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Have you heard the complaint that "The Business Model" is taking over academe and the bottom line is student credit hours? The numbers shared in the last issue do not bode well for many of us if this model continues to gain favor. Yet, botany programs at several institutions are maintaining their student numbers as they continue to offer a broad spectrum of coursework in the plant sciences. As promised in the last issue of *Plant Science Bulletin* this number will highlight some of those successful programs and share some of the ideas they have found useful in strategic planning and recruiting. Ohio University is a Research University with a long and distinguished program in botany. The University of Wisconsin-Stevens Point is a comprehensive regional campus with a primary mission in natural resources. They have very different missions yet both are successful in promoting botany. Hopefully you will find that some of their ideas and practices have potential application to strengthen your program.

In addition we have included a paper by Jack Carter adapted from a workshop he presented three years ago in Santa Rosa, LaPampa, Argentina. Although written for Argentine botanists his thoughts are equally valid for us. Jack, now retired from Colorado College, is a long-time member of the Society who was active in the teaching section and education committee. He is also Past-president of the National Association of Biology Teachers and a former Executive Director of the Biological Sciences Curriculum Study (BSCS).

We will continue this series in the next issue with additional invited contributionsand contributed letters on the topic. If you have ideas or recommendations about what you have found to be successfully in promoting botany on your campus, please share them by sending a letter to the editor.

-Editor

Combining Breadth with Specialization to Build a Strong Botany Department

With fewer than 30 botany departments left in the U.S., and many biology departments offering only a few plant courses (Sundberg, 2004), it is critical that the remaining botany departments not only survive but thrive. In order to do so, they must develop strong programs at both the graduate and undergraduate levels. This is a particular challenge for small to mid-sized departments because it is difficult to maintain both breadth of coursework and nationally competitive specializations in such departments. To accomplish this goal, our department at Ohio University has devised a hiring strategy that may be a useful model for others.

In 2000, our faculty undertook a strategic planning process. Because of the demographics of our department, over a third of our faculty were to retire between 2000 and 2005, and the new faculty who would be hired would determine the direction of the department for years to come. In discussing our vision for the department, there was a fundamental disagreement about the desirability of specialization. Some faculty felt that developing a few focus areas would be highly beneficial to our national reputation, grant procurement, and ability to attract graduate students, but others felt that specialization would jeopardize our ability to provide the breadth of undergraduate training in plant biology that has historically been a strength of our department.

The solution we devised, which permits us to maintain breadth while developing specializations, may be a useful strategy for other small to mid-sized departments. We decided to maintain our historic balance among faculty qualified to teach courses at three organizational levels (cellular,

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organismal, ecological) but to develop a research focus area at each level. The focus areas we selected are plant cell wall biology, phylogenetic systematics, and eastern deciduous forest ecology. Each specialization initially centered on the vigorous research programs of one or several faculty. The largest group at the time was phylogenetic systematics (5 faculty), but three strategic hires since 2000 have significantly strengthened the forest ecology and cell wall biology groups.

By selecting focus areas at widely different organizational levels, it is possible for a relatively small department (we currently have 12 faculty) to achieve two goals that are sometimes viewed as incompatible: 1) teach the full breadth of plant biology courses needed for strong undergraduate and master's degree programs; and 2) provide the critical mass of faculty necessary for effective doctoral training in selected specializations. For example, the forest ecology group includes faculty who address research questions in the eastern deciduous forest biome at individual (physiological), population, community, ecosystem, and landscape levels. These same people teach introductory plant ecology, advanced courses in community ecology, population biology, ecosystem ecology, ecophysiology, tropical ecology, and biostatistics, and an innovative course that teaches the concepts of forest ecology to non-majors in the context of settlement history and current land use.

The study groups of the phylogenetic systematics faculty include red algae, cellular slime molds, ferns, lycopsids, seed ferns, conifers, and angiosperms. These faculty teach introductory courses in plant structure and development, plant, fungal, and algal diversity, and dendrology, and advanced courses in vascular plant morphology, anatomy, systematics (the lab portion of which covers angiosperm taxonomy), molecular systematics, phycology, mycology, evolution, and paleobotany. The paleobotanical collection at Ohio University is among the largest in the nation and supports an active graduate program in this discipline.

The faculty in the cell wall focus area, who also participate in an interdepartmental graduate program in Molecular and Cellular Biology involving 42 faculty, approach cell wall biology from molecular-genetic, developmental, and biochemical perspectives. They teach general biology for non-majors, introductory courses in plant cell biology and physiology, advanced courses in cell biology, molecular genetics, biotechnology, and developmental physiology, and a writing course designed for plant biology majors. Finally, a faculty member who does not belong to any of the focus groups teaches plant genetics, plant pathology, introductory botany for non-majors, and "Plants and People" (a large non-majors course that is also taught by members of all three focus groups).

It should be clear from this list that the breadth of course offerings in our department is not compromised by our decision to focus recent and future hires on three research specializations. With 45 majors, we are among the ten largest undergraduate botany programs in the country. At the same time, we are increasingly receiving applications from prospective graduate students who are interested in one of our three targeted specializations. Highlighting these focus areas on our web site (http://www.plantbio.ohiou.edu/) helps draw the attention of prospective graduate students who are specifically interested in cell walls, phylogenetics, or forest ecology. Our faculty generally have 30-35 graduate students in their labs any given year.

Overlaying the focus group organization is a second, informal network of inter-group collaborations,

which increase the range of faculty and student research. For example, Sarah Wyatt (a developmental biologist), Harvey Ballard (a systematist), and Glenn Matlack (a forest ecologist) are collaborating on a project using microsatellite markers to examine the process of invasion by three exotic plant species. Another project (Wyatt, Ballard, and Theresa Culley [Univ. of Cincinnati]) uses microsatellite markers in violets for pansy cultivar development and to evaluate the bioremediation potential in some heavy-metal tolerant species. Wyatt and Brian McCarthy (forest ecologist) are using a genomics approach to search for blight-resistance genes in American Chestnuts. Ballard and Wyatt are exploring the molecular genetic mechanism that regulates the mixed breeding system in violets. Wyatt, Ballard, and Kim Brown (forest ecologist) are collaborating on a study of ecological speciation in Hawaiian violets. Most of these projects involve both graduate students and undergraduate researchers. All undergraduates majoring in our department either conduct independent research or participate in an internship outside the university.

An unusual component of the department's course offerings is Global Studies in Plant Biology. This program was initially developed by Harvey Ballard and Morgan Vis, but it has been expanded to involve Kim Brown and Glenn Matlack. It incorporates a seminar that introduces a particular geographic region, an international field course within the focus region, and subsequent laboratory research on one or more group projects using materials and data from the field course. The geographic focus changes from year to year, moving about the world to spotlight different regions and their plant life. Previous courses have targeted the alpine vegetation of the Bolivian Andes, the oceanic island communities of the Hawaiian Islands, and the rainforests of Brazil and French Guiana. Upcoming programs will focus on Thailand, New Zealand, and China. Global Studies in Plant Biology is one of very few programs in the country that unite an international study opportunity, an intensive field course format, field and lab skills training, and student participation in faculty-led research.

Although the Global Studies Program may help attract majors, our most effective undergraduate recruiting tool has been our large non-majors courses, which are taken by many freshmen who have not yet declared a major. These courses are taught by some of our most engaging and dedicated teachers, several of whom have won College or University teaching awards in the past few years. We know from the exit interviews that we conduct with all graduating seniors that many students decided to major in plant biology after taking "Plants and People" or one of our other general education courses.

In a day and age when legislators and administrators often mistakenly equate size with viability, small departments have to work extra hard to demonstrate their quality and national competitiveness. The success of our program is the result of several factors: a hiring strategy that combines breadth with specialization; integrative research projects involving a collaboration of faculty, graduate students, and undergraduates; development of innovative courses; effective program promotion via the Internet; and undergraduate recruitment through popular general education classes. Botanical education is thriving at Ohio University.

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Botany program at the University of Wisconsin-Stevens Point

The botany program within the biology department of the University of Wisconsin -Stevens Point (UWSP) is very successful. To some degree the successes are due to happenstance, good fortune and sometimes arbitrary decrees of the state and administration. In a few intances the successes are due to deliberate choices made by the department. In 1996, the department received a UW System Board of Reagents teaching Excellence Award naming it the "OUTSTANDING DEPARTMENT IN THE UW SYSTEM". The NSF Doctoral Candidate Survey, a comprehensive annual survey of doctoral candicates, found UWSP to have the second largest number of former undergraduate students who went on to complete a Ph.D. in life science (86 over the 19 years of the survey) compared to all primarily undergraduate colleges and universities in its size range (4-year regional comprehensives). Our

successes are due to three major factors: excellent, motivated students; well trained, dedicated faculty; and good facilities and support. One other secret factor—for over 35 years, the department chair has been a botanist [not the same person]. [Don't let your zoology colleagues read this.]

Our students come from around the nation, but most are from small towns or rural central Wisconsin and they have a strong work ethic. Several years ago, UWSP was mandated by the state to reduce enrollments to 8500 from over 9000 students. At the same time the biology department had an active recruitment program. The result was that applications went up dramatically and better students enrolled in our classes. In the introductory classes the average student ranks 15th in his/her high school graduating class and a class of 24 or 32 students is likely to have three or more valedictorians or salutatorians. We have excellent students!

Botanists represent a large part of the faculty [nine of twenty three] and most major disciplines are represented with courses in; plant taxonomy, aquatic vascular plant taxonomy, plant anatomy, plant morphology, plant ecology, plant genetics, paleobotany, mycology, phycology, bryology and lichenology, agrostology, horticulture, tree physiology, plant physiology, many many independent studies and general botany. As much as possible in central Wisconsin, field work is included in courses. The department has a traditional organismal emphasis.

Two courses deserve special mention. All biology students are required to take introductory botany [biology 130] , a 5 credit course. The course is taught by 5 of the botanists, each having 1-4 lab sections [two 2-hour labs per week per section- no graduate students] and that faculty member lectures [3 hours per week] to the same sections. The laboratories planned by the teaching staff and are prepared and coordinated by a full-time professional (John Hardy) and a continually rotating, but well-trained group of undergraduates. The course is quite traditional [and yes, we still teach life cycles]. A majority of our students arrive at UWSP planning to be marine biologists, medical doctors or zoo veternarians. Seldom do we get incoming freshmen indicating that they want to be plant physiologists or plant taxonomists. The introductory botany class convinces many that there is another biological world that they had not previously considered.
The second "course" is "independent research" which can cover just about anything a student and faculty member can dream up from describing the cell structure of a fossil Ginkgo seed at the SEM level or determining how pathogenic fungi enter roots of potatoes, to collecting identifying and preparing herbarium specimens of mosses from Guatemala. Many of these projects are part of or are related to individual faculty members' own research. These are where many of our students get their first glimpse of the excitement (and frustration) of research. Many students continue these studies as graduate work [elsewhere- we have no graduate program]. Several independent studies have been published. Needless to say [but we'll say it anyway], these studies are very time consuming for faculty. However, the time is well spent. Besides, they are fun and undergraduates often don't know enough to know what can and cannot be done, sometimes with startling success. The university has a program that provides small undergraduate research grants and the College of Letters and Science has an Undergraduate Enrichment Initiative that funds faculty work involving undergraduates. The UEI program has provided biology faculty and their student researchers with ca. $45,000 per year for nearly a decade. Undergraduate independent research is a strong component of our student successes.

The physical plant for the department is somewhat crowded, but well equipped. We have TEM and SEM facilities (available to faculty and students with training), adequate green house space, a large herbarium, a paleontolgy collection, a modern molecular biology facility including an automated DNA sequencer, a common equipment facility with ultra- and refrigerated centrifuges, PCR, electrophoresis, shaker, and microscopy facilities. Plus the department has sought substantial funds from the college, university, and UW system for teaching lab modernization (over $100,000/year for over a decade). All our teaching labs are equiped with high-quality stereo and compound student microscopes as well as internet-linked computers, DVD/CD/Laser disc players, and video camera backs on all instructor scopes for class-wide viewing via LCD projects or TV monitors. We also have a great support crew in the stockroom, greenhouse, lab prep areas and office staff [people who never get the credit they deserve].

Botany is growing at UWSP. Our faculty positions seem secure, the faculty are devoted mentors and productive scholars, and the students are enthusiastic and hard-working. More and more of our students indicate an interest in plant-related fields and our department is becoming know as one of the only places in the state (especially outside of Madison) to pursue quality botanical interests.

John Curtis (emeritis professor) and Bob Bell (chair), Department of Biology, University of Wisconsin, Stevens Point, Stevens Point, WI.

Developing a Curriculum for the Teaching of Botany

As a precursor and introduction to this topic I wish to review with you the role and limits of *Science as a Way of Knowing*. An outstanding scholar and personal friend, the late Professor John A. Moore, of the University of California, Riverside, developed these ideas into a series of publications that started in 1984. Some of you may have studied this series of publications by the same title. Professor Moore, with the assistance of a wide range of scholars in the biological sciences, produced these documents in order to assist us in making the distinctions between science and other ways of knowing. For example, on our campuses we have generally divided learning among the sciences, social sciences and humanities. John wanted to make the case for science without detracting from the social sciences and humanities. He felt it was imperative that we, as scientists, make clear to society the types of questions that science can attempt to answer and the types of questions science cannot answer. As an outgrowth of the work by Professor Moore we have identified three areas that must be addressed with our students if they are to better understand the boundaries of the scientific enterprise. **1.) The Nature of Biological Knowledge. 2) Processes of the Scientific Enterprise. 3.) Values of the Scientific Enterprise**. Within the realm of biological knowledge students must understand that our knowledge is tentative, public, empirical, replicable and historic. Among those characteristics of the processes of science we must include: observing, classifying and inferring. Also, we must include hypotheses formulation, the design of experiments, the collection and interpretation of data, proposing explanations and communicating our findings. And then we must teach our students that knowledge has value, that questioning is essential, that data are fundamental, that verification is required, and to respect the logic of scientific findings. Ask yourself if you feel we are teaching the nature, processes and values of science to our students. In the United States we have determined that we are not reaching these objectives in our sciences courses.

The Role of Education in the Plant Sciences.
Because I have devoted so much of my adult life to the study of botany and plant geography, I am well aware of the multitude of connections that exists between the floras of North America and South America. Botanists, zoologists and geologists on this continent, in Central America and South America probably understand better than any other group of people what has taken place in the deep history of planet earth. The scientific information they have produced brings these continents very close together. Discoveries in plate tectonics and continental drift have taught us that our continents have only recently moved apart and that we must work closely together in solving the many important scientific problems related to the history of this planet.

At the same time, when considering the many ways in which humankind is so rapidly destroying planet earth, what we teach our students about the earth and biologic sciences in our schools and universities in the next half century, will determine the future of all life on this planet. Our role as teachers, as well as research scholars, is more important today than it has ever been in the history of our species.

Because there are so many *Homo sapiens* spreading to every corner of the earth, seven billion of us, we have come to recognize that the next major extinction will probably be triggered by too many of us. As we exploit and destroy the skies above, our air and water supply, and the millions of other organisms that make their home with us on this planet, we biologists recognize that humankind is destroying this environment that allows all species to persist.

What we teach future generations about living systems has never been more important than it is today. We have an obligation to bring biological knowledge to all citizens. Our major objective as teachers of the plant sciences must be to produce **the botanically literate society**. What must the botanically literate person know and be able to do?

I will present some background information that has resulted from nearly 40 years of developing, studying, and evaluating curriculum materials by the Biological Sciences Curriculum Study (BSCS). Through years of experience the BSCS has developed methods and procedures for the production of curriculum materials in the life sciences. These materials have greatly improved biological literacy for those students who have been exposed to them in the United States and in many countries around the world. I have taken the liberty of translating the BSCS methods and message for the biological sciences (*Developing Biological Literacy: A Guide to Developing Secondary and Post-secondary Biology Curricula*) into what I see as the similar objectives for teaching the plant sciences. I have done this because I feel strongly that how and what we teach about the earth's flora and the local flora, through our field and laboratory activities and in our classrooms, will never be more important than it is today.

A Short History of Botany in the U.S. – Strengths and Failures.

I would like to digress for a few minutes and present a short history of the teaching of botany in the United States. The state of the plant sciences in the United States is today **not** good. The place of botany has slipped from a very powerful position among the sciences in the last half-century. Since approximately 1940 or World War II the plant sciences have practically disappeared as a nationally studied science in the United States.

Consequently the average citizen in the U.S. knows little or nothing about the science of botany, the place of plants in the future of planet earth, and the importance of plants in their daily lives other than for food and perhaps fiber. Most people cannot provide either a common or scientific name for the plants growing in their own yard, let alone describe the flora of the ecosystem or life zone in which they live. Most students complete elementary science, middle and high school biology, and their first course in college biology without ever becoming involved in a serious and challenging problem-solving experience using plant materials. Our students and their parents suffer from what has recently been described in the literature as “plant blindness.”

The United States has done what I consider an extremely poor job of continuing to conduct quality research in most areas of the plant sciences in our major universities. The funding for basic research in organismal botany, as a percentage of the total national research budget, has been greatly reduced over the past 40 years. It is actually less than 6% of what is was in 1960. Another helpful comparison is to examine the division of funds for research between the National Institutes of Health, the National Science Foundation and private companies. In the year 2000 NIH received 60% or $18 billion of the total research budget, with the remainder, 18% or $3.2 billion, coming from private industry. Keep in mind that only a small portion of the NSF total budget of $4 billion is devoted to the study of ecology and evolution in the natural sciences.

Research scientists in botany today have little or nothing to do with reaching the large society. The federal budget for research through the granting agencies and the university financial structure, has been designed so that today research scholars would be foolish to take time from their research to become involved in teaching quality courses in botany for undergraduate students and teachers. In fact, today much of the undergraduate teaching is done by teaching assistants or part-time faculty.

As departments of botany elected or were forced to become a part of large biology departments, the number of positions in botany has continued to be eliminated. At the same time fewer and fewer students complete courses in the plant sciences.

As a part of a frustrating series of events, the teaching of the plant sciences has practically been eliminated from school textbooks and the curriculum. As a result of what has taken place in higher education, new teachers coming out of our universities and colleges are very poorly trained in basic botany, and most teachers give the impression that they have little interest in including plants as a major portion of the curriculum. The study of human biology, including genetics as applied to humankind and microorganisms, has literally crowded all other organisms out of the biology curriculum. Science educators in both the secondary schools and universities are failing to teach students the nature and role of plants in their lives.

I should also add that plant scientists have failed at reaching out to the larger society. Because we see ourselves as scientists, and often only as scientists, we have overlooked and dismissed our responsibilities to education the total society concerning the place of plants in all our lives and in the survival of all living systems.

Aspects of Plants in the Lives of All Humankind. It is unfortunate that the teaching of the life sciences has followed this path towards the elimination of plants from the curriculum. Obviously plants, animals and microorganisms have a great deal in common. The world is biologic and we cannot make sense out of the living planet without making the connections among all living organisms. It appears to me this problem has resulted from our religious, educational, and society history, and from our appointing ourselves to dominion over all other living organisms. We did this without fully understanding and recognizing that the blue-green algae and phytoplankton contribute far more to the future of planet earth than all the mammals combined. Only if and when *Homo sapiens* learn that we are just one of the millions of organisms on planet earth, will we start to correct this mistaken image of ourselves. We have trouble recognizing that we hold no special place on earth, beyond being the most destructive species to ever evolve on the planet. Humankind only continues to persist at the expense of all those other organisms, and those natural resources provided for us by planet earth. Once we recognize these principles of life on this planet, we will start to make those changes in our behaviors that must take place if our species and many others are to survive.

Plants surround us and are a very real part of our survival as a species, yet most people have a blind spot concerning the native flora right where they live. In fact two botanist /biology educators in the U.S. have proposed a study addressing the question of why Americans are so interested in animals, yet blind to plants that surround them. They are calling this phenomenon "*Plant Blindness*." They have defined plant blindness as: the inability to see or notice the plants in one's own environment – leading to: (a) The inability to recognize the importance of plants in the biosphere, and in human affairs; (b) the inability to appreciate the aesthetic and unique biological features of the life forms belonging to the plant kingdom; and (c) the misguided, anthropocentric ranking of plants as inferior to animals, leading to the erroneous conclusion that plants are unworthy of human consideration (Wandersee, J.H. and Schussler, E.E., 1993, *A model of plant blindness*.). We will in the not too distant future see what the outcome of this study will be, but I believe this is all the result of what we have been taught by our families, in our schools and in our churches.

I would add to this my own assumption or hypothesis, based on almost a half century of teaching, curriculum study and curriculum development. From the time educators decided we would construct the curriculum around what the young want to learn, basically about themselves, rather than what adults and well-educated people know they must know and understand in order to survive as educated adults on planet earth, schools moved away from teaching about plants, animals, ecosystems, and biomes to teaching what I like to call "tip-of-the-nose biology" or "me and my world." The role of a quality education is to get the human species out of itself and to realize that there are many more organisms out there that must be conserved and that contribute far more to planet earth than *Homo sapiens* ever could or ever will.

For all practical purposes, in the U.S. there is no place an individual can go to become knowledgeable of the floristic world other than the educational institutions. At the same time these educational institutions have literally removed the study of plants and natural history from the curriculum.

Based on what I have observed in the United States my suggestion to this audience [Argentine botanists] is to please maintain botany as a separate course and a separate science. Plants and animals have many things in common and we must make the connections among them, but there are many factors that identify plants as uniquely different. Do not allow either education or research I the plant sciences to become overshadowed, crowed out, or eliminated by larger general biology courses or large biology departments. That was one of our major mistakes as botanists in the U.S. If you must develop a biology course, construct it around plants, because without the world's flora very few animals will persist.

What Concepts in Plant Science are of Great Importance to All Members of Society?

The study of plants must maintain its uniqueness as part of the science curriculum at each level from elementary and secondary schools and through the university. Our students must be taught that although there is a uniqueness to all living organism, plants hold their own uniqueness from all other living organisms. Without a thriving world flora, most living species, including humankind, will finally disappear from the earth.

Such scientific concepts as plant reproduction, genetics, development, ecology and evolution must be taught uniquely as they relate to plants. The concepts of photosynthesis, meiosis, mitosis, the sporophyte-gametophye relationship and ecosystems should be taught using living plants materials. The study of humankind is simply not adequate to a quality science education for the new century.

Examples of the inquiry process must be taught in a botany course using plants as the model organism. Skills required to study plants, including quantification, mechanical skills involving computers and laboratory and field equipment, as well as the skills of describing and understanding variation in plants should be retained as a basic part of the botany program.

The place of plants in our lives must be taught to people of all ages. These values include conservation of the world's flora, the study of biodiversity, monitoring the world's flora, and those problems related to the loss of plant species. Equally important is the study of the spread of introduced species, exotic species and weeds over the planet.

May we now consider several of the basic aspect of curriculum development that must be included if we are to produce a quality science education in the plants sciences?

Curriculum Themes in Studying Botany

The botanists reading this article are responsible for the future of botanical education. You have the power to improve the knowledge, skills and values of the public towards the place of plants in their lives. You can and must establish control of the curriculum for the teaching of botany in the elementary and secondary schools and the university. Please take this responsibility seriously.

These curriculum themes are each important in their own way if the people are to develop an understanding and appreciation for the science of botany. They are important as a part of science education, as a part of conservation and survival, as a part of the national economy, and as an ethical and esthetic aspect of life.

I present these themes, which are unique to biology, in order that you might keep them in mind as you develop a sound curriculum in botany.

Curriculum Themes in Studying Botany

Understanding that Science is a Process
Identifying the Unifying Principles of Botany
Describing the Content of the Plant Sciences
Describing the Personal Aspects of Botany
Describing the Social Aspects of Botany
Describing the Economic Aspects of Plants
Describing the Ethical Aspects of Botany
Identifying Appropriate Technologies
Describing the History of Botanical Knowledge

Unifying Principles of Botany

What are the unifying principles that hold botany together? These principles identify the characteristics and structure of living systems. Consequently these are the major principles that all students must understand at the end of a basic botany course. No botany course is complete if we

have not taught these concepts very well. They form the basic structure for the study, teaching and learning of the life sciences. We have not done our job as teachers if we have not taught each of these unifying principles, and if we have not taught the way in which these principles are interrelated.

Unifying Principles of Botany

Evolution: Patterns & Products of Change
(Living systems change though time. Evolution has produced diverse systems over the earth.)

Ecology: Interactions & Interdependence
(Living systems interact with their environment and are interdependent with other systems)

Genetic Continuity & Reproduction
(Living systems are related to other generations by their genetic materials)

Growth, Development, & Differentiation
(Living systems grow, develop and differentiate based on a genetic plan that is influenced by the environment.)

Energy, Matter & Organization
(Living systems are complex, and require energy to maintain their organization.)

Maintenance & Dynamic Equilibrium
(Living systems maintain a relative stable internal environment through their regulatory mechanisms and behavior)

Understanding that Science is a Process

The process of science is the active process of what we scientists do as we produce and update our knowledge of the natural world. We must never allow our students to think of science as a fixed body of knowledge. Too often our students are given the impression that science is a textbook full of information that will never change. Our textbooks can only describe the "tentative" body of knowledge about plants at any particular time. Keep in mind that a textbook is out of date the day after it is published and within three to five years it must be revised.

What I have outlined on this page are some of the separate aspects of doing science. Certainly we will seldom do each of these steps in this order. At the same time we should involve our students in as many of these steps as possible as they complete our courses, so that they may come to understand the process of science. Also, the experiments we ask students to design and conduct must be appropriate to their educational level (high school vs. beginning college vs. graduate research).

Identifying difference in objects or discrepant events is the first step in recognizing the need or possibility for scientific study. Comparing two objects as we search for similarities and differences is very basic to good science. All of these terms are not compatible: Forming a hypothesis is the asking of a question that can be studied. Predicting an outcome does not necessarily require a scientific study, but it should entail the examination of experience or scientific information that is available. If the students have all conducted a similar investigation it is extremely valuable for them to compare their results with those of the other students. At the same time describing the results of the experiment, proposing explanations and writing the results must be part of learning the process of science.

The Study of Botany is an Active Process

(Students Must be Taught the Process of Science)
Observing, Questioning & Comparing
Identifying Problems
Forming Hypotheses (Predicting Outcomes)
Designing & Conducting Experiments
Collecting & Organizing Data
Analyzing Data & Relating Ideas
Proposing Explanations
Making Inferences
Communicating Explanations & Applying Knowledge

Learning & Teaching Strategies

This is the area where superior teachers have an opportunity to bring their creativity to their students. The question we must ask ourselves is: How can I improve the quality of learning for my students? The strategies included here have potential for improving our ability to reach our students. We do know that different students learn thought different activities. (I know my center of learning takes place in the field and through conducting activities rather than reading a textbook or listening to a lecture) Ask yourself how you learn best. Our job is to provide as many of these learning strategies as we can for our students. My experiences through my work with BSCS and in my own teaching have taught me that

the more of these strategies we can provide, the more interesting and exciting our classrooms will become and the greater the learning experiences for our students.

Learning & Teaching Strategies
Conduct Field Activities
Conduct Laboratory Activities
Conduct Inquiry & Problem Solving Activities
Participate in Discussions & Debates
Conduct a Personal Experiment
Cooperate in a Learning Activity
Read, Write, Speak & Explain
Interact with Aspects of Technology & Computers

In Summary
In this paper I have attempted to develop a summary of what I consider to be some of the most important factors botanists may wish to consider in the development of a plant science program. Most of the themes, principles, and strategies are obviously important to teaching all of the life sciences.. But I have here directed these ideas specifically to the development of a curriculum in botany

I hope I have made my position clear: the most important and threatened group of organisms on planet earth are the green plants. Their survival is basic to the continued survival of practically all other life forms. At the same time, over the past half century this group of organisms has been almost eliminated from the life science curriculum in schools and universities. Only you, the community of botanists, can maintain and strengthen the teaching and learning of plant sciences.

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News from the Society

Alpine Diversity: Adapted to the Peaks

July 31-August 5, 2004

Snowbird Resort, Salt Lake City, Utah

Conference Overview

The annual Botany Conference brings together a broad spectrum of researchers, professors, educators and motivated students, all focused on what's new and vibrant in the diverse field of plant biology. Botany 2004 promises to be the most successful in the series. This is the annual conference of four leading professional societies, including the Botanical Society of America, the American Bryological and Lichenological Society, the American Society of Plant Taxonomists, and the American Fern Society.

An anticipated 800 participants will present over 600 scientific contributions including 14 symposia, papers, posters, and special lectures. A full slate of field trips and scientific workshops and social events will round out the program.

Botany 2004 is being held at the Snowbird Resort, near Salt Lake City, Utah. Nestled in the Watsach Mountains, it is a setting surrounded by unsurpassed natural beauty and botanical interest. An Exhibit Hall will be located in the Event Center Tent, which will be the center of social activities including conference-wide breaks and poster session for the meeting.

Saturday, July 31, will feature the 3rd Educational and Outreach Forum. This successful component of the Botany conference is designed to draw an audience of educators and researchers involved in the teaching of biology and plant science on many levels, from kindergarten through college. The day will include a range of interesting discussion-type sessions, a keynote lecture by Dr. Eugenie Scott, Director, National Center for Science Education and conclude with a reception, which will give attendees the opportunity to discuss and network in a social setting. Sunday, August 1, will be an active day of scientific workshops, and fieldtrips. Sunday evening will open the scientific meeting with the conference-wide Plenary Lecture. The Plenary speaker, Dr. Rita Cowell, will bring the perspective of the immediate past Director of the National Science Foundation to excite and challenge attendees.

Monday morning, August 2, kicks off the scientific sessions and special symposia. Tuesday afternoon, August 3, will feature a conference-wide Poster Session, with an expected 200 posters featuring current research and recent topics. Scientific Sessions will conclude on Wednesday August 4. Participating Societies will also hold social events and meetings through out the week.

The Snowbird Resort and Conference Center was chosen for the site of Botany 2004 for the unique botanical interests of the area, and also for the destination. Plan to include this meeting in your family vacation plans for this summer. Botany 2004 will be a family-friendly conference, with 10 exciting local tours planned, Camp Snowbird for kids, an evening of free Stargazing, and to begin the week - Snowbird's 17th Annual Jazz and Blues Festival.

Housing has also been arranged to accommodate families with condo-style housing that sleeps up to six, and are complete with a kitchen!

Student Financial Support

As we work to make Botany 2004 an exceptional Annual Meeting we offer some ideas to help defray your costs:

Serve as a Student Projectionist
Students who work up to 10 hours (2-3 sessions) as a projectionist can have their early student registration fees refunded. Experience with 35mm slide, overhead and LCD projectors is desirable, but not necessary. In return for successfully serving as a projectionist for all assigned sessions during the meeting, the early student registration fee equivalent will be refunded. Fee waivers are not granted. Student projectionists must register for the meeting and pay the registration fees.

If you are interested in serving as a student projectionist, please fill out the "Application to Serve as a Student Audio-Visual Projectionist," and submit your application by June 26, 2004.
Apply for the Minority Undergraduate Participation Grant

Apply for Student Travel Grants (Information coming Soon)

Deep Gene Research Coordination Network

MORPH Research Coordination Network

Share A Room
Several options for housing will be available for Botany 2004 attendees. Choices range from traditional hotel rooms to condo style rooms which will sleep 6 and are complete with kitchen facilities. Complete information is available in the Conference Registration Book.

Need a Roommate....Check out our Roommate Matching Service.

For additional information, check the BSA conference website:

http://www.botanyconference.org/newsite/general/index.php

BSA in New Headquarters at Missouri Botanical Garden

Greetings from the BSA staff team in Missouri and Ohio. Wanda and I have settled into what we hope is our final home here in St. Louis. We now reside at 4475 Castleman Avenue, one block west of the Missouri Botanical Garden. Johanne remains in Columbus, Ohio and will run the conference functions of the BSA from there. We extend a big thanks to Dr. Peter Raven and the MBG staff for their assistance in providing an excellent home and for their ongoing support. We look forward to working with the people of the MBG, and other such organizations, as we begin to develop programs in support of our mission.

Wanda and Bill at work in new offices

On behalf of the BSA, I'd like to ask members for your assistance as we move forward with the development of programs. Tasks and roles will vary but largely support educational programs, peer review of educational materials for the BSA web site and/or in writing material for the web. In response to your contributions, we will be pleased to write letters of recognition for your service to science, education and to the public in general. In most instances you'll also receive credit for contributions on the BSA web site.

We are looking to add services you find useful as benefits to your membership in the BSA. Please send in your ideas, as they are most appreciated.

As you'll be aware in 2003 we added access to the entire run of the ***American Journal of Botany*** as one such option. In line with the request for assistance mentioned above, we are working to ensure all materials produced by members are searchable on the BSA website (and thus the web in general). Over the coming month we'll add the full run of AJB abstracts 1914-2004 with links back to the full text articles.

We are also in the process of placing the entire run of ***Plant Science Bulletin*** on the web. What a fantastic look back in time. It's interesting to see how things evolve and how some never change.

Significant changes were made to the system supporting abstract submissions for the Botany conferences. For most people the process worked well and the benefits were obvious. For some it was a real pain! Thank you for your patience and my apology for any inconvenience to the latter group. I'm pleased to say we found the bug that caused the problems.

We hope to see as many of you as possible out in Utah this summer. We are all looking forward to a great Botany 2004.

Sincerely

Bill, Wanda, and Johanne.

Letters

With reference to the article in P.S.B. about the Selby botanical Gardens spirit collection, I have to make the following observations and suggestion: 1) the percentage of denatured alcohol is not stated although one can guess it from the added water; 2) the preservative, that appears to be based on that used at the Royal Botanic Gardens, Hew, the co-called "Key Cocktail." Is worthless, or almost so, for anatomical studies. Preservation of the actual cells and tissues is so poor as to render them "mush," as I have found from using specimens from the Key collection. Why not use a "good" preservative that would suit the purposes of taxonomists as well as plant anatomists? I recommend a mixture containing 70% ethanol (9 parts), commercial formalin (0.5 parts), and glacial acetic acid (0.5 parts). I suspect the Selby preservative is cheaper than the one I suggest, hence its use, but this is not a valid reason where science is concerned. Bill Stern, Research Associate, National Tropical Botanical Garden, 4013 South Douglas Road, Coconut Grove, Florida 33133.

In Memoriam:

Wayne Manning 1899-2004

Long-time BSA member Bucknell University Professor of Botany *emeritus* Wayne Eyer Manning passed away Sunday, February 8, 2004 at the age of 104. Wayne was born on April 12, 1899, received his BS from Oberlin College in 1920 and his Ph.D. on the floral anatomy of the Juglandaceae from Cornell in 1926. He taught at Cornell for 1 year and at the University of Illinois, Urbana for 1 year before joining the Smith College faculty from 1928-1941. Wayne worked in a Defense Plant during WW II and subsequently joined the Bucknell University faculty in 1945. He retired from Bucknell in 1968. His research and over 40 publications on the Juglandaceae remain as seminal works on the floral anatomy and taxonomy of this family.

Warren G. Abrahamson, Ph.D. David Burpee Professor of Plant Genetics, Department of Biology Bucknell University Lewisburg, PA 17837

Announcements

Positions Available

Collections Manager, Department of Botany, California Academy of Sciences

The Department of Botany is seeking a Collections Manager responsible for supervising all aspects of development, maintenance, operation, and use of the herbarium (CAS and DS). Position will begin January 1, 2005. Duties include: maintenance and organization of departmental collections, supervision and training of curatorial assistants and volunteers, assistance in developing (may involve programming) and maintaining computer database records related to the collection, management of all incoming and outgoing specimens from the herbarium, correspondence with other institutions concerning specimen transactions, overseeing the preparation, identification, and integration of new specimens into the collection, pest management, assisting with the preparation of grant proposals, assisting with preparation of annual staff evaluations, assisting in educational and outreach activities, recording herbarium activity and usage and maintaining statistics on collection composition for inclusion in annual report, conducting departmental tours, possible participation in field expeditions with the goal of generating research quality collections, participation in special projects when necessary. A minimum of a Masters degree in botany or biology, experience working with the maintenance of systematic botanical collections, and demonstrated knowledge of taxonomic botany; good computer knowledge is desired. To apply, please send a letter of interest, resume, and names and contact information for three references to California Academy of Sciences, Human Resources Department #CollMgr1, 875 Howard Street, San Francisco, CA 94103. Application deadline is July 31, 2004. The California Academy of Sciences is an Equal Opportunity Employer committed to diversity.

Systematic Botanist (Research Botanist) Smithsonian Institution National Museum of Natural History

The Department of Botany seeks TWO outstanding systematic botanists for full-time research positions, initially as a four-year term appointment, but upon satisfactory performance during that period, eligible for conversion to permanent status. Candidates with an established and recognized research program on a large or important plant group such as pteridophytes, Fabaceae, Euphorbiaceae, Melastomataceae, or Rubiaceae may be given preference. Successful candidates should have demonstrated expertise that emphasizes innovative as well as conventional application of the systematic collections of the United States National Herbarium, utilizing modern methods based on comparative morphology and augmented by other methodological tools including molecular phylogenetics. The position will be filled at the GS12/13 level (salary range of $60,638 to $93,742 commensurate with experience). In addition to a proven record of scientific achievement in the research specialty, applicants are expected to have expertise and interest in additional fields, such as biogeography, biodiversity and conservation, enthnobotany, floristics, informatics, or theoretical systematics. Applicants must have demonstrated ability to establish an externally funded research program, and to conduct active botanical fieldwork. See announcement number 04AD-1065 at http://www.mnh.si.edu/rc/positions/ for further details for the application for this position.

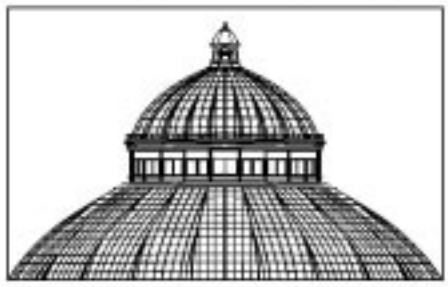
PHYTOCHEMISTRY/SECONDARY PLANT METABOLISM.

The Department of Botany, North Carolina State University, invites applications for an Assistant Professor position in the area of Phytochemistry/ Secondary Plant Metabolism. The individual is expected to develop a productive, extramurally funded research program that enhances and complements existing programs in the Department, College, and University. We are seeking an individual who will establish an innovative research program using modern approaches to study phytochemistry or secondary plant metabolism and who can teach related graduate and undergraduate courses. Relevant research areas may include (but are not limited to) characterizing new and useful plant metabolites and defining key secondary plant product pathways and their regulatory processes. This position is a 12 month, tenure-track position with responsibilities divided between research (50%) and teaching (50%).

Candidates must have a Ph.D. degree in plant biology, phytochemistry, pharmacognosy, biochemistry or a related discipline, a record of peer-reviewed publications and scholarly accomplishments commensurate with experience. Postdoctoral experience is preferred. Applicants should send a CV, copies of graduate transcripts, statement of research and teaching interests, and a list of three references to: Wendy F. Boss, Chair of the Phytochemist Search Committee, Department of Botany, Box 7612, North Carolina State University, Raleigh, NC 27695-7612. Applications received prior to July 1, 2004 will be assured of full consideration.

North Carolina State University is an Equal Opportunity and Affirmative Action Employer. Individuals with disabilities desiring accommodations in the application process should contact Carol Apperson, Botany Department, carol_apperson@ncsu.edu, (919) 513-3809. NC State welcomes all persons without regard to sexual orientation.

Award Opportunities



THE NEW YORK BOTANICAL GARDEN
Institute of Systematic Botany
200th Street and Southern Blvd., Bronx, New York
THE RUPERT BARNEBY AWARD

The New York Botanical Garden is pleased to announce that Karen Redden, currently a graduate student in the Department of Biological Sciences, George Washington University, Washington, D.C., is the recipients of the **Rupert Barneby Award** for the year 2004. Ms. Redden will be studying the systematics of a diverse group of legumes centered around *Dicymbe, paloue, paloveopsis, Heterostemon*, and *Elizabetha* that are concentrated in the Guiana Shield area.

The New York Botanical Garden now invites applications for the **Rupert Barneby Award** for the year 2005. The award of US $1,000.00 is to assist researchers to visit The New York Botanical Garden to study the rich collection of Leguminosae. Anyone interested in applying for the award should submit their curriculum vitae, a detailed letter describing the project for which the award is sought, and the names of 2-3 referees. Travel to the NYBG should be planned for sometime in the year 2005. The application should be addressed to Dr. James L. Luteyn, Institute of Systematic Botany, The New York Botanical Garden, 200th Street and Kazimiroff Blvd., Bronx, NY 10458-5126, USA and received no later than December 1, 2004. Announcement of the recipient will be made by December 15th.

Anyone interested in making a contribution to **THE RUPERT BARNEBY FUND IN LEGUME SYSTEMATICS**, which supports this award, may send their check, payable to The New York Botanical Garden, to Dr. Luteyn

Symposia, Conferences, Meetings

Agricultural History Symposium And L. H. Bailey Symposium September 9-11, 2004 Cornell University, Ithaca, NY in conjunction with the Centennial of the College of Agriculture and Life Sciences

Call for Papers

One hundred years ago, in 1904, Liberty Hyde Bailey and New York State farmers convinced the State Legislature to support a College of Agriculture at Cornell University, a largely private institution that had been established in 1865 as New York's land-grant institution. Since then the New York State College of Agriculture and Life Sciences has gone on to achieve worldwide fame and recognition.

As part of the College's centennial celebration, a symposium will be held in Ithaca in September 2004. Its organizers seek historical papers on the subjects including state support of higher education in agriculture; Cornell University and agriculture; New York State and agriculture; achievements of alumni, faculty, and
staff of CALS, the Green Revolution, and other agricultural institutions internationally; and related topics in the history of the agricultural sciences (horticulture, soils, entomology, animal science, etc).

The deadline for the submission of abstracts for papers and sessions is May 15, 2004. Proposals or any inquiries should be sent to Prof. Margaret W. Rossiter, Department of Science and Technology Studies, 331 Rockefeller Hall, Cornell University, Ithaca, New York, USA 14853 or e-mail at mwr4@cornell.edu

L. H. Bailey Symposium

AGRICULTURAL HISTORY SYMPOSIUM –in conjunction with the Centennial of Cornell's College of Agriculture (will include the L. H. Bailey Symposium)
Organizer: Margaret W. Rossiter, The Marie Underhill Noll Professor of the History of Science, Cornell University
Venue: Cornell University
Dates: Thursday thru Saturday, September 9-11, 2004,
Co-sponsored by The History of Agriculture Society; the L.H. Bailey Hortorium, Department of Plant Biology & the Department of Plant Breeding and Genetics.

Symposium: Liberty Hyde Bailey, a legacy of "Scientific Outreach." **

Organized by Lee B. Kass, Visiting Professor of Botany, L. H. Bailey Hortorium, Department of Plant Biology, Cornell University
Date: Friday, September 10, 2004
Venue: Kroch Archives, Cornell University
Co-sponsored by the Historical Section of the Botanical Society of America; the L.H. Bailey Hortorium, Department of Plant Biology & the Department of Plant Breeding and Genetics.

Abstract
L. H. Bailey, Dean of the New York State College of Agriculture at Cornell University from 1903 to 1913, established many scientific programs with a public dimension. Bailey led the public mission of the Land Grant Universities. Examples of his vision for scientific outreach may be viewed from founding departments in Nature Study, Horticulture, Plant Breeding and the L. H. Bailey Hortorium. All having faculty or staff with appointments devoted to extension and public service.

This symposium is an outcome of the symposium on "Scientific Outreach for the Next Millennium" and the Public Outreach Lecture presented at Botany 2000 in Portland, Oregon. The symposium was sponsored by the ASPT/ABLS/AFS/BSA Teaching Section and members of all attending societies were invited to the lecture.

**Speakers and titles as of March 15, 2004

Morning session: 10:30-12:00AM
Liberty Hyde Bailey, a legacy of "Scientific Outreach" I

Short introduction (5min.): **L. H. Bailey's contribution to Scientific Outreach**.
Lee B. Kass, Cornell University

Liberty Hyde Bailey and "Things of the Garden"
Robert Dirig, Assistant Curator, L. H. Bailey Hortorium Herbarium, Cornell University

L. H. Bailey and "the friends of things that grow": A Vision for Cornell
Plantations

Donald A. Rakow, The Elizabeth Newman Wilds Director, Cornell Plantations

Planting Natives: Americanism in Landscape Gardening, 1830-1930
Philip J. Pauly, Professor of History, Rutgers University

Liberty Hyde Bailey and the Nature Study Idea
Sally Gregory Kohlstedt, Professor of History of Science, University of Minnesota

Afternoon Session 1:30-3:00 PM

Liberty Hyde Bailey, a legacy of "Scientific Outreach" II

Rousing the People on the Land: Liberty Hyde Bailey's Vision of Cooperative Extension's Civic Mission and Work
Scott Peters, Assistant Professor of Education, Cornell University

Students as Targets of Scientific Outreach at Cornell's Plant Breeding Department, 1907-1915
Barbara Kimmelman, Professor of History, Philadelphia University

Horticulture: An Academic Calling
George Good, Department of Horticulture, Cornell University

The L. H. Bailey Hortorium: Resources for Taxonomy of Cultivated & Native Plants
Kevin Nixon, Curator, L. H. Bailey Hortorium, Department of Plant Biology, Cornell University

Closing Remarks (10 min**)**: TBA

The L. H. Bailey Symposium will be sponsored by the BSA Historical Section and is an outcome of the symposium on "Scientific Outreach for the Next Millennium" and the Public Outreach Lecture presented at Botany 2000 in Portland, Oregon.

5th International Walnut Symposium Sorrento (Naples) Italy November 9th-13th, 2004

The 5th International Walnut Symposium is organized by two Conveners with different backgrounds: one related to fruit culture, the other to agro-forestry. This is an unusual choice, but well accepted by ISHS because for the first time, all aspects of the walnut plant will be considered during the symposium.

The 5the International Walnut Symposium aims to be a very important opportunity to compare different and various experiences, improve the knowledge and stimulate new objectives under "the walnut crown." To achieve this objective, scientific and technical contributions on walnut for fruit, wood, and other productions will be presented and discussed in different scientific sections.

The scientific sections and technical visits are organized in order to create a connection between the scientific, technical, and use communities; information about basic and applied research and the economical aspects will be presented and discussed, taking in mind the sustainable utilization of the valuable resource, walnut.

For additional information see: www.walnut2004.sistemacongressi.com

Monument of Printing and Holistic Medicine

Jacob Bigelow, *American Medical Botany*, Boston, 1817-1820. With 60 full-page plates, this is one of the first color-printed books published in the United States, and an important record of the early pharmacological use of plants in New England. Bigelow's knowledge, both as a field botanist and as a physician, influenced American medical practice for an entire generation. Commentary by Philip Weimerskirch; includes searchable text transcription. $30. http://www.octavo.com/collections/projects/bgwamb/index.html

Books Reviewed In this issue:

Concise Encyclopdedia of Temperate Tree Fruit, Baugher, T.A. & Singha, S. 2003 387 pp. ISBN 1-560022-940-3. The Haworth Press, Binghampton, NY 13904-1580. The *"Concise Encyclopdedia of Temperate Tree Fruit*" gives an insight into various aspects of the cultivation of temperate tree fruit. It is not, however, an encyclopedia. The structure of the book is a series of 42 chapters in alphabetical order, from Anatomy and Taxonomy, over Carbohydrate Partitioning and Plant Growth to Water Relations and Wildlife. Unfortunately this sequence apparently enforced some grossly erroneous chapter headings. For instance, there is not the slightest hint of anatomy in the first chapter titled "anatomy," just a little bit of morphology. More serious is that the morphology presented can be pointless, because many features illustrated do not occur in any of the fruit trees discussed, and incorrect. For instance, the authors seem to be unaware of the differences between a berry and a drupe and between solitary flowers and racemes.

The first chapter gives a list of temperate tree fruit species including: apples, pears, quinces, peaches, almonds, apricots, plums, cherries, figs, mulberries, northern pawpaws and persimmons. However, in the following chapters nearly all data presented are on apples or pears, with a smattering of data on stone fruit. This clearly reflects the relative economic importance of these crops, but it turns the concise encyclopedia of temperate fruit trees into a concise encyclopedia of apples and pears. Also, the discussion of cultivars and production processes are almost exlusively restricted to fruit production in the US. The illustrations are of variable quality and there are not as many figures or photos as one would want. For instance, in the chapter on "Diseases" high-quality photographs would be clearly desirable, but the chapter contains only four photographs and these are not particularly helpful.

All in all, the book contains some interesting data, but the title should definitly be changed so as to reflect its real contents, along the lines of "some aspects of the cultivation of apples and pears in North America in alphabetical order". Maximilian Weigend, Freie Universität Berlin.

Horticulture as Therapy, Principles and Practice. Sharon P. Simson and Martha C. Straus (Editors). Haworth Press, Inc. 1998 (softcover edition, 2003). ISBN 1-56022-859-8. 478 pages. Horticultural therapy is a relatively new field which, according the editors, has apparently been developing rapidly in the past twenty-five years. It is defined as "a treatment modality that uses plants and plant products to improve the social, cognitive, physical, psychological, and general health and well-being of its participants." It is a textbook organized to allow the reader to become qualified as a horticultural therapist. It was clear from the beginning that reading many sections of this book required considerably more background in health and social services than possess, so I asked a friend of mine who is a master gardener with a nursing background to read and comment on the sections that interested her. She read it all and assures me that the medical aspects are all respectable and up-to-date and the concepts inspiring, though somewhat repetitive. She indicated that there was sufficient information for someone with her background to know how and where to go for the training and certification she would need to enter any of the vocational, social or therapeutic programs in this field.

Because botanists are often asked why we study plants, the information in the chapter about the special connections between plants and humans is of interest. As early as the days of ancient Egypt, walks in gardens were prescribed as peaceful and non-threatening activities for the mentally disturbed. Chapter headings on special populations that would benefit from horticultural therapy include stroke, spinal cord and physical disabilities, brain injury, developmental disabilities, mental illness, children and youth, older persons, substance abuse and offender rehabilitation. Each of these chapters identifies the client population, treatment issues, recommended therapies and case studies.

Horticultural therapy is about very structured activities designed to reach very specific goals. For example, for substance abuse rehabilitation, clients are instructed in how to propagate plants for a commercial greenhouse. The are shown the various methods of taking cuttings, how to plant, fertilize and water and then re-pot them as they grow larger. Ordinarily, the simple objective for these activities is the production of numerous saleable plants, but in a therapeutic context the goals are to identify and learn to deal with compulsive behaviors (overwatering plants), to realize that new beginnings start from very small steps (new roots from tiny cuttings) and that a suitable environment (larger pot) supports growth. The book abounds in proposed activities with plants designed to treat various conditions and there is an emphasis on

research and professional evaluation of treatment outcomes as well.

One chapter dealt with botanical gardens and the multiple potential roles they play in the horticultural therapy field including everything from making plant material available and running programs on-site to having qualified staff who conduct off-site therapy training programs. Case studies from three botanical gardens and profiles of four professionals illustrated how horticultural therapy is actually done.

The edition I have reviewed is the "softcover edition published 2003". The hardcover edition was published in 1998, and in checking the bibliographies of each of the independently written chapters, I found very few references that were dated beyond 1995. In a field developing as rapidly as this one, there must be many more current references and more innovative programs than those that are as venerable and well established as the Chicago Botanic Garden, for example. Although commendably comprehensive in its coverage, methodologies must be advancing rapidly as well and staying current with new treatment protocols would seem to warrant the effort needed to produce an updated edition.

There is much here that would interest someone in social services or in horticulture. However, other than serving as the basis for an independent project for a particularly interested student, the book really offers very little of real botanical interest. However, I did find it interesting to know that such a field exists. Joanne Sharpe, Coastal Maine Botanical Gardens, Boothbay ME 04537 (with input from Jan Bailey-Bruch, Master Gardener, Norway ME 04268).

Hypericum: the genus *Hypericum*. Ernst, Edzard (Ed.) 2003. ISBN 0-415 366954-1 (Cloth US$120.00) 241 pp. Taylor & Francis, 29 West 35th Street, New York, NY 10001. St John's wort (*Hypericum perforatum* L.) is one of the best-selling herbal medicines worldwide, often prescribed as a natural antidepressant. In the US alone, the annual sales exceed US$200 million. It is therefore understandable that research into all aspects of St John's wort continues to be intense. This source provides a summary of our current knowledge: it covers botany, cultivation, manufacturing, standardization, quality control, biochemistry, pharmacology and clinical application.

According to Editor Ernst, a physician, many questions remain unanswered: Which are the pharmacologically active compounds? What is the best method for standardisation of *Hypericum* products? Is St John's wort effective for severe depression or for any other condition for which trial data are scarce? What are its mechanisms of action? What are the long-term effects and risks? Should St John's wort products be marketed as dietary supplements or as drugs? How does it compare with synthetic drugs for the same indication? He suggests that "the data imply that investments into research can be well worth it [. . .] and this volume is a significant landmark on the way this research has taken us."

Hypericum botany as presented by Norman Robson, "is a genus of about 450 species of trees, shrubs and herbs that occur in all temperate parts of the world. Most species can be recognized by opposite simple entire exstipulate leaves containing translucent and often black or red glandular secretions, [. . .] free petals, fascicles of stamens and seeds lacking endosperm." Artist's diagrams illustrate fine details in the stem lines, variation in marginal contour and glandularity of sepals, venation and glandularity of petals, floral whorls and placentation in ovaries, and patterns of capsule vesicles. He derives the name as "given by the ancient Greeks to a plant that they hung above their religious figures to ward off evil spirits." "The earliest use of the name that has been traced so far is in the 2nd c. BC by Nikander (Alexipharmaca V, line 603): 'And take a double 12-grain dose of myrrh, or a fresh draught of horminium, or pounded mountain hypericum or branches of hyssop.' Dioscorides, Galen and Pliny mentioned the name.

Hypericum has been associated with pharmacy and folklore for many centuries. The power to ward off evil spirits was especially important at times when such spirits were believed to be most abundant, e.g. on Halloween and Misdummer's Eve (23 June) when *Hypericum* was picked to decorate religious images. The pagan feast celebrated on Misdummer's Day was eventually Christianized and dedicated to St John the Baptist, whose birthday was the 24th of June, and the plant used on that day became St John's wort.

St John's wort has been used for its medical properties throughout the ages. It is currently recommended in plant therapy for its antiviral and antidepressive properties. Antidepressants represent a huge market, thus providing the impetus for expanding *Hypericum perforatum* cultivation. An unidentified fungal disease has infected *H. perforatum* fields since 1995. Most of the 20 hectares of St John's wort planted in Switzerland are grown

organically. The normal harvest has been thwarted by disease. The dieback can destroy this perennial crop in the first year of cultivation. Since organic farming does not allow the use of fungicides, cultures were irretrievably lost. Gaudin et al present data identifying *Colletotrichum gloeosporioides* as the cause of St John's wort dieback in Switzerland and breeding for a tolerant variety. Kegler reports on a virus causing vein yellowing and necrotic leaf spots of St John's wort.

It is essential that a book about a medicinal plant that treats depression should devote significant place to various aspects of its chemistry and pharmacology. Many authors contributed their findings to this account. Gaedcke addresses the important issues of manufacturing, standardisation and characterisation, and Cellárová discusses culture and biotechnology. Hölzl and Peterson introduce the chemical constituents of *Hypericum* spp.: hypericin, hyperforin, xanthones, tannins and proanthocyanidins, phenolic acids, anthraquinone derivatives, terpenes and *n*-alkanes/*n*-alkanols. Michelitsch et al review the analysis of hypericins and hyperforin in herbal medicinal products. Despite intensive research efforts, it has not yet been possible to identify all the active components of St John's wort extract, a statement that could also have been written two decades ago. Seidler-Lozykowska reports on secondary metabolites content of *Hypericum* sp. in different stages and plant parts. Meier reviews manufacturing and quality control aspects of herbal medicinal products of St John's wort. This chapter is well illustrated with color photographs of the blooms as well as chromatograms of pharmaceutically relevant constituents.

Dias addresses the potential of *in vitro* cultures of *Hypericum perforatum* and *H. androsaemum* to produce interesting pharmaceutical compounds. Ernst and Izzo examine the clinical pharmacology of *Hypericum perforatum*, with case reports of possible interactions between St John's wort and prescribed drugs. Court communicates the work of Kyung-Tae Lee's group in Seoul about hypericin as potential anti-tumour agent. Kumar, Singh and Bhattacharya present neuropsychopharmacological studies on Indian *Hypericum perforatum.*

Stevenson and Editor Ernst have the last word in their final chapter, *Hypericum* in the treatment of depression. Imprecise diagnostic criteria and short time frames were two criticisms leveled at reports of early trials. Methodological issues are reviewed and revised. Weighing up the existing evidence of the benefits and risks of *Hypericum*, they conclude that "when taken without concomitant medication, the herb is an effective and well-tolerated treatment for mild to moderate depression. It may be similarly effective as conventional antidepressants with the possible advantage of superior tolerability. However, *Hypericum* does not represent a risk-free therapy and its efficacy in the long term has not been established. Further evidence is required to define more precisely the potential role of *Hypericum* in the treatment of depression."

Hypericum is another recent title in the series: Medicinal and Aromatic Plants - Industrial Profiles, having the series editor's stated intent "to bring together information which is currently scattered through an ever increasing number of journals. Each volume gives an in-depth look at one plant genus, about which an area specialist has assembled information ranging from the production of the plant to market trends and quality control." This volume's chapters are well referenced and will do much to inform health care professionals, biochemists and botanists about the potential of this genus. An eight-page index assists readers to locate subjects of interest. - Dorothea Bedigian, Washington University and Missouri Botanical Garden, St. Louis.

Maya Medicine: Traditional Healing in Yucatán. Kunow, M. A., 2003. ISBN 0-8263-2864-4. Albuquerque: University of New Mexico Press. . Many ethnobotany books disappoint. Long on tabloid headlines to draw in readers, they are often short on careful data collection and analysis. Maya Medicine is a pleasant and useful departure from that mold. Readable, concise, and never overreaching the data at hand, this book has value for present and future students of Maya culture and botany.

The book focuses on present-day curing practices and practitioners in the Yucatán Peninsula of Mexico. It is based on the author's six visits to the Yucatán, where she worked in the town of Pisté near the Chichén Itzá Maya archeological site. The author interviewed local healers and recorded data concerning Maya concepts of illness, training in healing arts, and healing practices. She made voucher collections of all plants she found to be used, and the vouchers are deposited in the Tulane University Herbarium. The book also provides a careful comparison of current (1990's) uses with those documented in Roys's (1931) The Ethno-Botany of the Maya.

Roughly half of the book is devoted to narrative description of healing practices. Documenting the use and identification of plant materials occupies the remainder of the book and is provided in the form of tables, descriptions, and illustrations. A series

of tables presents side-by-side comparisons of the author's results with those recorded by Roys, giving nice documentation of the historical continuity (or lack of it) for various plant uses and healing practices. The author's own illustrations of selected species are novel for an ethnobotanical work, and are an example to be encouraged. These allow the reader to check at least some identifications of interest without resorting to examination of the voucher specimens. The illustration of *Acacia collinsii* Safford, for example, does not show the curved thorns stated by Safford (1923) to be diagnostic of this species and thus perhaps this identification could be re-checked.

The plant catalog, found in Appendix A of the book, contains a wealth of information that informs the text. Entries are alphabetical by Latin species name, but Spanish and Maya names are also listed. Brief field notes concerning the plant are given, followed by a description of how a medicine is prepared and then administered. The latter is a valuable aspect of the book, because such "recipes" handed down by oral tradition are often changed or lost over time.

This work does not try to address the global or regional context for the uses of the plants in the catalog. For example, *Cymbopogon citratus* (Nees) Stapf, which would be known to many readers as lemon grass and for its use in Thai and Indian cooking, is given only its Spanish name (zacate limón) and stated to be "known as 'fever-grass' in the West Indies. In Brazil it is dried and used to scent clothing in closets or trunks." In other words, its origin and long history of use in tropical Asia are not mentioned. Documenting the extent to which healers are using indigenous versus non-indigenous plants would give the reader a host of additional information about local botany and cultural conditions.

The Index to Plants by Families is a handy summary and worthwhile feature, allowing a family-level comparison with medicinal uses of plants in other regions, for example temperate North America (cf. Moerman 1997). The only errors occur in the classification of Leguminosae into papilionoid and non-papilionoid groups. (Here's how the entry should be: Papilionoideae: *Abrus, Apoplanesia, Dalea, Diphysa, Erythrina, Indigofera, Lonchocarpus, Phaseolus, Piscidia*; non-papilionoids: *Acacia, Calliandra, Leucaena, Mimosa* (Mimosoideae), and *Bauhinia*, Caesalpinia, *Cassia* (Caesalpinioideae)). Additional errors, in the spelling of Latin names and author names, are few and mostly minor; the only serious one, possibly done at the editorial level, was to make the spelling of *Bourreria* (Boraginaceae) the same as that of *Borreria* (Rubiaceae); in this day and age of search-and-replace, it's not surprising that this "correction" is consistently made throughout the book. None of the errors, however, diminishes the contributions of this otherwise fine work.- Nancy Murray and David Johnson, Department of Botany-Microbiology, Ohio Wesleyan University, Delaware, OH 43015

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Moerman, D. E. 1997. Poisoned apples and honeysuckles: the medicinal plants of Native America. In L. Romanucci-Ross, D. E. Moerman, & L. R. Tancredi, eds., The anthropology of medicine: from culture to method. Westport, CT: Bergin & Garvey.

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Oregano: the genera *Origanum* and *Lippia*. Kintzios, Spiridon E. (Ed.) 2002. ISBN 0-415-364-943-6 (Cloth US$115.00) 277 pp. Taylor & Francis, 29 West 35th Street, New York, NY 10001. From his passionate introductory chapter christened 'Profile of the multifaceted prince of the herbs,' Editor Kintzios leads readers through a captivating portrayal of oregano. Borrowing from Kintzios' words, this volume "offer[s] an updated and analytic review on the currently available technical knowledge and market information of the world's commercially most valued spice - oregano." Kintzios addresses "aspects of practical significance for the crop's industrialization - optimizing germplasm selection and utilization, novel cultivation methods and product processing, blending and uses in different countries, along with other market-related issues never included in previous reviews."

The book's core is its second and third chapters. 'Structural Features of *Origanum* sp.' by Bosabalides, presents a new synthesis about glands of various types. Glandular hairs are "more complicated from the anatomical, ultrastructural and functional point of view. They biosynthesize and secrete substances like essential oils, resins,

gums, slimes, nectar," and their patterns of variation are used in taxonomy. The chapter is enriched with electron micrographs of the structures and diagrams of the morphogenisis of these glands. Chapter three, 'Taxonomy and Chemistry of *Origanum*' conveys the crop's basis for human use. Ietswaart revised the genus *Origanum* (1980), but at that time chemical data were too sparse to be useful in taxonomic classification. Skoula and Harborne present the chemical data that were amassed in the meantime. Distribution maps of each section of the genus and species present an excellent visual introduction to their spread. According to Ietswaart's taxonomic revision, there exist 49 *Origanum* taxa within 10 sections. Very complex in their taxonomy, *Origanum* biotypes vary with respect to the content of essential oil in the aerial parts of the plant or essential oil composition. There is exceptional natural chemical polymorphism within the genus *Origanum* with respect to essential oil.

A subsequent chapter by Baser describes in more detail the biological activities of Turkish *Origanum* species, and all too briefly, folk use of oregano including home distillations of kekik water, for which demand is growing. The 'Chemistry of the genus *Lippia* (Verbenaceae)' by Catalan and de Lampasona also places emphasis upon essential oils. "The most outstanding feature of the genus *Lippia* is the perplexing difference observed in the essential oil composition reported for the same species collected at different places. It is also worth noting that the oils obtained from the same plant stock remain chemically constant in successive crops. As the biosynthesis of mono- and sesquiterpenoids is enzymatically controlled, these facts indicate that the genus possesses a rich genetic diversity."

'Cultivation of oregano' by Makri indicates that it seems to be undemanding, due in part to the "repellent or inhibitory action of their aromatic oils. When grown on a commercial scale however, certain diseases and insect pests do cause damage under some conditions." "Literature searches have found at least 61 species of 17 genera belonging to six families mentioned under the name oregano. The family Lamiaceae is considered to be the most important group containing the genus *Origanum* that provides the source of well-known oregano spices - Turkish and Greek types." The selection of new cultivars in Hungary avoids the disadvantages of exploiting oregano directly from the wild. There, oregano is cultivated on light, dry and well-drained soils, which are somewhat alkaline. Propagation can be done vegetatively by separation of roots, or by seed.

The cultivation of marjoram (*Origanum majorana* L.) has a long historical tradition in the eastern parts of Germany, and has been cultivated in the area around Aschersleben for over 100 years. Marjoram is cultivated mainly after potatoes or legumes, and it comes in the crop rotation before wheat or barley. Oregano has been used in the Anatolian region of Turkey since ancient times, and there are 23 species reported to be indigenous to Turkey. Records date its use back to the 7th c. BC. The crop is used as a spice and medicine. There has been a marked increase in area devoted to cultivation of oregano in the last few years, and Turkey is one of the leading exporters in the world. The US imports roughly 50% of Turkish export.

Due to its multipurpose use as kitchen herb in the food and flavor industry, the demand for oregano has grown tremendously within recent years. Most of the oregano from *Origanum* spp. is still gathered from the wild, exceeding 10,000 Tons crude material per year. Since oregano shows high biodiversity especially regarding phytochemical characters, questions arise as to which cultivar is grown for which purpose, based on specifications that also need to be defined.

Baricevic and Bartol examine the biological/ pharmacological activity of the *Origanum* genus, a daunting enterprise. They introduce their essay with the indication that the name 'hyssop' (the Greek form of the Hebrew word 'ezov'), called 'za'atar' in Arabic, was first mentioned in the Bible (Exodus 12:22 description of the Passover ritual) and has curative value in hypoglycaemic treatments. It also demonstrates antifungal and antimicrobial potential, analgesic, antiinflammatory and antispasmodic, insecticidal, nematocidal and molluscicidal activity.

The monograph closes with a short chapter about the 'Biotechnology of Oregano' by Editor Kintzios that reviews explant sources, explant disinfection, culture media and conditions, morphogenesis *in vitro*, organogenesis and micropropagation, and somatic embryogenesis. It concludes with the opinion that the use of tissue culture for the production of essential oil components is not yet feasible from a commercial point of view.

Bartol and Baricevic used all the data they retrieved during their literature searches about oregano's biological/pharmacological activity that were presented in an earlier chapter, and employed those records to great advantage, making another new and major contribution, several giant steps beyond their exhaustive report of biological activity. For the book's final chapter they offer an undertaking that provides a valuable service, 'Bibliometric

analysis of agricultural and biomedical bibliographic databases with regard to medicinal plants in the genera *Origanum* and *Lippia* in the period 1981-1998.' Scrutinizing the sources of their information, they point out a phenomenon that with proliferation of databases, and the expense involved, many users, especially those involved with interdisciplinary sciences already experience "retrieval anxiety or frustration."

The authors assessed all of the databases they consulted to examine scatter, and ranked the information retrieved from available resources. They compared AGRICOLA, AGRIS, CAB Abstracts, Food Science and Technology Abstracts, EMBASE, BIOBASE, and MEDLINE. Then they filtered multiple occurrences of references. The results of their analysis show that CAB abstracts, followed by AGRIS serve as the databases with the highest number of records on both genera. Among agricultural databases CAB accounted for some 39% of single and 24% of all occurrences, implying that if CAB were not consulted, just three quarters of pertinent references would be retrieved. They also ranked the journals that contained these articles, so readers can view which journals contain the most applicable data.

The authors' discussion points out a significant reality, "Monographs on specific life sciences related topics frequently forego certain aspects of methodology. [. . .] It is usually not customary for scientists to explain how bibliographic data were obtained. It is thus not possible to assess if most relevant sources were consulted at all."

This point matters a great deal, particularly in instances where one author is biased against another scientist whom he may view as a rival. He may refuse to cite published work that he is aware of, but does not want to credit, in order to achieve personal gain, and an unearned favorable reputation. It is equally problematic in cases where an author invited to prepare a review article for a revised 2nd edition is apathetic and does not search out related new publications, but merely relies on his own previously published account and old files. Certainly most readers are unlikely to be aware of the fine distinctions, but would simply put confidence in a 'new' review, believing that having consulted such an 'authoritative' source, they can be safe assuming that further published work about the subject does not exist.

Oregano is one recent title in the series: Medicinal and Aromatic Plants - Industrial Profiles, having the series editor's stated intent "to bring together information which is currently scattered through an ever increasing number of journals. Each volume gives an in-depth look at one plant genus, about which an area specialist has assembled information ranging from the production of the plant to market trends and quality control." This book scores high, with in-depth, scholarly writing, is well referenced, contains supportive illustrations and maps, a thorough 9-page index, and could be helpful to growers, food scientists, chemists and health care professionals. It is an exemplary edited work that is very successful because all authors were committed to making comprehensive contributions. Aside from occasional typographical slips, and this reviewer's personal wish for more information about the ethnobotany of the taxa, Oregano is a commendable monograph about an important herb and remedy. - Dorothea Bedigian, Washington University and Missouri Botanical Garden, St. Louis.

Vetiveria. The genus Vetiveria. Maffei, Massimo (Ed.). 2002. Taylor & Francis, London and New York, pp. 191. The presentation of the book is of excellent quality, having hard cover, good print and paper, and numerous illustrations and photographs. As well it provides complete information about *Vetiveria,* a grass genus with great economic significance in the obtaining of essential oils. It is composed of nine chapters to which twelve authors have contributed. Each chapter is signed by the authors and it includes the corresponding bibliography. Chapter 1, *Introduction to the genus Vetiveria*, details its systematic position, the morphological and reproductive characteristics, as well as the species and varieties of this genus. A treatment of *V. zizanioides* is included, with its countless common names, giving details about its habitat, cultivation conditions, distribution, diseases, essential oils production and other uses. Chapter 2 *Anatomy, Biochemistry and Physiology*, presents a detailed analysis of the leaf anatomy and ultrastructure and the anatomy of the root. It is profusely illustrated with excellent pictures. A complete consideration of the biochemical determination of the photosynthetic mechanisms is provided. Chapter 3 *Collection, Harvesting, Processing, Alternative Uses and Production of Essential Oil* provides a detailed review of their cultivation, and production of essential

oil; other uses are illustrated, such as forage and the manufacture of products from their leaves and aromatic roots. Oil extraction and distillation techniques from the roots are also included. In Chapter 4 *Chemical Constituents and Essential Oil Biogenesis in Vetiveria zizanioides*, the chemical composition of the vetiver oils belonging to four sesquiterpenes groups and a chronological analysis of previous studies is detailed. Chapter 5 *Ethnopharmacology and Pharmacological Properties of Vetiveria zizanioides*, includes data about the pharmacologic and pharmacokinetic properties. The following chapters: 6 *Vetiver Grass Technology*, 7 *Biotechnology*, 8 *Economic Importance, Market Trends Industrial and Needs, and Environmental Importance*, cover all the aspects related with the cultivation, uses and productivity. Finally in chapter 9, *Beyond the Vetiver Hedge,* the author summarizes the qualities of *Vetiveria zizanioides* from the point of view of their sustainability. The text is complemented with a very complete index that includes all the terms referred to in the different chapters. This study of the genus constitutes volume 20 of the series "Medicinal and Aromatic Plants - Industrial Profiles", Edited by Dr. Roland Hardman. Zulma E. Rugolo de Agrasar, Instituto de Botanica Darwinion, Argentina.

Garden of Invention: The Stories of Garden Inventors & their Innovations. George Drower. The Lyons Press, Guilford, Connecticut, 2003. 292 pages. The history of gardening is rich and full of surprises. In *Garden of Invention*, George Drower escorts us through some of gardening history's lesser-known stories, touching on topics ranging from tools of the trade to philosophical movements. First published in the U.K. by Sutton Publishing as *Gardeners, Gurus, & Grubs*, it was revised and released last year in the U.S.

Drower's book, which is nicely illustrated with historical drawings, woodcuts, maps, and photos, begins with an account of that garden standard, the wheelbarrow, which he traces to 2nd-century B.C. China. The author describes all manner of wheeled carts, but also wondrous Chinese "sail barrows," an 18th-century drawing of which shows a junk-rigged barrow ready for action. The vocabulary of gardening is technical and arcane, but words like "sheets" and "halyards" aren't often heard drifting across our row crops.

Closer to home is the story of the Concord grape, carefully selected and bred for by Concord, Massachusetts, resident Ephraim Wales Bull. Bull finally marketed his grapes after winning first prize in 1853 from the Massachusetts Horticultural Society. Even so, it is not Bull's grape juice and jam that we buy today, but Welch's, for it was Thomas Welch who went on to successfully market unfermented grape juice, and later other products. How Bull felt about this is perhaps best expressed in his epitaph: "He sowed—and others reaped."

Although *Garden of Invention* emphasizes England's role in gardening history, readers do get samples of New World contributions. This they see, for example, through a brief (unnecessary?) account of the oft-repeated story of the tomato; in an interesting account of the history of New York City's—and Frederick Law Olmsted's—Central Park; and in profiles of several influential American botanists and gardeners. Even so, there are some curious omissions. Why include Robert B. Thomas, founder of what is now *The Old Farmer's Almanac*, but not J. I. Rodale? Why Robert Prince, but not Thomas Jefferson?

Despite some curious selections, as well as some unevenness in the writing and depth of coverage, the material is almost always interesting. Who knew that the future royal gardener, John Tradescant, not only had no sense of smell, but also introduced the abacus to England from Russia? Or that W. Atlee Burpee started out selling chickens and livestock, with seeds offered so customers could grow their own feed? Trivia perhaps, but also fodder for thought while thinning seedlings and pulling weeds.

The true impact of a book may best be measured in how it changes the reader. Though I am not laying plans to sail-rig my wheelbarrow, my reading did make me yearn to run out to my gardens in hopes of inventing or fabricating something useful, this from someone who is fortunate to occasionally hit a nail with a hammer, and I've already started greenhouse cucumbers in order to give George Stephenson's straight, glass cucumber tubes a try. I've even started reading Sir Arthur Holt's 1916 translation of Theophrastus's *An Enquiry into Plants*, discussed in Drower's book. For though as I write this I am surrounded by spring seed catalogs, there is still prime reading time left before the soil warms … and you might consider using some of that time for reading *Garden of Invention*. - Steven B. Carroll, Division of Science,Truman State University, Kirksville, MO 63501.

Fire Blight: The Foundation of Phytobacteriology. Griffith, Clay S., Turner B. Sutton, and Paul D. Peterson (eds). 2003. ISBN 0-89054-309-7. (Paper US$55.00) 144 pp. The American Phytopathological Society Press, 3340 Pilot Knob Road, St. Paul, MN 55121-2097. We all know the story of Pasteur and Koch and how they discovered the bacterial origin of many human diseases, but how many of us know that at about the same time, American botanists were discovering that fire blight of pome fruits and rosaceous ornamentals was also caused by a bacterium? This brief history describes the origin of phytobacteriology and three key players whose investigations of fire blight helped to establish a new field of plant science.

Fire blight, caused by the bacterium *Erwinia amylovora*, is indigenous to North America and co-evolved with such rosaceous species as hawthorne, mountain ash and wild *Malus* species. With the introduction of susceptible European apple and pear cultivars during the colonial period the situation changed dramatically. Whole orchards appeared to be "blasted by lightning," seemingly overnight. By the mid-1800's the blight had spread as far as Indiana and Ohio and there were numerous theories to explain the disease. The stage was set for Thomas Burrill, a young botanist at the Illinois Industrial University (University of Illinois) to identify "oscillating corpuscles" in the "mucilaginous fluid" in the bark of infected trees. In the first paper reproduced in this volume Burrill identified these corpuscles as bacteria and suggested that the same bacteria were the causal agents of blight in both apples and pears. The second paper reproduced includes the series of inoculation experiments performed by Burrill in 1880 on some 69 pear, apple, and quince trees in the university orchards.

Joseph Arthur, trained at Iowa State University, became the first botanist on the staff of the Cornell University Agricultural Experiment Station at Geneva, New York. For obvious reasons he became interested in fire blight and in 1884 repeated Burrill's experiments on some of the New York varieties. In the first paper reproduced in this volume he elaborated on Burrill's procedures by using pure cultures of the bacteria and by demonstrating that cell-free filtrated could not transmit the disease. In the second paper he reviewed contemporary understanding of the disease and went on to demonstrate movement of the bacteria in the sap and suggested that transmission was through cracks and injury during branch and flower bud break and possibly via insects. He also elucidated the mechanism explaining the long-observed phenomenon that over-pruning made trees more susceptible to the blight.

The third member of the triumverate, Merton Waite, was a student of Burill's at Illinois and took a position as the first Plant Pathologist at the USDA station in Beltsville, MD. Four short papers are reproduced. His main contribution to the biology of the disease was to demonstrate that bees were the primary vector of the disease and that floral nectarines were an important point of entry for the bacteria. From a practical viewpoint his recommendations for cultural cleanliness, including timely removal of all diseased parts from affected trees, disinfecting pruning shears between cuts, and quarantining stock from diseased orchards, became the main cultural recommendations to contain the spread of the disease in orchards.

The editors of this short work provide concise and readable reviews of the significant contributions of these three pioneers of plant pathology in addition to selecting and reproducing salient articles and reports to illustrate the seminal works. Once again we have an example of plant scientists at the cutting edge of exciting discoveries in biology – only to be overshadowed in history by non-botanical contemporaries. This book should be required reading for all teaching botanists. – Marshall D. Sundberg, Department of Biological Sciences, Emporia State University.

Ever notice that *Verbena hastata* rarely possesses the hastate leaves for which it is so named?

Adaptively, these leaves have no obvious selective value.

The evolutionary moral of the story?

"He who hastates is lost."

- Don Les

Edible and Poisonous Mushrooms of the World. I. R. Hall, S. L. Stephenson, P. R. Buchanan, W. Yun and A. L. J. Cole. 2003. ISBN 0-88192-586-1(cloth US$39.95) 371pp Timber Press, Portland, Oregon. The authors claim "…mushrooms are among the most fascinating and beautiful inhabitants of the natural world". Now, I admit that I'm a botanist because of my deep appreciation for the plant kingdom. But after reading this book and admiring the stunning photographs, I can see the authors' viewpoint.

Given my teaching background, I always ask one question first: Would it make a good text book for an upper level course? No, unless the course is centered on mushroom cultivation. The introduction contains some very basic information about mycology aimed at a general audience. The authors briefly mention general mushroom characteristics, and their role in food and medicine. The book does not cover the nutritional value of mushrooms (e.g. protein and mineral content) that would juxtapose nicely against the coverage of both the poisonous and cultivation aspects of the book. The Introduction instead focuses the reader's attention on topics to be covered in the book - - collecting wild mushrooms and the mushroom market.

The book is divided into three main sections - - Cultivating Mushrooms, Collecting Wild Mushrooms and a List of Wild Mushrooms. The Cultivating Mushrooms section focuses on methods used to grow saprobe mushrooms (about 95% of all cultivated mushrooms) and mycorrhizal mushrooms. I was amazed to learn that as recently as 1998, the Chinese grew more than half the mushrooms consumed by the world, which generated more than $1 billion in export revenue. The authors cover the various techniques involved in cultivating button mushrooms, shiitakes, oyster mushrooms, straw mushrooms, enokitakes, and several other mushrooms. The section on cultivating mycorrhizal mushrooms was most illuminating - - retirement to a truffière sounds lucrative, as long as the soil, climate, tree species and rainfall are all suitable.

The section on Collecting Wild Mushrooms includes everything from when and where to look, to how to get a spore print, and it includes a user-friendly, beginner-level key. The authors do point interested parties towards more pictorial keys, or keys that are aimed at an audience well-versed in mycological terminology. The remainder of the chapter is devoted to nine general syndromes associated with mushroom poisoning and a brief description of the symptoms involved with each. Again, there are no high-powered biochemical mechanisms involved in poisoning, just a description of the symptoms.

The List of Wild Mushrooms section contains well over 100 common mushroom species arranged in the order of the key. Along with describing the species, descriptions generally include where the mushroom can be found (e.g. North America, Europe), what other mushrooms it might be confused with, and its edibility status. The photographs are absolutely beautiful, and will likely inspire me to brave fall game hunting seasons (decked out in fluorescent colors, of course) to do some mushroom hunting. The pictures are large, colorful, and it seems there is at least one on every page. The book also contains several smaller sections. The majority of these focus on Chinese names of mushrooms, some addresses (mainly mycological societies), web sites and a glossary of terms.

In closing, I want to reiterate that this is a book aimed at a general audience. Serious mycologists won't find anything new here, but it is a nice incorporation of information for those interested in mushroom cultivation, wild harvesting, or just appreciating the denizens of the fungal kingdom.

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A checklist of the trees, shrubs, herbs, and climbers of Myanmar. Kress, W. J., R. A. DeFilipps, E. Farr, & D. Y. Y. Kyi. 2003. Contributions from the United State National Herbarium 45: 1-590. The latest version of A checklist of the trees, shrubs, herbs, and climbers of Myanmar builds upon a foundation of four previous checklists of similar name to provide a working list of the seed plant diversity of the country formerly known as Burma. After a short introduction and description of the geology, climate, and vegetation of the country (compiled by Shirley L. Maina), the checklist commences with the cultivated Araucaria bidwellii and proceeds alphabetically family by family through the Gymnosperms, then the Monocotyledons, and finally the Dicotyledons. Nearly 400 pages and 11,800 species later we arrive at Tribulus terrestris in the Zygophyllaceae, followed by a short (20 entries) bibliography, alphabetical list of English and Myanmar common names, list of names of uncertain status, list of new taxa published in the volume, an index to families, and an index to all scientific names. The latter will be useful to those looking for Liliaceae sensu lato, whose species are distributed here across Agavaceae, Alliaceae, Aloaceae, Anthericaceae, etc. Within families, taxa are arranged alphabetically, with inclusion of author names, habit, distribution (by state), and common names. Specialists (listed in the Introduction) have reviewed many families to assure that the names and distribution information are as accurate as possible. A selection of color photographs illustrates major ecosystem types, as well as 20 individual plant species significant in the Myanmar flora.

The work addresses a critical gap in our modern knowledge of the floras of Asia. For Asian plant systematics, Myanmar is historically significant, as many species were originally described from the area by Alphonse De Candolle, Griffith, Hooker and Thomson, Kurz, and others from plants collected in localities identified only as “Pegu,” “Tavoy,” and “Tenasserim.” In many cases these descriptions turn out to bear the oldest names for widespread and important taxa. But Myanmar is significant ecologically and biogeographically as well: it encompasses snow-capped mountains, desert plains, and lowland tropical rainforests, and thus distributions of entire floras begin (or end) within the country. Even a bare-bones list such as this one (there are no specimen or literature citations to document names or distributions) helps to define the geographic transition points. How far does the rich Rhododendron flora of the Himalaya extend into this country? What is the distribution of SE Asian lowland dipterocarp forests and the largely Malesian floristic element that accompanies them? Which genera characteristic of temperate floras are represented? Such questions may be answered by studying the checklist.

The book will be an important reference for plant biologists in a variety of disciplines. It provides a previously unavailable context for active flora projects in neighboring regions, such as the Flora of China and Flora of Thailand efforts. For ethnobotanists, the index of common names provides a nomenclature for beginning to understand cultural significance of particular plant species. A map of parks and wlldlife sanctuaries within the country, coupled with the distribution data for individual species, gives a glimpse of possible conservation priorities for the future.

The book should be viewed as a tool to enable biologists to learn more about the biodiversity and ecology of this region of the world, rather than as a definitive reference. The authors freely acknowledge the limitations, and invite participation to improve the existing database, most of it now available electronically (http:/persoon.si.edu/myanmar) with searchable databases of family names, scientific species names, and common names. A helpful feature of the Website, not available in the book, is that species lists for individual states may be generated by clicking on either a map or a list of state names.

Given the aim and scope of the work, shortcomings are minor. Despite the attention of specialists, monographers will still need to examine species lists with a critical eye: I found that about 15 percent of the 111 species of Annonaceae, for example, are not listed by their currently accepted names. A map or list of historical localities relative to the modern-day political geography would have aided those of us engaged in monographic studies, and could possibly be added to the Web edition of the list. Indicating language of origin for common names would also be useful.

The volume is stated to be “free while supplies last,” so anyone with an interest in Asian plant systematics should obtain a copy and use it. The greatest testament to the value of this checklist will be how quickly it is rendered out of date by the research on the Myanmar flora it engenders. - David Johnson, Department of Botany-Microbiology, Ohio Wesleyan University, Delaware, OH 43015

Why did the conservative professor keep postponing his lecture on *Juncus*?

Because he wanted to keep his students in “rush limbo”.

Don Les

Books Received

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Don Les

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