis radiata."
Mr. Carl Rothfels, Duke University, Advisor: Dr. Kathleen Pryer - for his Botany 2007 presentation entitled:
"*Making Fronds in the Desert: Phylogenetics of Farinose Ferns (*Notholaena*: Pteridaceae).*"
Ms. Alejandra Vasco, New York Botanical Garden, Advisor: Dr. Robbin C. Moran for her Botany 2007 poster entitled:
"*Taxonomic Revision of the* Elaphoglossum ciliatum *group (Dryopteridaceae).*"

Scientific Literacy, Participation, and the BSA

President-elect's Address

Many changes have taken place in the BSA during the past few years. The most obvious is the establishment of a professional management team that takes the day-to-day functions of the Society off the shoulders of the membership and allows us all to direct our energies toward our mission and how we might best meet it. For example, during the past year, under President Chris Haufler's leadership, we have increased collaborations with our fellow plant societies, begun to expand international outreach, and strengthened development activities so that we can prepare better for the future of the Society. Tonight I'd like to share some thoughts about other issues facing the BSA and how we as a Society can respond.
Specifically, I'll address briefly the issues of scientific literacy and participation in science by underrepresented groups. Then I'll describe—also briefly—some of the things that the BSA is doing with regard to these issues and what we can all do to help.

It is of course no surprise that science and technology have become major aspects of society. It's rare to open a newspaper—either paper or electronic—and not see headlines that report a scientific discovery or address a scientific or technological issue. Scientific issues are no longer relegated solely to the "science pages" but appear in the general news, business, and editorial sections as well. From stem cells to global warming to genetically modified food, our national—and international—debates focus increasingly on scientific issues. However, scientific literacy has not kept pace with the infusion of science into society.

Scientific literacy is defined in many ways, but a core definition encompasses the following: (1) a broad understanding of basic scientific concepts, (2) it derives from a mix of concepts, history, and philosophy that helps us understand the scientific issues of our time, (3) it is NOT the specialized language of experts, and (4) it refers to the USE of science, not DOING science. In other words, one need not be a scientist to be scientifically literate. Given this broad definition of scientific literacy, how scientifically literate (or illiterate!) are we as a nation? The numbers are not good:

· Fewer than 7% of American adults are scientifically literate.
· Worse: only 22% of American college graduates
· And only 26% of those with graduate degrees are scientifically literate.

These are really sobering statistics—despite education—even advanced education—we collectively do not have sufficient scientific knowledge to understand the issues facing our country and our world. The political consequences are obvious.

What is the source of the problem? The ACT has been studying this for several years. Most of us—especially those of us with high school age children—think of the ACT as a college entrance exam, but the ACT also does research, and one of its topics in recent years has been college and career readiness.

In 1983, the federal government published "*A Nation at Risk*," which emphasized the need for a so-called "core high school curriculum" to provide a "foundation of success for the after-school years." More than 20 years and many state and national standards later, the ACT asked whether all of the changes implemented in recent years have made a difference. In fact, they found that high school graduates are entering the workforce and college without adequate preparation. This may not come as a surprise to those of us who teach introductory courses, but to see this as a national problem, and not just a local one, I think is very disturbing. Not surprisingly, the ACT have documented that simply taking the "right number of courses" is not sufficient. Amazingly, 3 out of 4 ACT-tested 2006 high school graduates who took a prescribed "core curriculum" were not prepared to take credit-bearing entry-level college courses with a reasonable chance of succeeding—3 out of 4!! The conclusion is that additional courses are not enough; **rigor** is needed. The ACT has established 4 benchmarks that signal college readiness. By tracking students who take ACT-sequence exams in 8th, 10th, and 12th grades, they have found a slight increase—from 18 to 23%—in the percentage of students who meet all 4 benchmarks, from 8th to 12th grades. However, the percentage that met NONE of the benchmarks also increased: from 14 to 21%. In short, the rate of failure exceeds the rate of success!!!

The ACT also assessed the percentage meeting the Math benchmark, as the math curriculum was expanded to Algebra I, Algebra II, Geometry, and Trigonometry. This was done across all schools and in so-called "rigorous schools"—those that recommended at least Algebra I, Algebra II, and Geometry, with rigorous course content. The percentage meeting the Math benchmark increased with increasing numbers of math classes, but the increase was much greater in the "rigorous schools."

Likewise, the percentage meeting the Science benchmark also increased more substantially in the "rigorous schools," as students took Biology, Chemistry, and Physics.

Not surprisingly, the ACT reports improved performance at the "rigorous schools"—(1) a higher percentage of students (9%) met the ACT College Readiness benchmark, and (2) 1/3 fewer students met NONE of the benchmarks. The solution, at least at one level, is simple: require Algebra II and/or Chemistry of all students. In addition, the ACT recommends that both the **number** and **kinds** of courses should be specified—to infuse rigor into the "core curriculum" and improve the quality of the courses. Again, this seems a simple solution, but it is much more difficult than it should be. Further, the problems in high schools do not always begin in high schools; some students enter high school with inadequate preparation, so problems at the middle school level and below also need to be addressed. Finally, the ACT note the need for teacher support in a multitude of forms. It is these latter two recommendations that I will pursue further, in terms of the BSA.

The BSA is helping to meet these needs on a number of levels. First, the BSA has developed partnerships with other societies, such as the CSSP (Council of Scientific Society Presidents), for information and advocacy. Each year, the Presidents and Executive Director of BSA attend a CSSP conference for training, discussion, and advocacy on issues ranging from education to green industry. And we have other partners as well. In addition to our fellow plant societies, the BSA collaborates with the American Institute of Biological Sciences, the National Science Teachers Association, the National Association of Biology Teachers, and the Mathematical Association of America.

The BSA also provides teacher training and support, for example through the Education and Outreach forum that now precedes the scientific sessions at our annual meetings, and through workshops. Both the Forum and Workshops address a number of topics; this year's selections are listed on the BSA website.

The BSA is also developing web resources to engage children and the general public. The Online Image Collection is a tremendous resource, and I encourage you all to submit images that can be included in it. The BSA's Statement on Evolution is useful to teachers and the public alike. Other educational resources—such as Forensics and Carbon Imprint—and Careers in Botany are also available on the web.

Plants are great teaching tools—they can be easy to grow, and of course they don't bleed when you cut them up—always an advantage for school labs. Plant-based lab projects have dual benefits: they introduce students to science, AND they introduce students to plants.

During the past few years, the BSA has developed some excellent inquiry-based lab materials. One of these packages is the McIntosh Apple Development Project, which explores the development of an apple, from bud to fruit. This project has received funding from McGraw-Hill Publishers, along with the BSA.

A more recent project is PlantingScience. PlantingScience fosters student research through scientific inquiry and pairs students with an online mentor. So far, 500 students, 10 teachers, and 40 scientist mentors from across the country have participated. This project recently received a large grant from Monsanto to develop new materials, and two proposals are pending at NSF.

To summarize the first issue—scientific literacy—we have a largely scientifically illiterate population, but there is hope, and the BSA is contributing to science education and outreach on a broad scale.
Let's move on to the second issue: participation in science by persons of underrepresented groups. Based on NSF data through 1999, women account for half of all bachelor's degrees in science and engineering. However, women remain underrepresented among graduate students, post-docs, and faculty in science and engineering. The percentage of graduate students increased from 34% in 1991 to 41% in 2001. With the exception of psychology, the highest percentage is in the biological sciences, in which women make up 54% of the graduate student population. However, the percentage of women decreases as the career track progresses. Other fields of science and engineering are lower. So despite progress, a gender gap remains.

NSF has also compiled data on participation by racial/ethnic groups. Blacks, Hispanics, and Native Americans earn fewer science and engineering bachelor's degrees relative to their population than do whites, while Asians/Pacific Islanders earn more than whites. However, the proportion of bachelor's degrees earned by non-whites has increased since 1989. The distribution of scientific fields is fairly similar among all groups except Asians/Pacific Islanders—a higher percentage of Asians/Pacific Islanders earn degrees in computer science and engineering, with a slightly higher percentage in the biological sciences.

These statistics all indicate that improvements are being made in making science a more inclusive and diverse enterprise. However, we still have a long way to go to make careers in science accessible to everyone who might be interested.
The BSA has started several projects to address issues of underrepresented groups. For example, the BSA is affiliated with MentorNet, an online partnership.

In addition, Program Director Karen Renzaglia is the PI on an NSF-funded project in the UMEB Program—Undergraduate Mentoring in Environmental Biology. During the next few years we hope to have even more emphasis on mentoring of students—both undergraduate and graduate—post-docs, and people in the early stages of their careers. The importance of mentoring cannot be overstated—most of us are here tonight because someone at some point (for me it was Chris Haufler) said that we needed to become members of BSA and showed us the ropes. We hope that the continued inclusion of student members on BSA committees—which began during the past year—will help the professional development of the students, and we know that we as a Society will benefit a lot from their participation—we already have.

We will soon be starting a Women in Science Resources Corner on the BSA website.
And finally, an ad hoc committee has been established to develop ways in which the BSA can better attract and serve the needs of underrepresented groups. We will be working with our fellow plant societies in these efforts.

But let's not leave everything to established committees and the Executive office. There are plenty of things we can all do to improve science literacy and increase the diversity of those engaged in science. For example, we can all support our BSA programs, with time, efforts, and special donations.

We can participate on committees and special initiatives. We can develop partnerships that address these issues directly or that will work with the BSA. Contact our local schools and support our local teachers. We can offer courses to improve science literacy among non-scientists. We can mentor students of underrepresented groups, and we can provide research opportunities to high school and undergraduate students.

There are many ways to participate—these are just a few. So during the next year, please think about these issues and how the BSA can promote science literacy and diversity in science. We will be happy to take your suggestions.

Finally, I would like to thank BSA Meetings Manager Johanne Stogran (and her staff and family), and the rest of the BSA staff, for a wonderful meeting! And special thanks to Bill Dahl and the BSA staff for their efforts in developing and implementing new BSA programs. I look forward to an exciting year of serving the Society!

Thank you for coming, safe travels, and we'll see you in Vancouver!

-Pamela Soltis, President-elect, Botanical Society of America

BSA Science Education News andNotes

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

PlantingScience—BSA-led student research and science mentoring program

The seeds of PlantingScience have sprouted and the program is showing vigorous growth. Would you like a chance to get involved and trained in K-12 outreach? Would you like to help stimulate an appreciation of science and plant biology in tomorrow's scientists, without ever leaving your desk? The opportunities to be a part of the online inquiry-based student mentoring program are growing.

Thanks to an award from the Monsanto Fund, the BSA will host writing retreats in 2007 and 2008 to develop new inquiry materials for the PlantingScience program. The 2007 writing teams of plant scientists, K-12 teachers, and education researchers include Gordon Uno, Paul Wiliams, Larry Griffing, Marsh Sundberg, Valdine McLean, Toni Lafferty, Ethel Stanley, Carol Stuessy, and Jane Metty. If you have ideas you'd like to contribute, or would like to join the 2008 writing teams, please email chemingway@botany.org.

Please see www.plantingscience.org to learn more about the online science inquiry and mentorship program, and the Scientist Mentor page for information about serving as a mentor. The Botanical Society of America and the American Society of Plant Biologists are supporting incentives for members to join the Master Plant Science Team of the PlantingScience program. For a relatively small time investment, you can make a major impact on how students experience and understand science.

Education and Outreach at Chicago Meeting—A few highlights, more next issue

Such an outstanding selection of education and outreach events at Botany/Plant Biology 2007: it is not possible to encapsulate all in one sitting. In this issue are three brief summaries. In PSB 53(4), look for highlights about the Joint BSA-ASPB Education Workshop, other collaborative efforts, and spotlight on Bessy Teaching Award winners.

Under-represented People Committee Meeting—On Sunday afternoon a gathering met informally to share ideas on supporting and enhancing diversity in the Society. The BSA ad hoc committee on participation for underrepresented people (Muriel Poston-Chair, Pam Soltis, Bill Dahl) organized the meeting. Dean of Faculty at Skidmore College Muriel Poston and BSA President Pam Soltis reminisced about the "Women in Science" round-table discussion that Pam led at the Botany 2004 Snowbird meeting. Ann Hirsch, former Chair of American Society of Plant Biologists' Women in Plant Biology Committee, shared her perspectives on the development of Women in Plant Biology, which today hosts extensive career workshops for women and men, from an ad hoc committee that met initially in the 1980s to discuss child care and networking needs for women at ASPB meetings. Beginning in 2003, with an NSF Undergraduate Mentoring in Environmental Biology (UMEB) award to Karen Renzaglia and Jeff Osborn, the Society has offered financial and professional assistance for up to ten minority undergraduate students per year. Although UMEB funding will end soon, the efforts will not. There is strong momentum to institutionalize support for women, minorities, and persons with disabilities. Action items formed before the close

of Botany 2007. In her Wednesday evening presidential address, Pam announced new resources would soon be added to the BSA website. You might have missed the discussion Sunday, but it was just the start. Please share your thoughts and join endeavors to promote diversity in the sciences, and the Society.

New BSA Teaching Innovations Short Course—Jim Wandersee and Marshall Sundberg offered the first-ever BSA Short Course at the Chicago Joint Congress. The 4-hour short course focusing on active learning was offered especially for prospective and new plant sciences faculty, and others, who seek an optimized overview of the latest thinking and research on successful college science teaching—including e-Learning. Through a team-teaching, alternating format, Jim and Marsh modeled a variety of practical techniques to increase student involvement in large and small class sizes such as clickers, black bag object lessons (what do a vinyl record, CD, tape, and corn kernel have in common?), student journals, concept maps, and novel ways of using textbooks. Interspersed with the engaging discussions and group learning activities, they also introduced key pedagogical knowledge on learning for understanding. In addition to receiving teaching and assessment strategies and a textbook, *Active Learning in Secondary and College Science Classrooms*, participants completing the short course earned Continuing Education Credits and a Certificate of Completion, which will certainly be welcome in Retention/Tenure/Promotion files. Based on the full enrollment and positive response to new BSA Teaching Innovations Short Course, others might well follow.

National Science Foundation's Vision and Chance in Biology Undergraduate Education—Judy Skog and Terry Woodin of National Science Foundation sponsored a discussion about the future of teaching undergraduate biology. The room was full to overflowing, with more than 100 botanists taking part. This was one of a series of conversations that a cross-directorate working group plans to host to identify the issues that scientists and biology educators feel are critical to a modern, sound science curriculum. Guiding questions were: (1) what should be the main goals of the 21st century undergraduate biology science curriculum and how do these goals translate into desired outcomes; (2) how do we design a curriculum to achieve these goals, and what is the best way to deliver that curriculum; and (3) how do we best prepare our faculty and structure our departments and institutions to achieve these goals? Lively dialog followed. Changing the way we teach and to whom were common major points, along with institutional and funding support for implementing changes. Possible outcomes of these conversations include a report outlining needs and a program to help meet these needs.

Plant Genome Outreach Meeting

Volker Brendel (Professor of Genetics, Iowa State University) and Adah Leshem-Ackerman (Plant Genomics Outreach Coordinator) hosted a May 2007 meeting of professionals involved in plant genome outreach activities to share information and ideas. Institutions with outreach programs (Virginia Tech's Fralin Institute of Biotechnology, U Wisconsin's Biotechnology Center, U California's Partnership for Plant Genomics Education, Cornell's Boyce Thompson Institute for Plant Research, and the BSA) as well as individual PIs with outreach efforts in Tribal Colleges and Historically Black Colleges were represented. Recommendations included continuing plant genome outreach coordinators' meetings, considering an outreach mentor program, and upgrading the PGROP website. The Plant Genome Research Outreach Portal (PGROP), one of Volker and colleagues' outreach efforts, is a searchable database. Teachers, researchers, journalists, and other user groups can easily find materials and programs related to plant genetics and genomics tailored to their interests. This website accepts submissions from the genetics/genomics community. Do you have a resource you would like to submit? http://www.plantgdb.org/PGROP/

Education around the Nation

Do undergraduate research opportunities fuel interest in STEM disciplines?— Hands-on research experiences are thought to increase interest in science, technology, engineering, and math (STEM) disciplines. Do they have the anticipated effect? Surveys of almost 15,000 undergraduates and mentors of undergraduate researchers reveal that research opportunities do indeed encourage greater interest in STEM careers and raise expectations of obtaining a Ph.D. The undergraduates, most of whom were juniors and seniors with high grade point averages and high expectations before arriving in college, also reported that their experiences increased their understanding of and confidence in their research skills. Surveys of NSF principal investigators and mentors documented early attraction to STEM, with 29% reporting their interests developed during high school and 59% tracing interests back to younger years "as a kid." Based on these combined findings, Russell and colleagues recommend providing research opportunities for college freshman and sophomores, but also encouraging STEM interests of K-12 students.

Russell, S.H., Hancock, M.P., and McCullogh, J. 2007. Benefits of Undergraduate Research Experiences. *Science* 316: 548-549.

To access the SRI reports, and the survey instruments and data on which they are based, go to http://www.sri.com/policy/csted/reports/university/index.html

Enrollment in Southern colleges more diverse—According to the recent fact book released by The Southern Regional Education Board, a nonprofit organization that promotes and tracks education in 16 states, the number of blacks enrolled in colleges rose 50% in the last decade. Black representation on Southern college campuses now exceeds the proportion of the population at large: 21% of college students versus 19% of overall population. The increase reflects the removal of barriers and demographic shifts of a growing Hispanic population. Although Hispanic enrollment also rose over the same time period, it remained far below the proportion in the Southern population. Black enrollment increased disproportionately in 2-year colleges. Interpretation of these trends and challenges to close the gap in graduation rates of black college students are detailed in the fact book. http://www.sreb.org/

National Pollinator Week—A new Pollination postage stamp, a Pollination Exhibit at the U.S. Forest Service Visitor's Center and a Pollinator Garden Wheel tool from the National Research Council. These are a few of the events marking June 24-30, 2007, declared by the US Senate and US Department of Agriculture as National Pollinator Week. Organizations around the country are joining forces to increase public awareness about the importance of, and threats to, pollinators. The Pollination Partnership web site is a central source for information, including the NRC 2006 publication *Status of North American Pollinators*, an interactive Garden Wheel, and a Pollinators at Risk Quick Time video. The North American Pollinator Protection Campaign has a comprehensive pollinator curriculum for grades 3-6.
http://www.pollinator.org/pollinator_week.htm
http://dels.nas.edu/pollinators/
http://www.nappc.org/curriculum/

Editor's Choice. Botany in Science Education Journals

Wendell, Douglas L. and Dawn Pickard 2007. Teaching Human Genetics with Mustard: Rapid Cycling *Brassica rapa* (Fast Plants Type) as a Model for Human Genetics in the Classroom Laboratory. *CBE Life Sci Educ* 26: 179-185.

The authors exploit two commonalities (self incompatibility and genetic diversity) to use rapid cycling Brassica rapa as a model for human genetics in hands-on experiments for paternity testing. Each new experiment yields novel results. See also materials by the authors online http://personalwebs.oakland.edu/~wendell/Mustard.htm

Skendzic, E.M. and C. A. Mossman 2007. The Influence of Light on the Development of the Coprophilous Fungus, *Pilobolus*. *American Biology Teacher* 69(5): 287-291.

The authors describe a laboratory exercise they do with college introductory biology students to examine the effects of blue light on fungi and to introduce asexual life cycles.

A special Gardening Education issue—The January 2007 issue of Applied Environmental Education and Communication Vol. 6(1) is devoted to learning possibilities and outcomes in youth garden projects.
http://www.informaworld.com/AEEC6

Simmons, S.R. 2007. "Amazing Grace": A Memoir of Mentoring. *Journal of Natural Resources and Life Sciences Education* 36: 1-5. In this personal reflection, the author recalls his experiences with his undergraduate mentor and the impacts on his development as a professional and a mentor to his own students.

Krufka, Alison, Susan Evarts, and Chester Wilson. 2007. **I'm Looking Over a White-Stiped Clover: A Case of Natural Selection**. *Journal of College Science Teaching* 36(7): 14-17.

This case study uses the distribution of plain and striped (the latter associated with cyanide production) white clover plants in Minnesota and North Carolina to set up a series of exercises illustrating natural selection. It's a good case study model and suggests some possibilities to me for society members from around the country to participate in a big student collaboration!

Lord, Thomas, Chad Shelly, and Rachel Zimmerman. 2007. **Putting Inquiry Teaching to the Test: Enhancing Learning in College Botany**. *Journal of College Science Teaching* 36(7): 62-65.

The primary pedagogy here is Peer-Led Team Instruction and this article describes several "lecture" and laboratory activities that the authors have implemented in their introductory botany course. It's a good introduction although the assessment of results is weak. The encouraging thing, for those of you who have not incorporated

student-active techniques into your teaching, is that the authors confirm the growing quantitative literature that students performed as well or better on content-based exam questions as students in previously taught traditional sections and that there were mixed responses to questions about changing student attitudes.

A Model Elementary-level Plant Science Curriculum Based on ASBP's 'Plant Principles'

PK-12 science, technology, engineering and math (STEM) education reform is currently receiving a great deal of attention in the U.S. As part of this reform effort, discipline specific content has been provided by professional scientific societies (e.g., Botanical Society of America (BSA) < http://www.botany.org/outreach/ > and American Society of Plant Biologists (ASPB) < http://www.aspb.org/education/ > outreach). University collaborations with local school districts also have had an impact on educational reform. At the University of Wisconsin-La Crosse (UW-L) for example, a collaborative team of content area (author, Biology) and teacher education faculty have developed teacher professional development workshops to improve plant education at the elementary grades. The final product of this work has led to the development of an elementary level plant curriculum.

K-8 teacher professional development workshops, built around ASPB's "Principles of Plant Biology" <http://www.aspb.org/education/foundation/principles.cfm>, were developed for the School District of Onalaska (SDO). The workshops were used to train a group of 'lead teachers' to promote more plant education within the SDO. Twelve elementary and one middle school teacher received approximately 120 hours of training over a three-year span (see workshop "Daily Outlines 2000-2002" < http://www.uwlax.edu/faculty/gerber/html/projects.htm >). Since only one middle school t eacher participated in the program, a K-5 'spiraling curriculum' with hands-on activities connecting ASPB's principles, Wisconsin Model Science Academic Standards, and SDO curriculum needs was developed. Following teacher professional development workshop activities in the 2003 spring semester, the developed plant curriculum was voted on by the SDO's science curriculum committee and was incorporated into the district-wide science curriculum (see "Elementary Plant Curriculum"< http://www.uwlax.edu/faculty/gerber/html/projects.htm >. To evaluate the success and sustainability of our program, lead teachers were twice surveyed by an independent evaluator upon completion of the three-year workshops and again four years after the last workshop concluded. Survey results are currently being analyzed.

Multiple spin-off projects have resulted from this work including: collaborations with undergraduate pre-service teachers (Lawniczak et. al., 2004; Yusten et al., 2003); collaborations with in-service SDO teachers (Stellflue et al., 2005; Gerber, 2006); and professional development workshops given at local (Washburn Academy) state (Wisconsin Society of Science Teachers) and national (National Science Teacher Association, National Association of Biology Teachers) meetings. A Teachers Using LIving Plants (TULIP) project website was developed to provide workshop outlines, lesson plans, and other plant-related educational materials online < http://www.uwlax.edu/faculty/gerber/index.htm >.

The framework of these workshops has also been used to develop a science, technology, engineering, & math (STEM) professional development school (PDS) at Pertzsch Elementary School in the SDO. Slated to begin in the spring semester of 2008, this STEM-PDS will involve a greater involvement between UW-L and SDO (see AACTE, 2007, p. 92 for details). A STEM website < http://www.uwlax.edu/murphylibrary/departments/curriculum/stem/index.html > has been created to provide online access for the pre-service teachers, practicing teachers, and others interested in STEM education. This site provides PK-12 teachers with access to STEM trade books, web resources, education and outreach materials provided by professional science and teaching societies, and more (see Gerber et al., 2007 for details). Within the STEM website, botanical information for teachers can be found primarily in "The Living Environment" (plant biology), "The Designed World" (agriculture), and "Professional STEM Societies and Organizations" links.

References:

AACTE (American Association of Colleges for Teacher Education). 2007. Preparing STEM Teachers: The Key to Global Competitiveness. http://www.aacte.org/Governmental_Relations/AACTE_STEM_Directory2007.pdf

Gerber, T., J. Jax, K. Lange, and S. Smith. 2007. Improving PK-12 Curriculum Resource Centers. Science Books & Films (SB&F) 43 (3): 98 or access online at http://www.uwlax.edu/murphylibrary/departments/curriculum/stem/index.html

Gerber. 2006. Enhancing Botanical Education with Project 2061 Publications. 2061 Connections. Jan/Feb issue, Field Notes http://www.project2061.org/publications/

2061Connections/2006/2006-01b.htm

Lawniczak, S., D. T. Gerber, & J. Beck. 2004. Using Plant Displays for Improving Elementary School Science Education. Science & Children 41(9): 24-29.

Stellflue, P., M. Allen & D.T. Gerber. 2005. Plants, drawing & color: connecting science and art. Science & Children 43(1): 33-35.

Yusten, J., D. T. Gerber, & J. Beck. 2003. A Comparison of Soil Test Kits for Use in the Secondary Classroom. The American Biology Teacher 65(9): 675-678.

- Tim Gerber, University of Wisconsin-LaCrosse.

Leaf morphology tutorial web site

http://www.csu.edu.au/herbarium/

The impetus for this project had the following beginnings: I had noticed that many of my second year students were consistent in incorrectly keying out plants in our local Flora where the key requires an early choice between simple/compound and pinnate/bipinnate leaves. I had assumed that these students would have a good understanding of leaf morphology as this is a basic botanical skill. My subsequent direct testing on leaf morphology showed that this was not the case.

To give the full-time students and the large cohort of distance education students (and any other interested botanists) better resources to improve their leaf morphology recognition skills Kylie Kent (CSU Herbarium) and I designed a web-based tutorial. We hoped that a logical arrangement of features, combined with a larger range of material than can be provided in a practical class, would allow students to better develop their skills in this area.

The tutorial is based on scans of about 50 species, with two interactive tests (designed by Scott Black using ToolBook) using an additional 22 species. The species are a mix of Australian natives, and crop, weed and garden species that have been introduced to Australia.

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

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

Letters to the Editor

What are you?

When one is introduced to someone from the general public on a social occasion, the question often arises: what do you do for a living? The answer you give typically determines the ensuing conversation. If one responds "botanist", most people will recognize that you work with plants. But many will not infer that you are also a biologist, and by extension, a scientist who conducts research. It will be assumed that you know how to grow plants, especially house plants, and probably that you enjoy gardening in your spare time. In fact, many may equate botany with gardening, or at the very least, horticulture. Perhaps you are thinking that a "botanical (or plant) scientist" would be a better, more precise, response.

If your forte is plant molecular systematics, do you really want to state this? Or do you state that you are a "molecular biologist"? "Plant ecologist" may be an appropriate response if your research is oriented toward organismal plant biology with an environmental component. However, many will not view you as a scientist if you designate "ecologist" as your career! Organismal specialties can be given too, but "phycologist" or "bryologist" or "mycologist" will most likely be countered by blank stares.

If you work in an academic setting, then "professor" may be a more accurate descriptor of your career. Possibly, the addition of a modifying phrase would render the description more precisely. "Professor of Botany" (a rather rare title, nowadays) or "Professor of Plant Science"? Now, most will recognize that you are a teacher of botany at the college level. However, given the amount of higher education you've no doubt acquired in the course of pursuing an advanced set of degrees and the extensive research activities you engage in, referring to you as a "teacher" may be somewhat denigrating, like referring to a medical doctor as a "nurse". Your duties as a research scientist, writing grant proposals, performing experiments and publishing the results, as well as mentoring students, go quite beyond the simple concept of "teacher" that exists in the minds of most of the general public (including those with a college degree).

In the end, it may be predominantly a matter of what aspect of your career you most want to depict.

So…what are you?

Gregory P. Cheplick
College of Staten Island
City University of New York

In Memoriam:

Robert Hegnauer (1919—2007)

Robert Hegnauer, corresponding Member of the Botanical Society of America since 1987, passed away on April 14, this year. In him we loose a a great botanist, phytochemist and pharmacognosist and a helpful and friendly colleague. His monumental *Chemotaxonomie der Pflanzen* (13 volumes) will remain a rich resource of information and systematic insights for generations to come. Robert was born in Aarau, Switzerland. Orphaned at a very early age he was raised by an uncle in the town of Belp. Following his training as an apothecary in Bern, he studied phamaceutical science at the famous ETH in Zürich, where he wrote his PhD thesis on the morphological diversity and secondary metabolites of *Thymus* species in Switzerland, supervised by the famous pharmacognosist Professor H. Flück. He then moved to the Netherlands as research assistant at Leiden University. Remarkably soon he was appointed full professor of Pharmacognosy, at the early age of 33. In 1962 followed his appointment as Professor of Experimental Plant Systematics, a position that also entailed the establishment and directorship of a new Biosystematics Laboratory and research group in Leiden, near the old and famous *Hortus Botanicus*. Early in his career he developed the ambitious plan to bring together all existing knowledge on the chemical compounds in plants and fungi in a series of reference books entitled "*Chemotaxonomie der Pflanzen*". The first volume was published in 1962, the last volume in 2001. With over 10,000 pages, *Chemotaxonomie* is much more than an encyclopedic compilation, because Hegnauer was uniquely qualified to provide a synthesis of the meaning of these chemical compounds for whole plant biology, adaptation and co-evolution with animal pollinators and dispersers, and for the phylogenetic classification of genera and families. In the original research by himself and his research groups cyanogenesis in plants and alkaloids were focal themes.

National and international recognition of the immense value of the *Chemotaxomie* volumes followed with Honorary Doctorates at the ETH in Zürich (1972) and the University of Utrecht (1997), election to the Fellowship of the prestigious Royal Netherlands Academy of Arts and Sciences, and Honorary Memberships of various international societies. The impact of *Chemotaxonomie der Pflanzen* would have even been greater had it been written in English, but Robert, although perfectly fluent in English, was of the old European school that considered it self evident that any scientist should be able to read the classical botanical literature in German and French as well as in English. He himself spared no effort to abstract literature from a wide diversity of languages in his books.

Early in his career Robert was the victim of a serious traffic accident, being overrun on his bicycle by a car in the center of Leiden. This had him hospitalized and recuperating at home for very long periods. Students of my generation were examined in plant taxonomy at his bedside, using wildflowers and garden plants picked by his wife and children in their lovely garden. Throughout the last 45 years of his life he suffered the after effects of the physical damage caused by the accident and of the long medications that followed. So it was little short of a miracle that he could see the *Chemotaxonomie* finished in his lifetime, and live to the age of 87. Despite his great international fame Robert remained a very modest person. He loved to give advice and share his immense knowledge until the very end, and the Hegnauer home was a hospitable place where exchange of knowledge was combined with enjoying a good glass of wine, beer, gin or any of the very special Swiss liquors so full of interesting secondary plant metabolites. Throughout , Minie Hegnauer-Vogelenzang was his devoted and supportive wife, who also co-authored one of the last *Chemotaxonomie* volumes .

Already during his lifetime, Hegnauer bequeathed his very extensive and exquisit phytochemical and ethnobotantical library to the Rijksherbarum (currently the Leiden Univeristy branch of the National Herbarium of the Netherlands) so that current and future generations can use it. He leaves us with a very rich heritage indeed.

-Pieter Baas, Leiden

Personalia

Dr. Kayri Havens Appointed Director of Plant Science and Conservation at Chicago Botanic Garden

The Chicago Botanic Garden has appointed Dr. Kayri Havens, Ph.D., as director of plant science and conservation. In this role, Dr. Havens will oversee a staff of 225 scientists and interns, and manage 15 programs on-site at the Chicago Botanic Garden, throughout the Midwest region, the Western United States and Australia.

"Kay has done an outstanding job developing the Garden¹s plant conservation programs," said Dr. Larry De Buhr, vice president of academic affairs. ³She was one of the first of three scientists to work at the Chicago Botanic Garden. During the past ten years she has led our effort to save the world¹s plant life through our many initiatives including habitat restoration, invasive species control, monitoring the impact of climate change on plant life and seed banking."

Havens joined the Garden in 1997 as the manager of endangered plant research. She developed the plant conservation program and was responsible for research and off-site conservation of globally rare plant species and their threats. She was promoted to Director of the Institute for Plant Conservation in 2000, responsible for rare plant research and reintroduction, habitat fragmentation and seed banking programs.

Havens is the chair of the Conservation Committee of the American Public Gardens Association; a member of the U. S. Board of Directors of the Botanic Gardens Conservation International; is a North American representative to the World Conservation Union Species Survival Commission and is a board member of the scientific review panel of the Midwest Invasive Plant Network.

She has been the keynote speaker and has presented papers at numerous national and international conferences and symposiums, including the Botanic Gardens Conservation International World Congress in Barcelona, Spain in 2004 and Wuhan, China in 2007; the Ecological Society of America meeting in Merida, Mexico in 2006, and gave the keynote address for the Plant Conservation Alliance annual meeting in 2007.

Havens has authored or co-authored two books, 30 articles and is a manuscript reviewer for the American Journal of Botany, Conservation Biology, International Journal of Plant Science and Conservation Genetics.

Through the Chicago Botanic Garden¹s plant science and conservation program, Garden scientists discover knowledge that addresses threats to endangered flora, mobilize the knowledge into action, train plant conservation leaders and utilize research findings to shape national and international plant conservation policy.

Chicago Botanic Garden scientists, research associates, adjunct scientists, graduate and undergraduate students, research technicians and volunteers examine the impact of habitat fragmentation on imperiled plants; study soil and its impact on habitat restoration and the uptake of carbon dioxide from the atmosphere; preserve endangered plants through a regional rare plant monitoring program; restore Western landscapes after wildfires; reintroduce imperiled plants to fragile ecosystems; and preserve the seeds of rare and endangered plants. Garden-led programs also train interns to work in endangered habitats in Wyoming, Idaho, Utah, California and Montana and present year-round research symposia that attract scientific leaders from around the world

³By mid-century, we could lose 34,000 plant species worldwide,² Havens said. In the United States alone, we are in danger of causing the extinction of 29 percent of our plant species. I am honored to be working with the scientists at the Chicago Botanic Garden who are working around the nation to stem the tide and create hope for the plant world.²

Havens notes that in the future, the work of the Chicago Botanic Garden¹s scientists will address threats to plant diversity; conduct research to discover biological reasons for plant rarity and invasiveness; study native plants for their medicinal and economic benefits and conduct soil research to enhance restoration of degraded native habitats worldwide and the habitats¹ subsequent ability to remove carbon from the atmosphere. ³The breadth of our research agenda will expand and we hope to attract world-class scientists for this and our doctorate curriculum,² said Havens.

Havens holds a Bachelor of Arts in Botany from Southern Illinois University, Carbondale; a Master of Science in Botany, with an emphasis in Plant Physiology from Southern Illinois University, Carbondale, and a doctorate in Biology from Indiana University, Bloomington, where she studied reproductive success in a rare evening primrose from New Mexico. Her current research interests include genetic issues in plant reproduction, plant responses to global climate change, and plant rarity and invasiveness.

Symposia, Conferences, Meetings

54th Annual Systematics Symposium

"Biodiversity and Conservation in the Andes"

Missouri Botanical Garden 12–13 October 2007

With support from the National Science Foundation

Organizing committee: Olga Martha Montiel and Peter Møller Jørgensen

Friday. October 12, 7:30-9:30. Informal Mixer in Ridgway Center

Saturday, October 13, 8:30 am - 8:30 pm Talks in Ridgway Center

Alan Graham: **The Andes—Geological overview from a biological perspective**

Jon Fjeldså: **Diversification of the South American avifauna: the role of high lineage persistence in the tropical Andes region**

Lena Struwe: **Ecological vicariance as a speciation process in the Andes—Examples from Gentianaceae**

Iván Jiménez: **Determinants of broad-scale variation in plant species richness across Northwest South America**

Kenneth Young: **Andean land use and biodiversity: Historical legacies, humanized landscapes, and future species extinctions**

Christa Placzek: **Climate change in the Andes**

Carolina Murcia: **Application and transfer of science for the design and management of protected areas in the Northern Andes**

John Terborgh: **Why parks are failing in the tropics**

SPACE LIMITS REGISTRATION TO 400; PLEASE REGISTER EARLY

Registration must be accompanied by a $75.00 registration fee, which covers the cost of refreshments at the Friday mixer and lunch and dinner on Saturday. Information on local hotels and motels will be sent to registrants. **No refunds will be granted after 24 September.**

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

_____
_____
_____
_____

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

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

Positions Available

Conservation Scientist – Ecology and Curator of Native Habitats
Chicago Horticultural Society

Purpose: Strengthen the Chicago Botanic Garden's Restoration Ecology program by conducting appropriate research to inform and management practices relating to community and restoration ecology. Advance the prominence and visibility of the Garden's native habitat areas (oak woodland, prairie, and Skokie River corridor)

Duties and Responsibilities:

1. In collaboration with researchers and scientists at the regional and national levels, conduct relevant research related to the ecology of native habitats in the Upper Midwest.

2. Teach "Community Ecology" in support of the Garden's joint graduate program with Northwestern University. Assist in developing and conducting educational programs, publications, symposia, Garden tours, lectures, and media contacts relating to native habitats.

3. Assist with the management of the Garden's native habitats to support appropriately diverse native plant and animal communities, with special emphasis on controlling adverse impacts from invasive taxa.

4. Develop funding proposals and execute research projects that provide financial support for the Garden's research and management programs in its native habitat areas.

5. Assist with duties and responsibilities as assigned to meet the needs of the Garden's Restoration Ecology Department and the Department of Plant Science and Conservation.

6. Disseminate research results through lectures, publications in refereed and technical journals, the popular press and media contacts, and presentations at professional meetings.

Department: Restoration Ecology within Department of Plant Science and Conservation

Reports to: Director, Restoration Ecology

Supervises: Students, Interns, and/or Volunteers

Cooperative Relationships: Botanic Garden staff; regional, state, and federal natural resource managers and scientists; community ecologists; professional and scientific societies.

Position Requirements: Minimum requirement of Ph.D. in community ecology, restoration ecology, or related field, and three years of experience directly related to the duties of this position. Strong knowledge of native habitats in the Upper Midwest, attention to detail, and excellent organizational and communication skills (both oral and written).

Resumes to: Human Resources Department
Chicago Botanic Garden
1000 Lake Cook Rd.
Glencoe, Illinois 60022
Or
E-mail employment@chicagobotanic.org

Award Opportunities

American Philosophical Society Research Programs

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

Information about All Programs

Purpose, scope

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

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

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

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

BRIEF INFORMATION about INDIVIDUAL PROGRAMS

Franklin Research Grants

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

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

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

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

Lewis and Clark Fund for Exploration and Field Research

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

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

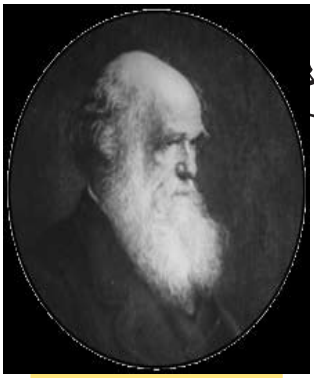
Award
Grants will depend on travel costs but will ordinarily be in the range of several hundred dollars to about $5,000.

Deadline
February 15; notification in May.

Harvard University Bullard Fellowships in Forest Research

Each year Harvard University awards a limited number of Bullard Fellowships to individuals in biological, social, physical and political sciences to promote advanced study, research or integration of subjects pertaining to forested ecosystems. The fellowships, which include stipends up to $40,000, are intended to provide individuals in mid-career with an opportunity to uti9lize the resources and to interact with personnel in any department within Harvard University in order to develop their own scientific and professional growth. In recent years Bullard Fellows have been associated with the Harvard Forest, Department of Organismic and Evolutionary Biology and the J.F. Kennedy School of Government and have worked in areas of ecology forest management, policy and conservation. Fellowships are available for periods ranging from six months to one year after September 1st. Applications from international scientists, women and minorities are encouraged. Fellowships are not intended for graduate students or recent post-doctoral candidates. Information and application instructions are available on the Harvard Forest web site (http://harvardforest.fas.harvard.edu). Annual deadline for applications is February 1st.

Courses/Workshops



Investigating the Evolution of Plant Form

Conceptual Integration from the Molecular to the Ecological

A MORPH sponsored mincourse

December 14th - 16th
at the University of Colorado, Boulder

Faculty:

Scott Armbruster

Spencer Barrett

Peter Crane

Pamela Diggle

Michael Donoghue

Peter Endress

William Friedman

Larry Hufford

Vivian Irish

Amy Litt

Michael Purugganan

This intensive minicourse and workshop will provide an opportunity for a select group of doctoral students and distinguished investigators in plant evolutionary developmental biology to interact. The goal will be to address current methodological and conceptual hurdles associated with the study of the evolution of plant form. In particular, participants will focus on the integration of developmental information across molecular, organismic and ecological levels of plant biology. In addition to presentations by the faculty, each student will outline critical issues associated with his/her own evolutionary developmental research for discussion by all participants.

All Graduate Students currently at U.S. institutions or with US citizenship are encouraged to apply.

Applications and further detailsl may be found at:

http://www.colorado.edu/eeb/MORPH/grants/minicourses/minicourses.html

Please contact William (Ned) Friedman at ned@colorado.edu with any questions

The application deadline is September 1, 2007

The fifteen student participants will have all reasonable travel, hotel, and meal costs covered by MORPH

Molecular and Organismal Research in Plant History
http://www.colorado.edu/eeb/MORPH

The Biodiversity and Taxonomy of Plants
MSc degree/Postgraduate Diploma

Introduction
The MSc course was established in 1992 by the University of Edinburgh and the Royal Botanic Garden Edinburgh in response to growing demand worldwide for trained plant taxonomists. Environmental surveys and effective conservation strategies depend upon detailed knowledge of plants in their habitats. To communicate such knowledge accurately and effectively, training is required in plant taxonomy, the discipline devoted to plant diversity and evolution, relationships, and nomenclature. The course benefits widely from a close partnership between the University of Edinburgh and the Royal Botanic Garden Edinburgh.

Aims and scope
Forming a bridge between traditional and modern approaches, this course equips biologists, conservationists and ecologists with a wide knowledge of plant biodiversity and its investigation, combined with instruction in the methods of pure and applied taxonomy. Being located in a botanic garden, close to major collections of plants and with the expertise at hand increases the scope of this course tremendously.

The course consists of formal instruction, practical work, workshops, essays, research projects and tutorials covering all major areas of botanical endeavour and including specific topics of interest:
-Functions and philosophy of taxonomy
-Evolution and biodiversity of the major plant groups, fungi, and lichens
-Plant geography
-Conservation strategies, surveys and monitoring
-Production and use of floras and monographs
-Biodiversity databases
-Phylogenetic analysis
-Population and conservation genetics
-Field research and plant collecting
-Curation of living collections, herbaria and libraries
-Plant morphology, anatomy and development
–Molecular systematics

Fieldwork and visits to other institutes are an integral part of the course. There is a two-week field course in Belize during the Easter break. The summer is devoted to a scientific research project of the student's choice or as proposed by a supervisor.

Course graduates are employable in a wide range of fields, including:
-survey and conservation work in threatened ecosystems
-assessment of plant resources and genetic diversity
-taxonomic research
-management of institutes and curation of collections
-a stepping stone to PhDs and academic careers

Course structure
The course starts in September each year, lasts twelve months and involves two terms of lectures, practicals, workshops and investigations, with examinations_at the end of the first and second terms. On the basis of these exams and other course-work, students then either embark on a four-month research project to qualify for the MSc, or proceed to a third term of taxonomic study and essay-writing to be awarded the Diploma.

Most of the lectures and practicals take place at the Royal Botanic Garden Edinburgh. Some teaching also takes place at the University science campus at King's Buildings, where lectures may be shared with students from other courses.

Entry requirements
Applicants preferably have a university degree, or its equivalent, in a biological, horticultural, or environmental science, and above all a genuine interest in plants. Relevant work experience is desirable but not required. Evidence of proficiency in English must be provided if this is not an applicant's first language.

Funding
The course is currently supported by six NERC studentships (open to EU students only [see http://www.nerc.ac.uk/funding/students/students-faq.shtml]. Other, international funding bodies (e.g. British Council, Shell Centenary Fund, EU Alßan Fund) have supported overseas students in the past.

Further information can be obtained from the **Course directors:**
Dr Louis Ronse De Craene, Royal Botanic Garden Edinburgh (+44 (0)131 248 2804; l.ronsedecraene@rbge.org.uk) FAX +44 (0)131 248 2901.

Dr Chris Jeffree, The University of Edinburgh (+44 (0)131 650 5554; cjeffree@stafmail.ed.ac.uk FAX +44 (0)131 650 8650.

Websites: http://www.rbge.org.uk/rbge/web/edu/msc_course.jsp
http://www.gradlife.ed.ac.uk/index.html

Application forms can be obtained from: http://www.postgrad.ed.ac.uk/applicat/form.htm

Other News

Darwin's Garden: An Evolutionary Adventure

A New Look at Charles Darwin
in a 2008 Exhibition at The New York Botanical Garden
Highlighting Darwin's Little-Known Work with Plants
April 25 – June 15, 2008

The New York Botanical Garden will highlight Charles Darwin's substantial yet little-known contributions to the study and understanding of plants during a two-month celebration of Darwin's life and work. Exhibitions in three Botanical Garden venues, a symposium with leading Darwin scholars, and related programs will paint a portrait of Darwin as a botanist and plantsman and demonstrate how Darwin's botanical experiments and discoveries helped shape his contributions to the understanding of life in general. Entitled Darwin's Garden: An Evolutionary Adventure, the exhibition will open on April 25, 2008, and run through June 15, 2008, heralding the 2009 bicenntennial of his birth.

Darwin's Garden Re-created

Darwin's Garden: An Evolutionary Adventure will include exhibitions in the Garden's Enid A. Haupt Conservatory, LuEsther T. Mertz Library gallery, and Everett Children's Adventure Garden. The exhibition in the Haupt Conservatory will tell the story of how Darwin's careful observations and experiments in his gardens and greenhouses inspired his thinking about natural selection and evolution. It will re-create Darwin's own garden at his home in England, Down House, and represent the surrounding orchards and meadows where the naturalist made many further scientific observations. Some of Darwin's ingenious experiments with plants, which focused on plant movement, climbing plants, pollination and fertilization, and adaptations in orchids, will also be re-created as part of the exhibition. Displays of key plants that inspired Darwin's thinking—primroses, carnivorous plants, orchids, and climbing plants—will further illustrate the central role of plants in the development of Darwin's ideas.

The Inside Story: Darwin's Writings, Collections, Laboratory

The Mertz Library's William D. Rondina and Giovanni Foroni LoFaro Gallery will feature original materials from Darwin's own writings and collections among illustrated books, manuscripts, and other historical documents that offer insight into Darwin's thinking and demonstrate the importance of botany throughout his life. Themes explored in the gallery exhibition will include Darwin's botanical education, his historic voyage on the HMS Beagle, his professional friendships with botanists, and the publication of his revolutionary book On the *Origin of Species*, and his investigations into plant sexuality and sensitivity (how plants respond to touch, light, gravity, and chemical substances). The documents and archival materials will come from the Mertz Library's extensive collection of Darwiniana as well as from the library and herbarium at Cambridge University in England, the Royal Horticultural Society's Lindley Library in London, and the Archives at the Harvard Botany Libraries.

In the Everett Children's Adventure Garden, an interactive exhibition including plants important to the development of the concept of evolution will invite hands-on exploration. Carnivorous plants will also be on display. Darwin the man will be brought to life through a re-creation of his research laboratory, an assortment of his working tools, a child-friendly timeline of the highlights of Darwin's life, and a replica of the *Beagle*, together with a map of the ship's five-year voyage to South America and around the world. In the Ruth Rea Howell Family Garden, a "Relative Row" plot will display the variation within the nightshade plant family, which includes tomatoes. A comparison of wild and domesticated plants, modeled on Darwin's own "weed" garden that he used for observation, will demonstrate desirable traits in plants, both wild and domesticated, and describe the process of natural selection.

Symposium, Evolutionary Tour, Interactive Demonstrations, and More

The New York Botanical Garden, in collaboration with the American Museum of Natural History, will also host a two-day symposium during the exhibition. The symposium will feature presentations by leading scientists, historians, philosophers, and environmentalists—the current thinking by some of the world's leading Darwin experts. Because Darwin's theories continue to be a significant force in the world today, the symposium will offer an extraordinary opportunity to hear top scholars and commentators discuss the impact of Darwin and his findings.

Throughout the duration of the exhibition, an "Evolutionary Tour" will allow families to walk—step by step, plant by plant—through the tree of life among living plants in the Garden's collections. In the Haupt Conservatory and surrounding outdoor plantings, this approximately 40-minute walking tour will highlight significant plants in the evolutionary tree of life. It will be accompanied by commentary

accessible via visitors' cell phones. In addition, a number of interactive demonstrations around the Garden's grounds will enable visitors to observe plants the way Darwin himself did and to see his experiments with plants.

Weekend programs will feature drop-in lectures, workshops, and guided tours. In addition, performances will feature music and poetry from Darwin's era, much of it heavily influenced by nature.

Exhibition Leadership
The New York Botanical Garden is proud to have historian David Kohn, Ph.D., a renowned Darwin expert and Professor at Drew University, as Curator of *Darwin's Garden: An Evolutionary Adventure*. John Parker, Ph.D., Professor of Plant Cytogenetics and Director of the Cambridge Botanic Garden, is Advisor to the Botanical Garden on the project. In addition, an Advisory Committee of distinguished Darwin scholars will contribute a wide range of intellectual perspectives. Senior New York Botanical Garden staff, including Vice President for Horticulture and Living Collections Todd Forrest and Mertz Library Director Susan Fraser, round out the leadership of this comprehensive exhibition.

After the exhibition at The New York Botanical Garden, portions of *Darwin's Garden: An Evolutionary Adventure* will be displayed at the Huntington Botanical Garden in Pasadena, California.

Canadian Journal of Botany to be renamed *Botany*

NRC Research Press is pleased to announce that, beginning January 2008, the ***Canadian Journal of Botany*** will be changing its name to ***Botany***. This name change will solidify the journal's position as an international journal for plant biology.

Published since 1929, this monthly journal features comprehensive research articles and notes in all segments of plant sciences, including cell and molecular biology, ecology, genetics, mycology and plant-microbe interactions, paleobotany, phycology, physiology and biochemistry, structure and development, systematics. It also publishes commentary and review articles on topics of current interest, contributed by internationally recognized scientists.

The journal will continue to be published in the same manner, with no changes in frequency or ISSN for both electronic and print formats, and the volume number will continue on from 2007.

North American Botanic Garden Strategy for Plant Conservation

Brooklyn, New York-June 27, 2007-An unprecedented partnership of botanic garden associations in the U.S., Canada, and Mexico presented its North American Botanic Garden Strategy for Plant Conservation (NABGS) here at the annual American Public Garden Association conference (APGA) today. This strategy was developed to focus on the thousands of North American plant species that are threatened with extinction. Other plant-conservation strategic plans have been used as a framework for this plan. The most significant include the Global Strategy for Plant Conservation, adopted by over 180 countries that are signatory to the Convention on Biological Diversity, and the strategic plan of the Conservation Alliance, a US federal interagency group.

The Partnership for Plants Alliance is comprised of five key organizations: the American Public Garden Association (APGA), Asociación Mexicana de Jardines Botánicos (AMJB), Botanical Gardens Conservation International (BGCI), the Canadian Botanical Conservation Network (CBCN) and the Center for Plant Conservation (CPC). The members collaborated to develop a comprehensive strategy for the conservation of threatened plants in North America

As outlined in the Strategy, the goals are:
1. Understanding and documenting plant diversity;
2. Conserving plant diversity;
3. Using plant diversity sustainably;
4. Promoting public education and awareness about plant diversity;
5. Building capacity for conservation of plant diversity;
6. Building support for NABGS.

The goals of the North American Botanic Garden Strategy for Plant Conservation follow internationally agreed targets that have been adapted to the particular North American context. Underpinning the major goals are 19 specific and measurable targets and sub-targets setting benchmarks to determine the success of both existing and future conservation efforts.

The Strategy also recognizes that, the botanical gardens of North America hold some of the most diverse collections of plants in the world. Many gardens have the expertise, knowledge and resources to expand their plant-conservation efforts beyond North America and assist in conserving nonnative species in the countries of origin.

Sara Oldfield, secretary general of Botanic Gardens Conservation International, points out that "North

America has many world-class botanic gardens that have so much to offer other botanic gardens in global biodiversity hotspots. Exchange of skills and expertise will be vital to ensure that the targets of the GSPC are met by 2010. We are calling for 30 percent of US and Canadian botanical gardens to support international plant species and habitat conservation."

Teresa Cabrera Cochon, president of the Asociación Mexicana de Jardines Botánicos, said, "We are proud to participate in this groundbreaking continent-wide partnership to aid in the critical task of plant conservation. In Mexico, where thousands of plant species are at risk, we look forward to working with our strategic partners-and benefiting from the pool of shared resources, from plant collections to scientific expertise-to adjust the rapid rate at which our diverse plant communities are becoming endangered."

Dr. Steven Clemants, president of BGCI North America and vice president of science at Brooklyn Botanic Garden, host to BGCI North America, noted "This is an important and significant milestone for plant conservation. We are proud to lend BBG's considerable scientific and horticultural expertise, resources, and research in the area of native plants and plant conservation to the Alliance and its Strategy. Who better than botanic and public gardens to take on such an urgent and compelling threat to plant sustainability by reaching out to promote public education and awareness about plant diversity? With this strategy, the Alliance has demonstrated pro-active leadership in highlighting the issue and fosters a way to implement a successful conservation initiative. We look forward to working with the Alliance."

David Galbraith, executive director, Canadian Botanical Conservation Network commented, "With this announcement we acknowledge a real opportunity to affect change towards sustainable plant diversity. We are pleased to lend our considerable experience in plant conservation and, working together with our North American botanical organizations, to help lead the way to educate our citizens about our shared responsibility to save our plant collections and to help ensure that we never have to mark the extinction of any plant species again."

Kathryn Kennedy, president and executive director of the Center for Plant Conservation, said "the Partnership for Plants is designed to facilitate harmony between existing initiatives aimed at plant conservation, identify gaps where new initiatives are required, and promote mobilization of the necessary resources to these ends. The future of endangered plant species across the continent is strengthened by the exchange of skills and expertise that each partner brings to the strategy; and ultimately, the rich diversity of plant communities in each nation will be under greater protection because of the unique continental alliance."

Dan Stark, executive director of the American Public Garden Association, said, "Every botanic garden, large or small, has a role to play in conserving plants whether through storing seed, propagating rare and endangered plants, working on recovery plans or inspiring the public about the value and needs of threatened plant species. Combining our efforts should ensure that no more plant species become extinct."

Information on Threatened and Imperiled Plants

-The Global Strategy for Plant Conservation (GSPC) has been adopted by the signatories of the Convention of Biological Diversity (CBD) and includes 16 outcome-oriented global targets for plant conservation by 2010. The ultimate and long-term objective of the strategy is to halt the current and continuing loss of plant diversity. The strategy will provide a framework to facilitate harmony between existing initiatives aimed at plant conservation, to identify gaps where new initiatives are required, and to promote mobilization of the necessary resources. The reason for a strategy under the CBD is that setting meaningful targets is feasible since scientific understanding of at least higher plants, though incomplete, is better than for most other groups.

-Botanic Gardens Conservation International (BGCI) is a membership organization linking botanic gardens in over 120 countries in a shared commitment to biodiversity conservation, sustainable use, and environmental education. BGCI aims to mobilize botanic gardens and work with partners to secure plant diversity for the well-being of people and the planet.

-The Center for Plant Conservation is a U.S. based plant conservation organization, dedicated to conserving and restoring the imperiled native plants of the United States.

. The number of native plants in the US and Canada is approximately 35,000 of which around 5,500 are classified as "at risk." In Mexico, 981 species are included on the 2001 Red List.

Book Reviews

Developmental

Systematics

Seed Development, Dormancy, and Germination. Annual Plant Reviews, Volume 27. Bradford, Kent and Hiro Nonogaki. 2007. ISBN 9781405139830 (Cloth US$199.99) 392 pp. Blackwell Publishing Ltd. 9600 Garsington Road, Oxford, OX4 2DQ , United Kingdom

Cracking the barrier of seed dormancy to assure germination has challenged farmers for millennia. Botanists and horticulturalists have devoted much ink and many pages to the study. This new review, addressed to plant physiologists, molecular biologists, biochemists, biotechnologists, geneticists, horticulturalists, agronomists and botanists, integrates advances in the diverse and rapidly-expanding field of seed science: ecological and demographic aspects of seed production, dispersal and germination, and the molecular biology of seed development. The book offers a broad, multidisciplinary approach that covers both theoretical and applied knowledge.

Seed Development, Dormancy and Germination covers the development and regulatory processes of the developing seed, dormancy, germination and seedling growth, taking into consideration the complex environmental, physiological, molecular and genetic interactions that occur throughout the cycle. Twelve chapters address the genetic control of seed development and seed mass, seed coat development and dormancy, definitions and hypotheses about seed dormancy, seed dormancy (modeling, genetic aspects, lipid metabolism, abscisic acid and hormonal interactions), nitrous oxide in seed dormancy and germination, regulation of ABA and GA levels, de-repression of seed germination by GA signaling, mechanisms and genes involved in germination, and the role of sugar and abscisic acid regulation in germination and the transition to seedling growth.

A chapter titled Genetic Control of Seed Development and Seed Mass, by Masa-aki Ohto et al, opens this book. Although the authors qualify their chapter as not intended to be comprehensive, it provides requisite background and perspective on the genetic control of endosperm development, and genetic aspects of testa development. In the past decade and a half, there has been significant progress toward defining regulatory genes that control aspects of seed development.

Isabelle Debeaujon et al's well-referenced article: Seed Coat Development and Dormancy, and in particular, the section about Effects of flavonoids on seed dormancy and germination, illustrates that flavonoids, particularly proanthocyanidins (PAs), reinforce coat-imposed dormancy by increasing testa thickness and mechanical strength, details specific to my research questions. Indeed, cell layers containing pigments generally do not crush as dramatically as non-pigmented ones. During oxidation, PAs tend to cross-link with proteins and carbohydrates in cell walls, thus reinforcing testa structure and modifying its permeability properties. Flavonoids, phenolic acids and lignans, each are

possible germination inhibitors. The closing segment, Link between coat-imposed dormancy and longevity, relates the influences on rate of aging with storage temperature, seed moisture content and seed quality.

Henk Hilhorst's wide-ranging coverage, Definitions and Hypotheses of Seed Dormancy, is another relevant review, since wild *Sesamum* species show strong latency. Dormancy is classified; then hormonal and environmental signaling in dormancy regulation, are illustrated. Phil Allen et al present Modeling of Seed Dormancy, first defining the Types and phenology of seed dormancy, and the Environmental controls of dormancy: Temperature, After-ripening, Stratification, Light.

Leónie Bentsink et al review Genetic Aspects of Seed Dormancy, addressing key issues of dormancy and shattering, the defining changes that occur with plant domestication. Lipid Metabolism in Seed Dormancy by Steven Penfield et al focuses on the biochemical pathways required for the catabolism of seed storage reserves and the specific role these might play in the control of seed dormancy and germination. Nitric Oxide in Seed Dormancy and Germination, by Paul Bethke et al, treats the reactive, gaseous free radical that functions as a potent signaling molecule. The data presented here support the hypotheses that NO promotes seed germination either by reducing dormancy or by minimizing the effects of environmental conditions that inhibit germination.

Abscisic Acid and Hormonal Cross-talk in the Control of Seed Dormancy Maintenance and Alleviation, by J. Allan Feurtado and Allison R. Kermode, is one of three chapters that review the roles of plant hormones on seed dormancy, germination and development. Regulation of ABA and GA Levels during Seed Development and Germination in *Arabidopsis* by Shinjiro Yamaguchi et al, and Camille Steber's look at De-repression of Seed Germination by GA Signaling, complete that trio. Mechanisms and Genes Involved in Germination *Sensu Stricto* by Editors Hiro Nonogaki and Kent Bradford, with Feng Chen, the book's penultimate chapter, introduces readers to the many definitions of germination. Bas Dekkers and Sjef Smeekens article, Sugar and Abscisic Acid Regulation of Germination and Transition to Seedling Growth, closes the volume. Sugar signaling is related intimately to hormone signaling.

Seed Development, Dormancy and Germination provides a comprehensive overview of seed biology from the viewpoint of developmental and regulatory processes. It identifies current challenges and questions remaining for future research. Most of the chapters investigate *Arabidopsis*, indicating how prevalent this plant species has become as the *Drosophila* equivalent of higher plants. Editors Kent Bradford (Director, Seed Biotechnology Center, University of California, Davis) and Hiroyuki Nonogaki (Department of Horticulture, Oregon State University, Corvallis) have assembled captivating chapters by an international pool of distinguished authors, from Canada, France, Japan, the Netherlands, the United Kingdom and the USA. They also provided this volume with some unique features. Exploring the book's 38-page Index, I discovered that even entries in the chapters' bibliographies are included, for example, the term 'turgor.' Additionally, the Table of Contents provides an outline of each chapter.

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

Breeding Field Crops 5th ed. Sleper, D. A. and J. M. Poehlman. 2006. ISBN 0-8138-2428-1 (Cloth US$ 84.99) 424 pp. Blackwell Publishing, P.O. Box 570, Ames, IA 50010-0570.

Breeding Field Crops, first published almost fifty years ago, quickly became a staple text for undergraduate and graduate students and for field breeders and, throughout its editions, it has maintained its standing as one of the premier plant breeding textbooks worldwide. It achieved this distinction not simply because of its original clarity, but because subsequent editions have evolved in step with advances in our knowledge of basic genetics and reproductive mechanisms, the critical importance of international breeding programs and germplasm preservation repositories, database recording and exchange technologies, and the expansion of cell and tissue culture techniques and molecular manipulation strategies and capabilities.

I first became familiar with this text when it was in its third edition (published twenty years ago) when I was teaching a combined, upper-level undergraduate/M.S.-level course on the breeding of agronomic and horticultural crops. There were several attributes of this textbook (which have continued through this current edition) that have made it particularly enjoyable to use.

As stated in the Preface, it was written with the beginning student of plant breeding in mind. It begins, therefore, by addressing the obvious first

question, namely "What is plant breeding?" and very concisely describes the importance of plants, the disciplines critically associated with the process of plant improvement, and highlights the contributions of a few noteworthy plant breeders from Mendel to the present. It then provides a review chapter on basic botany, but focusing on how it relates to reproduction, including flower morphology, microsporogenesis and megasporogenesis, chromosome numbers of selected cultivated species, and self vs. cross-pollinating species. The third chapter describes how Mendelian genetics and chromosomal genetics complement and support one another and provide the foundation for traditional, directed, field breeding efforts. This chapter, along with the previous two, provides a critical base from which to describe the specifics of more detailed plant breeding strategies and considerations, introduced and described in later chapters.

One of the most useful features of this book, particularly as a student reference text, is the collection of Tables and Figures found throughout its chapters. For example, Figure 5.4 illustrates the genomic relationships between naturally-occurring *Brassica* species, a very important, but often confusing concept for some students to grasp. Although conventional in its visual appeal, it is the best illustration of this topic I have ever encountered.

In the third edition, chapter eight was entitled Plant Cell and Tissue Culture: Applications in Plant Breeding. In the following edition it was changed to Molecular Biology: Applications in Plant Breeding, while in this current edition it is entitled Biotechnology and Plant Breeding. Much of the same information, however, has been retained. This chapter is well written, but could be expanded in a future edition with additional recent references.

The fourth section devotes individual chapters to breeding methods and objectives for self-pollinated and for cross-pollinated and clonally propagated crops. This section, in my opinion, contains the singularly most important and remarkable feature of this book, namely the individual diagrams illustrating selection methods. Using a consistent format, the procedures for pedigree, bulk-population, single-seed descent, double-haploid, backcross, phenotypic recurrent, half-sib, full-sib, S_1 progeny, polycross progeny, and clonal selection methods are illustrated and very clearly defined. These figures are what initially drew me to this text, and are what cause me to return to this text year after year. Although the quantity of information presented on clonally propagated crops is brief and includes only one figure, it may improve the flow of this section if it were expanded and placed in its own chapter in the next edition, rather than being placed at the end of the chapter on cross-pollinated species.

Section Five begins with a discussion of genetic diversity and germplasm conservation. The authors include a very clear illustration of Vavilov's Center of Origin for the major crop species worldwide, with a tabular description of some of the more economically important crops found in each area. To emphasize the ecological, political, and environmental issues associated with conserving these priceless reserves of wild germplasm for future breeding efforts, the inclusion of a parallel figure illustrating human population numbers and political borders would provide a clear justification and a powerful incentive to increase international germplasm conservation efforts. In addition, the inclusion of contact information (with worldwide web addresses) for each repository would further increase the utility of this chapter, as would an example of an actual database record for an accession. Also, a separate chapter focusing specifically on established and emerging technologies for long-term protection, collection, maintenance, preservation, and distribution of germplasm would improve this text's usefulness as reference tool.

The next four sections provide information on the breeding of crop species of particular economic importance: wheat, rice, soybean, maize, sorghum, cotton, forage crops, potato, and sugarcane. Each chapter includes specific examples of breeding programs and objectives and each chapter includes numerous photographs and diagrams. These chapters would obviously be of benefit to plant breeders, but they also highlight the applied strategies and concerns unique to each crop. Perhaps an additional chapter detailing the methods used for selected horticultural crops (*e.g.* tomato, lettuce, cucurbits, berries, fruit trees) would make this text more comprehensive. The final chapter details seed production techniques, such as seed certification procedures and patent protection.

The fifth edition of *Breeding Field Crops* has retained much of its original format, content, and artwork from its two previous editions. When I first received this new edition, I noticed that it is about one third thinner (and seventy pages shorter) than the fourth edition (which is 230 pages shorter than the third edition). After examining it, however, I realized that much of these reductions are due to smaller and more efficient margins and font sizes which reproduce well on the glossy pages of the newest edition. Of course, the photographs would have more appeal if they were in color instead of monochrome, but this probably was a decision of

the publisher and relates to the smaller audience of a specialized text.

In summary, I would recommend this text to the audience for which it was originally written; namely, to advanced undergraduate students and graduate students, as well as to commercial plant breeders and researchers wishing to learn more about the important, and indeed essential "field" of plant breeding.

-Henry R. Owen, Professor of Biological Sciences, Eastern Illinois University, Charleston, IL 61920. (hrowen@eiu.edu)

Medicinal Plants: Chemistry and Properties. M. Daniel. Science Publishers. ISBN 1-57808-395-8

In order to understand the biological activity of a plant - - be it medicinal, poisonous, or nutritive - - we need to know its chemical constituents. Thus, it is plant secondary and primary metabolites that organize Medicinal Plants. For example, after a general introduction to the structure, characteristics, and general pharmacological activities of alkaloids, the author goes on to further distinguish among fifteen different alkaloid types (tropane alkaloids, isoquinoline alkaloids, indole alkaloids, etc.). Under each chemical grouping, the author describes one to several plant species especially known for those components. In addition to alkaloids, the author covers the many different chemical classes of Terpenoids and Phenolics, includes a section on Gums and Mucilages, and also discusses primary metabolites like carbohydrates, amino acids, proteins, fatty acids, and glycolipids. I found the chemical-related information clear-cut and easy to follow, although a figure or two would have helped increase comprehension.

Of the 350 plants covered in this book, 110 are European or American. The remaining species are from India (the author's home), Southeast Asia or China. So while there are many unfamiliar plant species discussed, the book offers a more global perspective of medicinal plants. An entry typically begins with a brief description of the plant, including its native country, and continues with a list of chemical components. Instead of listing every individual chemical, the author wisely lists only the major active components and the plant organ where they are found.

While chemical contents are adequately covered, most species entries only include a brief and general listing of plant uses (e.g. cathartic, emetic, carminative, stimulant, antihelmitic, expectorant, etc.). And while a few plant entries mention specific actions like anti-mitotic activity or pupil constriction, M. Daniel generally includes very little information on how the individual plant species acts medicinally. For example, the section on *Catharanthus roseus* mentions the indole alkaloids in the plant and its effectiveness against leukemia, but fails to mention how they cause depolymerization of protein microtubules during mitosis. There are, however, general discussions of biological activity under the main chemical headings (e.g. volatile oils inhibit cancer cells or act on the Central Nervous System), as well as sections that briefly discuss topics such as antioxidant therapy or aromatherapy.

Legal issues are not always mentioned in a plant's description. The section for Kava Kava (*Piper methysticum*) mentions its health-related controversies, although there are no such caveats for Ephedra (*Ephedra sinica*). This most likely represents the greater European influence in India.

As a quick reference, this book contains an excellent listing of a plant's chemical constituents, and for that alone I would recommend Medicinal Plants: Chemistry and Properties. However, for anything more than cursory information on medicinal activity, it needs to be used in conjunction with other resources.

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Practical Plant Identification. Cullen, James. 2006. ISBN-13 978-0-521-86152-6 (hardback) ISBN-13 978-0-521-678773 (paperback). xi + 357 pp. Cambridge University Press, Cambridge

Reviewing Professor Cullen's guide for *Practical Plant Identification* provided me with an interesting opportunity to revisit the fundamentals of plant taxonomy that I covered more than 30 years ago as a graduate student at Rutgers University. Since then my field studies have been in the semi-arid grasslands, shrublands, and high elevation forests

of the southwestern United States. The floral treatments that I have used in the west in these intervening years, while certainly compliant with classical botanical terminology, still seem to have a rhythm and style all their own, reflecting the dominant taxa of the region and the proclivities of their authors. Professor Cullen's classical training in plant taxonomy and depth of experience in the "old-world" and "new-world" north temperate flora is clearly evident in his very thorough, effective and straightforward presentation of basic taxonomic concepts and terms.

The subtitle to *Practical Plant Identification* clarifies the emphasis of the book – "Including a Key to Native and Cultivated Flowering Plant Families in North Temperate Regions." Roughly 50 pages of this book are dedicated to an overview of terminology that every field botanist should be familiar with. This section is supplemented with numerous line drawings, apparently similar to those used in the author's classical work entitled *The Identification of Flowering Plant Families* that served as the foundational text for this book. Some readers might expect color plates or more sophisticated illustrations; I found the line drawings to be very effective and well presented.

About 60 pages of *Practical Plant Identification* consist of a key to the approximately 320 or so plant families commonly found in north temperate regions. In the opening 4 pages of this section Professor Cullen provides a very insightful guide to using dichotomous keys. This introduction provides the reader with an important opportunity to understand how couplets are constructed and how one should approach the logical structure of dichotomous keys. Within the key, I found the couplets to be clearly written, concise, and well organized. The numbering system that is used makes it very easy to keep track of your location in the key. Of important interest in this key is the inclusion of many families from which horticultural species are derived, which should be helpful to field botanists whose interests focus on natural flora. At the end of the key to families there is a list of about 20 very helpful "spot" characters that, when applied in the field, should accelerate identification of unknowns to the family level. For example, plants having "translucent or dark, often aromatic glands, seen clearly in the leaves when held against the light" would likely belong to either the Myricaceae, Lauraceae, Guttiferae, Rutaceae, or Myrtaceae.

Fairly succinct, but complete and accurate descriptions are provided for the 328 plant families covered by this book. The descriptions are well organized and clearly written to provide the key characters one would want to be reminded of in the field. I found it troubling that the copy of the book that was sent to me for review had about 16 blank pages interspersed throughout this section, with text obviously missing. I suspect that the publisher will have responded to complaints about this error before this review is published and will have taken the necessary steps to fix the problem. Nonetheless, readers will find the family descriptions useful in the field, but may want to consult more complete descriptions when working in the herbarium.

The bibliography and glossary included at the end of the book may be of limited scope for many readers. The most recent citation in the bibliography was 2001 and the author admits that the glossary definitions are very brief. The index is very thorough and the few checks that I did indicated that it is well done.

Overall, I presume that this book would be most useful for those with some classical training in botany and plant taxonomy. If I were teaching an upper division course in field plant identification at higher latitudes than I find myself at present, I would use the book as a supplementary text. However, as Professor Cullen admits, the familial treatments he uses may differ substantially from those used by other authors. That is not necessarily a shortcoming in upper division courses in which students should be discovering that not everything in the sciences is homogenous. Professor Cullen can be applauded as well for directing our attention to those plant families yielding horticultural varieties that, in many areas, may escape and become naturalized.

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Vascular Flora of Ko Hong Hill, Songkla Province, Thailand. Thai Studies in Biodiversity No. 6,Maxwell, J. F. 2006. 472 pp.

A sizeable portion of the rich plant diversity of Southeast Asia is currently being documented by two long-term flora projects, the Flora Malesiana project (http://www.nationaalherbarium.nl/rhb/malesia.htm#flora%20malesiana) that covers the Malesian region from peninsular Malaysia to New Guinea, and the Flora of Thailand project (http://www.dnp.go.th/botany/BOTANY_eng/flora.html),

which documents the flora of that single country. Both projects have been in progress for decades, and proceed slowly because of the large number of species involved, the small number of taxonomic specialists, and the fact that many groups have never received taxonomic revisionary treatment of any kind. While we wait for these works to be completed, it's essential to have "snapshots" of the plant diversity of the region, where ecological and conservation studies often must nevertheless proceed, requiring knowledge of the local flora and a way to identify species.

From the juncture of the geographic areas covered by these two flora projects now comes a new "florula" of Ko Hong Hill in Songkhla Province of southern Thailand, by botanist J. F. Maxwell. Florulas are nothing new, but the preponderence of recent ones have been from the Neotropics. Ko Hong Hill, as the author notes, is an area of about 13 km^2 located near the campus of Prince of Songkhla University outside the city of Hat Yai. It is an area of largely secondary and disturbed forest interspersed with rubber plantations, yet a diverse flora of nearly 600 native species, representing 130 families of vascular plants, remains. For comparison, the flora of Barro Colorado Island in Panama, as enumerated by Croat (1978), comprises 1350 species, but from a slightly larger area of ca. 16.6 km^2, and from habitat with less recent disturbance.

The book begins with a brief description of the geography, climate, and vegetation of the area, and then proceeds to presentation of a series of seven family keys. The species are then enumerated by family more or less on the Bentham and Hooker system, plus the system of Tagawa and Iwatsuki (1971) for the pteridophytes. Each family treatment includes a brief family description, keys to genera if more than one genus is present, and then descriptions of individual species, arranged alphabetically. If more than one species of a particular genus is present, a key is given to distinguish those as well. Succinct, but detailed and parallel species descriptions are provided, together with brief notes on abundance, habitat, phenology, taxonomic problems, and local names. A list of references cited, 41 black and white line drawings of mostly weedy species, an index to taxonomic names, and color photographs of 39 additional species by Charan Leeratiwong conclude the work. The latter include photographs of *Barringtonia rimata*, a species of Lecythidaceae known only from this locality, and *Bolbitis malaccensis*, reported here as new to the flora of Thailand.

From this treatment it is possible to quantify floristic diversity of the area at several levels. Families represented by ten species or more are the Poaceae (51), Euphorbiaceae s. l. (46), Rubiaceae (43), Fabaceae (38, of which 8 are mimosoids and 6 caesalps), Cyperaceae (30), Moraceae (22), Asteraceae (15), Myrtaceae (12), Melastomataceae (12), and Convolvulaceae (12). Dipterocarpaceae and Fagaceae, at three species each, are notably species-poor, perhaps the result of logging of these desirable timber species before the floristic inventory was carried out. Genera represented in the flora by five or more species are *Ficus* (16), *Cyperus* (10), *Eugenia* (9), *Hedyotis* (7), *Mallotus* (6), *Fimbristylis* (6), *Ipomoea* (6), *Psychotria* (5), *Salacia* (5), and *Diospyros* (5). All told, the author describes and distinguishes 637 vascular plant taxa from Ko Hong Hill; this total includes four additional varieties of species present in the flora area, and about 44 species not native to Thailand.

Production of this flora was largely carried out while the author was on the faculty of Prince of Songkhla University in the 1980s. As the author explains in the Preface, the flora was initially produced in mimeographed form in 1986, before the widespread availability of word processors. Thus in order to produce this flora for publication it was necessary to re-type the entire manuscript. The editor of Thai Studies in Biodiversity, Dr. Warren Brockelman, is to be commended for encouraging publication of the work and helping to arrange for a typist to undertake this monumental enterprise. Regrettably, in spite of great effort, several printing and production errors occurred. The text of page 198 appears as well on page 224 and on page 233; the part of the key to genera of Rubiaceae on page 153 is printed so that the names of the genera have been cut off; and Figure 21 of *Globba fasciata* is repeated in the place of Figure 22, which should show *Zingiber zerumbet*. To aid in using this work, I have appended copies of the missing text and figure to this review for those interested in purchasing the book for its bargain price of 400 Thai baht (about US$13), although by now the missing pages may also be available from the Editor.

Vascular Flora of Ko Hong Hill has tremendous value as a teaching and research tool. The family keys are useful for teaching students in plant systematics. Because the flora includes a large number of species of disturbed and secondary growth areas, the work will be useful for identification of plants of such habitats throughout Southeast Asia. For students of tropical floras and tropical ecology more widely, this work provides, indirectly, a window into the effects of clearing and disturbance on what was once primary lowland rainforest in this region of the Asian tropics. Finally, the work should pave the way for plant identification-dependent studies in ecology and conservation, and perhaps

inspire similar "florulas" to be prepared for neighboring areas. I highly recommend it.

[Note: In the interests of full disclosure I want to add that I read and made corrections on a draft of this book before it was published.]

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Editors note:
Corrections/queries for material on manuscript pages 153, 224 and 233 and missing/misprinted mansucrip pages 156, 227, 236, an 438 may be obtained directly from Dr. Johnson.

Encyclopedia of Evolution. Stanley A. Rice. 2007, Facts on File Science Library. New York, NY, USA

Stanley A. Rice, a plant biologist at Southeastern Oklahoma State University, has published a new encyclopedia of evolution that should be of interest to biologists and general readers. It may not be as useful for a practicing evolutionary biologist, as there is a great deal of emphasis on current 'hot topics' concerning the teaching of evolution and on the evolution of humans, with less attention paid to deeper issues in the field. It would be a very good reference for someone teaching undergraduate courses on evolution, and would be handy for teachers looking for biographies of scientists from Gregor Mendel to Richard Dawkins and Carl Woese.

The work contributes to the sparse collection of encyclopedias of evolution, the latest being the two volume set edited by Mark Pagels. Before the Pagels work, the only 'encyclopedia' of evolution was Grzimek's Encyclopedia of Evolution. Unlike the Pagels edition, Rice is author of most of the articles so that the prose of the work tends to flow together better than these pervious works.

A major theme of Rice's work is the contemporary debate on evolutionary theory and its competitors, with intelligent design (ID) being the foremost of these alternative ideas. This emphasis is due to the rise in popularity of ID and Rice does a good job of debunking this well-worn case of pseudoscience. Rice includes extensive entries on different types of creationism, natural theology, ID, and the Scopes trial to bolster his claims that ID does not belong in the science classroom. Under the ID entry, for example, Rice successfully critiques the claims of ID theorists like Michael Behe of Lehigh University with a step-by-step refutation of his specific claims. Some of the entries dealing with creationism seem too tangentially related to evolution, though. For example, Rice gives us a detailed breakdown of the fallacies in the movie *Gone with the Wind* in the entry for the Scopes trial. While this addition is done in good spirit, I am unsure if many undergraduates have actually seen this movie, so it may not be that useful in the teaching arena.

Rice also includes detailed entries on all aspects of human evolution and the scientific personalities associated with major fossil humanoid discoveries such as the Leakeys and Donald Johanson, discoverer of the Australopithecine "Lucy" (*Autralopithecus afarensis*). There is even an excellent entry on the Flores Island people, the controversial genus of *Homo* found recently in Indonesia. Rice presents both sides of the story in this case, showing how evolutionary science is a dynamic, engaging field. As students are naturally interested in their own origins, this book would be useful in introducing the complex subject of human evolution to undergraduates.

Plant biologists would be especially heartened by the fine explanation on hybridization in the encyclopedia, especially because it does not even warrant a separate entry in the Pagel's earlier work. Rice includes examples of hybridization from across the plant literature, from Rieseberg's work on *Helianthus* spp. to the complicated hybrids arising in *Quercus.* One of the only shortfalls of this particular entry is the sparse 'Further Reading' section, with only a single reference supplied.

As with any reference work, a reviewer is bound to have complaints about what entries are missing or are extraneous. While Rice's work contains entries on many prominent and contemporary scientists, there are some noticeable exceptions. For example, among living biologists, Lynn Margulis and Richard Dawkins are given large entries, perhaps because of their roles in popularizing evolutionary science. Notably missing is an entry on George C. Williams, whose book, Adaptation and Natural Selection, is still a fine exposition of how evolution works and why group selection arguments are difficult to maintain. Two other exceptions are the omissions of Karl Pearson and William Bateson, two scientists responsible for much of the foundations of population genetics. Although their quarrels were

quite serious, the tension between their two camps brought forth a great deal of empirical data that helped fuel the more sophisticated positions of Ronald Fisher and Sewall Wright. Moreover, although population genetics is given an entry, Hardy-Weinberg equilibrium is not – this omission may be difficult for students because their first foray into population genetics usually begins with a much-dreaded derivation of this famous formula. Finally, unlike the Pagels edition, Rice does not include annotated entries at all, which are very useful for undergraduates or scientists not familiar with specialized literature on certain topics.

One fine addition to the general list of entries is a summary, listed by chapter, of Darwin's Origin of Species. As one who had to read the entire work in college, and who can't remember much of it now, I can appreciate this synopsis, because it emphasizes the most important parts of each chapter. Conveniently, Rice also cross-references entries from the encyclopedia as they turn up in Darwin's text. For example, in chapter six, which famously deals with difficulties in the theory of natural selection, Rice includes a cross-reference to an entry on 'Intelligent Design' right before Darwin deconstructs the apparently irreducibly complex structures making up the vertebrate eye and wings. This small detail helps us appreciate that ID and the 'irreducibly complex' argument is really William's Paley's 200 year-old argument fashioned in a way to make it palatable to a modern audience.

This work would be a fine addition to any teacher's library. It would also be appropriate for the layperson who would like to explore the subject of evolution in more detail. The author writes in an engaging style and the biographies, in particular, are quite good. I found myself learning a great deal about each scientist just by leafing through the volume at the breakfast table. Again, this work may not be suitable for the specialist in evolutionary biology, but should help the general reader understand the broad sweep of evolutionary thought and the recent misguided efforts to introduce intelligent design and creationism into the science curriculum.

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