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BOTANICAL SOCIETY OF AMERICA

Welcome to Our Second Century!

What could be better than celebrating the 100th anniversary of the Botanical Society of America? Why, starting off in our second century of course! And what a way to begin. This year, for the first time in three decades we will be meeting jointly with one of our offspring societies, the American Society of Plant Biologists (the last time we met together they were the American Society of Plant Physiologists). This will be the largest gathering of botanical scientists in North America since the 16th International Botanical Congress in St. Louis in 1999 and it promises to be the most exciting.

Chicago is our host city and there are plenty of botanical attractions to take advantage of before, during, or after the meetings. One of these is the Morton Arboretum in Lisle, Illinois, half and hour west of the city. In our lead article, Katherine Johnson introduces some of the programs introduced at the Arboretum to attract more of the general public and educate them about the importance of plants.

Of course most of the excitement will center on the meetings themselves and for botanical educators there will be a wealth of workshops and presentations from many of the leading science educators in biology. Many of us realize that one of the greatest problems we face in the classroom is having to overcome some deeply ingrained alternative conceptions (misconceptions) students bring with them to our classrooms. In our second article David Hershey elaborates on some of the misconceptions involving allelopathy that have found their way into textbooks and laboratory manuals. In doing so he provides he provides lots of ideas for authentic inquiry that can be done in the classroom.

I hope these articles will whet your appetite for the meetings this summer. Register now and I'll look forward to seeing you there.

-Editor

Public Gardens and the New Family Visitor

Public Gardens and arboreta have an important mission – and a huge challenge – facing them. Teaching the "general public" about the importance of trees and other plants was never more difficult than in today's world with shifting demographics, stiffer competition for leisure time activities, declining connection with nature, and changes in our audience's need for safety and structured activities.

Dr. Gerard T. Donnelly

We have always drawn an audience who appreciates nature. These people already

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Children's Garden

understand the value of plants. They visit our institutions for many reasons: to find respite around the greenery, to admire the gardens, to watch birds, or to hike along native landscapes. Unfortunately, these visitors represent only a fraction of our potential audience. For our institutions to fulfill our missions, we need to attract the growing number of families who, unlike traditional public garden visitors, do not feel drawn to nature and our institutions.

Young families today have had fewer opportunities for quality outdoor experiences, and they are less familiar with nature than their parents and grandparents. They often have structured lives with scheduled play dates, soccer practice, and programmed activities of every sort. Parents may not be prepared to lead their children on an adventure around a public garden because they lack an understanding of nature, having not played outside much as children themselves. To attract these families, we must appeal to their preference for structured activities and their need for more interpretation of what they encounter. We must introduce them to the wonders of nature and sustain their interest on a long-term basis.

New Facilities to Attract New Families

Ten years ago, the leadership of The Morton Arboretum, under the direction of Dr. Gerard T. Donnelly, President, began addressing how to attract families to the Arboretum by initiating major improvements to the site. Plans included building a larger visitor center, an ecologically friendly parking lot, an intriguing one-acre Maze Garden, and a four-acre state-of-the art Children's Garden.

The transformation of the site took several years. Meanwhile, staff worked to produce programming geared to this audience, experimenting with family concerts, temporary exhibitions such as tree houses, winter recreational activities, and other events in order to spark new interest and bring in new visitors. These special programs succeeded in boosting attendance figures on specific days but did not lead to a daily increase in numbers. That took building the permanent Children's Garden to accomplish.

Appealing to Family Needs

In the five years before opening the Children's Garden, some questioned if we were turning The Morton Arboretum into a Disney-like amusement park by building a garden with colorful exhibits and playground equipment. Some people argued that this type of garden deprives children, as well as adults, of "real" natural experiences. They expressed concern that we might plan to build similar exhibit gardens all over the Arboretum grounds.

Fears were put to rest when the garden opened to members on Labor Day weekend 2005 and then to the general public a week later. Skeptics could see that the manufactured garden elements did not eclipse the rich diversity of plants, but did indeed enhance a child's garden experience, as intended. Families praised the garden and membership soared. Because the Children's Garden sits on only four of The Morton Arboretum's 1,700 acres, plenty of natural areas remain for those seeking solitude.

More importantly, many parents have told us that they never would have considered visiting The Morton Arboretum before the Children's Garden was built because "there was nothing to do" on our site. Clearly we needed this garden to attract and grow our audience!

Part of our Children Garden's success stems from parents' needs for a safe, interactive place to bring children. When surveyed, a majority of parents rate "safety" as a main concern in any experience designed for children. Fears of serious injury or abduction compel parents to watch their children closely and favor structured activities over unsupervised play. Parents must enjoy the experience of bringing their children and be able to relax themselves, or it will not be worth the effort.

Moreover, if parents perceive a woodland trail as boring, so will their children. If parents' unfamiliarity with the surroundings makes them feel uncomfortable, they will pass along their fears and never bring the family. Attracting today's families may require taking a few lessons from Disney by building family-centered garden spaces where structured activities and botanical display receive equal emphasis.

Testing and Measuring Success

In the summer months before the Children's Garden opened to the public, we hired a team of professional exhibit evaluators to conduct a formative study of the garden. We wanted to gain insight into how families would move through the space, what areas held the most and least interest, and what things we might need to change in order to ensure a safe and attractive garden.

The study revealed that by offering a variety of things to do, the Children's Garden succeeded in engaging a wide age range of children. Toddlers delight in playing with musical flowers and sliding down a giant tree root while older children gravitate to climbing structures. Wide age appeal is especially beneficial to families with multiple children because the garden provides something for everyone to do. Especially important were the study's findings that families understood our messages about plants and nature. The study also assured us that this environment would serve families well.

Because of this pre-opening trial, we knew that families would love the garden. We knew that

Children's Garden

children quickly developed a sense of ownership of the garden, which allowed parents to let their children take more of the lead in deciding where to go. This freedom to explore is exactly what young children need to develop a personal connection to nature. It is what will encourage them to return and foster a profound appreciation for nature.

The physical and programmatic enhancements to The Morton Arboretum, especially the Children's Garden, along with new marketing strategies, have indeed attracted new families to our site. Attendance figures over the first 12 months since the Children's Garden opened exceeded the previous year's numbers by 55-percent. An overwhelming number of visitors immediately decided to become members because they planned to return many times. Our membership total at the end of August 2006, one year after the Children's Garden opened, was 50 percent higher than the year before.

Challenges of a Changing Audience

However valuable that pre-opening evaluation proved, no visitor study could have helped us anticipate some of the challenges we faced after the Children's Garden became a regular attraction when strong visitorship became a daily occurrence and the character of our general audience changed. We are learning to address three types of challenges: the practical issues of serving a large "stroller" audience, the need to introduce appropriate behavioral guidelines to a large group of new members, and the need to teach two generations about the wonders of nature.

Serving a Large Stroller Crowd

The first challenge crept up on us. At lunchtime on a fair weather day, our new, expanded cafeteria was burgeoning with young families. The noise level disturbed patrons who had come to enjoy a quiet lunch with friends. As a result, some visitors were discouraged from dining in our restaurant. Patrons crammed strollers into restrooms, which required more frequent servicing.

Building spaces filled and so did programs. Waiting lists for some children's classes were twice as long as the enrollment limit. As can be expected with any supply and demand imbalance, customers complained about not being able to get into programs and threatened to drop their memberships.

Meeting the challenge of increasing attendance has required ramped-up services and new ideas such as satellite cafeteria stations to relieve the crowds inside. We also embraced customer service training so that all front line staff would be equipped to handle complaints with poise.

Macguvers (Morton Arboretum Children's Garden Youth Volunteers)

Introducing Behavioral Guidelines

Our second challenge has been to accept that we are attracting a greater number of people who do not understand how an arboretum differs from a park. Families arrive in bathing suits to play in our stepping stone pond as if it were a water park. They bring footballs to toss around. We have always needed to explain why people cannot climb trees on our site, but now there are more people who need to be told why we cannot allow them to hang on our tree collections, run through plant beds, and pick the foliage.

While frustrating to horticulturists and program staff alike, this challenge has proved a little easier to master. Parents genuinely want to know what they may and may not do and abide by the rules. Initially, we resisted posting rules and signs announcing restrictions but now recognize that parents find these guidelines comforting because they remove ambiguity and make expectations universal.

Teaching Two Generations About Nature

Our third challenge is related to the second and should be viewed more as an opportunity than a problem. Just as some families do not know how to behave appropriately at a public garden, an alarming number of them display a lack of general knowledge of plants and animals. Nearly every day in August, visitors asked where the tadpoles from our pond had gone. They were disappointed not to find them because there had been so many in spring. Families were astonished that there was a connection between the huge pink lotus blossom and those conical brown things with the holes (the seed pods). When a turtle took up residence in the pond, it was frequently misidentified as a frog.

The simple solution to this third challenge is more interpretation, especially by trained guides who interact with visitors and help correct misconceptions. We have armed our volunteer staff with "pocket topics" that they carry around the garden

to teach visitors basic facts about the plants, insects, and wildlife that inhabit the garden. The opportunity to share new information with visitors this way has energized many of our volunteers. Now they play an essential role in fulfilling our mission: sparking interest and curiosity in nature for a new audience. We are also running a training program for teens called "Macgyvers" – which stands for Morton Arboretum Children's Garden Youth Volunteers. These teens lead educational activities for children aged 3 – 7. The little children learn more about nature, while the highly-trained Macgyvers gain presentational and other skills.

No matter how dynamic and exciting our Children's Garden may be, we know that it will not hold a person's attention forever. Eventually, novelty will wear off and many families will pursue the next exciting thing at the nearby zoo or children's museum. We anticipate some attrition with our membership and are planning ways to hold on to as many of the new members as possible.

We always intended to use the Children's Garden as a springboard to the rest of the Arboretum, but we have found that most families never venture beyond the central area that includes the Children's Garden, Visitor Center, and Maze Garden. We've seen plenty of parents dragging children out of these gardens, kicking and screaming because they don't want to leave, attempting to console them with promises that they'll return another day. Getting families who are attached to the new attractions to explore other parts of the Arboretum will take some effort and creative programming.

Over the first summer of operation, we offered families a booklet that suggested six other places to visit at the Arboretum. To pique their interest, each destination was linked to one of the areas of the Children's Garden. The brochures proved popular, and parents expressed appreciation for the additional opportunities for things to do with their families. A simple follow-up survey revealed that the great majority families had not visited any of the six areas, but that most planned to do so some time in the future. We plan to explore a variation of this idea next year.

Conclusion

Our society is changing in terms of its connection to nature. We have a population of young people, children and adults, who have learned more about plant life cycles and monarch migration from watching the Discovery channel than from playing outdoors. Our challenge is to draw them away from electronic entertainment long enough to capture their interest in the action off screen. If we succeed in showing them first hand what they have learned at a desk at school or on television, then we can go a long way to fostering appreciation for the natural world and our public gardens as institutions that preserve nature.

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Allelopathy or Pseudo-allelopathy in Classroom Experiments?

There are numerous plant misconceptions in the biology teaching literature (Hershey 2004-2005). Allelopathy is one popular lab activity particularly fraught with misconceptions. Allelopathy is defined as a plant naturally releasing an organic chemical, termed an allelochemical, that inhibits or promotes growth of another plant growing nearby. Allelopathy was included in many textbooks as an important factor in plant ecology largely because of claims in a *Science* cover article. Muller *et al.* (1964) observed grass-free zones around three native California shrubs, (*Salvia leucophylla, S. apiana,* and *Artemisia californica*), and claimed that the bare zones were caused by allelopathy. This conclusion was supported by lab experiments that showed that volatile terpenes from the shrubs inhibited cucumber and oat seedling root growth in the lab.

Muller's photo of bare zones around the shrubs was published in many biology and botany textbooks as a classic example of allelopathy. Muller (1953) went from being a strong critic of allelopathy claims to being a leading allelopathy supporter (Muller *et al.* 1964, Muller 1966). Yet, some of Muller's (1953) criticisms of allelopathy research applied to his later allelopathy experiments, e.g. "**The production of toxic material capable of killing seedlings of other species under experimental conditions does not in fact relieve the shrub of competition and thus constitute an advantage of survival value. The failure of this toxic principle to be effective in the natural habitat is possibly attributable to the activity of the microflora in breaking down the toxin or to its adsorption by colloidal components of the desert loams.**" Bartholomew (1970) seriously undermined Muller's allelopathy hypothesis when he found that fencing sections of the bare zone allowed grass to grow there. Bartholomew's conclusion was that the bare zone was caused by rodents, rabbits and birds using the shrubs as protection from predators while feeding on nearby grass seedlings.

Halsey (2004) provided a valuable historical analysis of Muller's allelopathy research and Muller's vigorous defense against its critics. As is often the

case, once a misconception gets into the teaching literature, it is difficult to eliminate (Hershey, 2004b). Allelopathy usually is presented as established fact in biology textbooks but its existence and importance in nature remain uncertain. Halsey (2004) concluded that "**Allelopathy remains a controversial topic today despite hundreds of investigations because of the difficulty in isolating all the possible variables affecting plant growth.**" Even leading allelopathy researchers admit that allelopathy has a bad reputation because of artificial experiments and unwarranted extrapolations (Mallik, 2005).

"Allelopathy" Teaching Experiments

There have been several allelopathy teaching labs recommended in the last twenty years. Yet, all have some of the same major flaws as older allelopathy research articles. In addition, they often mislead students into thinking that allelopathy is an uncontroversial subject and is easy to demonstrate with artificial lab experiments. Claims of allelopathy are often controversial because it may be impossible to separate allelopathic effects from other effects on plant growth (Inderjit and del Moral, 1997).

Hibbs and Shumaker (1987) recommended classroom experiments on intraspecific allelopathy of devil's backbone (*Kalanchoe daigremonatiana*). In one experiment, a large plant was planted in a flat of perlite or potting soil, and adventitious plantlets from that plant were placed in a grid pattern on the medium surface. A photo showed that the plantlets beneath the large plant remained small while those beyond the canopy of the large plant grew much bigger. However, the large plant shaded the plantlets beneath it and competed with nearby plantlets for mineral nutrients and water. The large plant may also have altered the rootzone pH to the detriment of the plantlets. No measurements were made to determine if an allelochemical was naturally being released from the large plant.

Hibbs and Shumaker (1987) also grew adventitious plantlets in flats of perlite with and without an aqueous extract of 200 g macerated *K. daigremonatiana* tissue per liter. Plantlet growth was inhibited but that technique was extremely artificial. In nature, plants do not macerate themselves as part of an allelopathic defense. Inderjit and Nilsen (2003) emphasized that grinding plant tissues to extract allelochemicals, or "grind and find," must be avoided in allelopathy research. A realistic treatment might have been to apply rainwater to shoots of an intact plant, catch the runoff and irrigate plantlets with the runoff to determine if allelochemicals leach from shoots. Perlite is an unrealistic medium for allelopathic experiments because it is chemically and biologically inert compared to soil (Bunt 1988). Soil or soil microbes may inactivate allelochemicals (Muller 1953).

Marcus and Burz (1994) claimed that radish seedlings were allelopathic to lettuce seedlings in classroom experiments yet their results could not be confirmed (Santaniello and Koning, 1996). A photo in Marcus and Burz (1994) had the caption "**Lettuce seeds when placed in Petri dishes with radish seeds failed to germinate.**" Yet the photo showed several lettuce seedlings in the Petri dish! (Hershey 1994a) No data were presented, just the photos. Even if radish partly inhibited lettuce germination or growth, it would not necessarily be due to allelopathy. It could be due to plant competition for light, water and mineral nutrients. Marcus and Burz (1994) cited Choesin and Boerner (1991) to support their claim that allelochemicals from some Brassicaceae inhibit seed germination. However, Choesin and Boerner (1991) concluded that "**Under our experimental conditions, *Brassica napus* showed no indication of being allelopathic ...**"

Latto and Wright (1995) found an inhibition of seed germination that might have been due to allelopathy in just one of nine treatments. Their technique of collecting supposed allelochemicals from seeds germinated on filter paper and then reusing the filter paper to germinate other seeds was problematic. Changes in the chemical, physical or biological properties of the filter paper itself may have affected germination of a second batch of seeds (Hershey, 1996).

Frame (1998) also germinated seeds in Petri dishes. The test seeds were treated with leachate from alfalfa sprouts. Fives grams of alfalfa sprouts were submerged in 25 ml of distilled water for 48 hours. That was artificial because under natural conditions any leachate is from rain or overhead irrigation on intact plants. Submerging alfalfa seedlings for 48 hours might be long enough for them to start to decay and for substantial microbial growth to occur. Frame (1998) might have inadvertently been testing the effects of a microbe or microbial toxin on seed germination.

Teaching experiments on allelopathy often germinate seeds in a Petri dish on filter paper wetted with tap or distilled water. That is not the best technique because a Petri dish is a very stressful and artificial environment. Seeds and seedlings will be deficient in most mineral nutrients and possibly rootzone oxygen if the filter paper is overwetted. Seeds or seedlings may also be subject to periodic drought as there are minimal moisture reserves in the filter paper, and most of the water may evaporate from the filter paper and condense on the Petri dish lid. Seeds germinated on filter

paper with distilled water may experience drastic changes in rootzone pH due to lack of buffering.

Use of distilled water for seed germination should be avoided. The harmful effects of distilled water on plants has long been recognized (True, 1914; Hibbard, 1915). Calcium and boron are of special concern because both are required external to the root for normal root functioning (Bohnsack, 1991; Lauchli and Epstein, 1970). Roots without calcium in the bathing solution have "leaky" cell membranes. Such "leaky" roots may cause artifacts in allelopathy experiments by allowing entry of chemicals that normal roots might exclude.

Garlic "Allelopathy" Experiments

Shimabukuro and Haberman (2006) recommended allelopathy experiments with garlic (*Allium sativum*) but did not cite any literature that claimed garlic was possibly allelopathic. They used the same basic lab technique as Muller *et al.* (1964) by examining inhibitory effects of a volatile chemical on seed germination and seedling root growth. Even Muller (1982) later referred to his 1964 technique as "contrived." The "contrived" technique in Shimabukuro and Haberman (2006) produced a nearly complete inhibition of lettuce seed germination supposedly due to volatile chemicals from crushed garlic in sealed Petri dishes. However, the experiment was extremely artificial because the seeds were in a sealed Petri dish, the garlic was crushed, and there was no soil, just filter paper and distilled water. Under natural conditions, any garlic volatiles

1. would have come from uncrushed garlic plants so would have differed in chemical composition, e.g. the volatile chemical, allicin, is formed enzymatically when garlic is crushed,
2. would have been present at a lower concentration,
3. would not have been concentrated around the seeds in a sealed Petri dish but could have diffused away,
4. might have been inactivated by adsorption to soil particles or by the action of soil microbes.

The garlic experiments failed to avoid some of the problems mentioned by Shimabukuro and Haberman (2006) in their introduction, i.e. **"Often unrealistically high doses of the active chemicals are used and the experiments are conducted in the absence of soil."** A more realistic experiment would have been to place an uncrushed garlic clove in a pot of potting soil used to germinate lettuce seeds. Detrimental effects of chemicals released by artificially crushing plant parts on the growth of other plants is not true allelopathy. Allelopathy involves a plant naturally releasing allelochemicals. Inderjit and Nilsen (2003) recommended against lettuce as a test species in allelopathy experiments because it is an "artificially sensitive species."

"The Dose Makes the Poison"

In an attempt to determine if garlic was allelopathic under field conditions, Shimabukuro and Haberman (2006) also grew lettuce seedlings in a pot containing 10 g crushed garlic and 18 g of dry potting soil. However, that was an unrealistically high dose as the following calculations indicate. Organic potting soils usually have a bulk density of about 0.1 g/ml (Bunt 1988) so the bulk volume of the potting soil was about 180 ml or 0.00018 cubic meter. Ten grams or 0.01 kg of crushed garlic per 0.00018 cubic meter equals 56 kg/cubic meter.

The volume of a hectare furrow slice is 15 cm (0.15 m) times 10,000 square meters or 1500 cubic meters. Thus, there would be 1500 times 56 kg or 84,000 kg crushed garlic per hectare. A high average garlic yield was reported to be 11,200 kg/hectare (Rosen *et al.* 1999). The application rate for the teaching experiment was the equivalent of plowing under 7.5 crops of garlic bulbs at once. That is unrealistic. Plowing under a single crop would be equivalent to about 1.3 g crushed garlic per 18 g of dry potting soil. Even that would be unrealistic because the point of growing garlic is to harvest the bulbs for sale, not plow them under.

Some gardeners do spray plants with crushed garlic in water to repel insects and prevent diseases. Thus, a relevant classroom experiment could examine if a garlic spray might inadvertently inhibit the growth of plants it was meant to protect. Such a realistic and relevant experiment may not produce the dramatic results of the artificial experiments in Shimabukuro and Haberman (2006) but it is much preferable.

Competition for Resources or Allelopathy?

A major problem with allelopathy research is that it is very difficult, if not impossible, to separate effects of plants competing for resources from allelopathic effects (Inderjit and del Moral, 1997). Classroom allelopathy experiments should address this problem so that students do not get the misimpression that allelopathy is easy to recognize in real situations.

Simple and unequivocal classroom demonstrations of allelopathy with intact plants may one day be possible by genetically engineering suspected allelopathic plants so they do not produce an allelochemical. One experimental treatment would then involve growing the normally allelopathic species A in the same pot with species B. The control treatment would involve growing species A,

engineered so it could not produce the allelochemical, in the same pot with species B. The effects of species A competing with species B for resources (water, mineral nutrients, light, etc.) could then be separated from allelopathic effects. Such an approach has already been applied to tobacco to demonstrate that nicotine functions to protect the plant from insects (Steppuhn *et al.*, 2004). A tobacco engineered so it produced very little nicotine suffered about three times more leaf area loss to insects than tobacco producing normal nicotine levels.

Pseudo-allelopathy

Many of the research and classroom experiments that claimed to demonstrate allelopathy did not truly examine allelopathy because two plant species were not grown together. Instead, there was an artificial (human-caused) release of toxic chemicals, often at unrealistically high doses. Harper (1994) stated "**Almost all species can, by appropriate digestion, extraction and concentration, be persuaded to yield a product that is toxic to one species or another.**" The teaching experiments discussed above add support for Harper's claim because most did not use a species considered allelopathic under natural conditions.

Situations where people artificially cause release of toxic chemicals from one plant that damage another plant should not be considered allelopathy. To differentiate between them, the term pseudo-allelopathy could be used for situations where an artificial release of chemicals from one plant harms or benefits another plant. Pseudo-allelopathy occurs in agriculture and horticulture. Some types of fresh, ground tree bark used as mulch or in potting media are toxic to seedlings (Bunt 1988).

Plants often produce secondary compounds that function in defense against animals or microbes. High doses of these chemicals may also be detrimental to plants in pseudo-allelopathy experiments but that does not necessarily mean they act as allelochemicals under natural conditions. For example, tobacco plants produce nicotine for defense against herbivores. Nicotine is also used as a commercial pesticide. An overdose of nicotine pesticide can also damage the plant it was meant to protect.

Better Classroom Experiments

Alternatives to classroom allelopathy experiments that also deal with effects of chemicals on plant growth involve plant mineral nutrition, a fundamental but often underemphasized topic in biology (Hershey 1993). Plant mineral nutrient deficiencies and toxicities are straightforward classroom experiments (Hershey 1994b). Unlike the controversy of many purported allelopathic effects, there is no controversy that plants will become deficient when they do not get enough of an essential mineral nutrient. Rootzone pH effects on plant growth are also easy for students to study (Hershey 1992). Few student labs have the equipment required to identify or quantify an allelochemical, yet students can easily and cheaply measure pH. The detrimental effects of the lack of calcium and boron in solutions bathing roots can be detected quickly. When placed in a solution lacking boron, squash (*Cucurbita pepo*) root elongation was measurably reduced in three hours (Bohnsack and Albert 1977; Bohnsack 1991). Corn (*Zea mays*) seedling roots placed in a solution lacking calcium begin to leak potassium within 30 minutes (Lauchli and Epstein 1970).

Other relevant classroom experiments on chemicals affecting plants are those on salinity, plant hormones and herbicides. Molisch, who coined the term allelopathy in 1937, considered the plant hormone, ethylene, from apple fruit to be an allelochemical (Mallik, 2005). Especially relevant are experiments with herbicides created because of purported allelochemicals. Mesotrione, tradename Callisto, is an herbicide that controls crabgrass in lawns and broadleaf weeds in corn (Cornes 2005). It is an analog of leptospermone, a purported allelochemical in lemon bottlebrush (*Callistemon citrinus*).

A simple and relevant classroom pseudo-allelopathy experiment consists of daffodil flowers in a vase with tulip flowers. Cut daffodil flowers release a toxic alkaloid(s) from the cut end of the flower stalk into the vase solution. It reduced tulip vase life from 7 to 4 days (Van Doorn 1998). The alkaloid(s) also caused yellowing of tulip leaves when it was placed directly on them. Daffodil plants growing in soil are not considered allelopathic so the alkaloid probably does not function as an allelochemical under natural conditions. The fact that cut daffodils release a toxic alkaloid(s) that harms neighboring cut flowers but daffodil plants do not release enough alkaloid(s) to harm neighboring plants provides an excellent illustration of the danger of extrapolating lab experiments to the field.

If classroom allelopathy experiments are conducted, it would be most relevant to use a species that research has suggested might be allelopathic under natural conditions, such as black walnut (*Juglans nigra*), spotted knapweed (*Centaurea maculosa*) and garlic mustard (*Alliaria petiolata*) (Bais *et al*. 2003; de Scisciolo *et al*. 1990; Stinson *et al*. 2006). Both allelopathic and non-allelopathic factors that can affect plant growth should be considered (Murray and Winnett-Murray 2004). The test species should be one that normally grows near the suspected

allelopathic species. Research using readily available cultivated plants as test species, such as lettuce or sunflower, is often inconclusive because different species can vary widely in their response to the same purported allelochemical.

Rather than seed germination on filter paper in a Petri dish, a more realistic classroom allelopathy experiment would grow a suspected allelopathic species and a test species together and attempt to eliminate competition for water, mineral nutrients and light. To eliminate competition for light, the suspected allelopath could be planted in a hole in the side of the pot, and the allelopath shoots prevented from shading the test species planted in the pot. Competition for water and mineral nutrients could be eliminated by frequent irrigation with a complete mineral nutrient solution. In one treatment, activated charcoal would be added to the soil to adsorb any allelochemicals excreted by the roots of the allelopath (Inderjit and Callaway, 2003). There would be four treatments total:

1. Control with test species alone in pot
2. Test species and suspected allelopath in pot
3. Control with test species alone in pot plus activated charcoal
4. Test species and suspected allelopath in pot plus activated charcoal

Bioassay Misuse

Another misconception promoted by allelopathy research and teaching experiments is misuse of the term bioassay. A bioassay was originally defined as quantification of a specific chemical using a living organism. It required the creation and use of a standard curve. For one IAA (indole acetic acid) bioassay, the standard curve was a graph of IAA concentration versus the length of *Avena* coleoptiles (Nitsch and Nitsch 1956). A plant extract was then applied to other *Avena* coleoptiles, their length measured and the standard curve used to estimate the IAA concentration in the extract. Bioassays were once the basis of most plant hormone research. Plant hormone bioassays are still useful in teaching experiments, e.g. the hypocotyl elongation bioassay for gibberellic acid (Reiss 1994).

Shimabukuro and Haberman (2006) started with a correct definition for bioassay but, despite their claim, none of their garlic experiments was a bioassay because none created a standard curve or quantified a specific chemical. Unfortunately, the definition of bioassay has been expanded by some to include almost any experiment that studies the effect of a chemical on a living organism (Inderjit and Nilsen, 2003; Rice and Maness, 2004).

Conclusions

Classroom allelopathy experiments in teaching journals are often poor models for student research. They should be approached with caution or avoided so students are not misinformed about the significance of allelopathy, where a plant naturally releases allelochemicals that harm or benefit another plant. Halsey (2004) should be essential reading before students or teachers attempt allelopathy experiments. There are more realistic classroom experiments on allelopathy than those determining the effect of unnaturally high doses of plant extracts on the germination of seeds on filter paper in Petri dishes. Classroom allelopathy experiments should also be based on a real observation from natural or agricultural ecosystems where one plant seems to be allelopathic to another.

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News from the Society

2007 Darbaker Prize in Phycology

The Botanical Society of America is accepting nominations for the 2007 Darbaker Prize in Phycology. This award is presented for meritorious work in the study of microscopic algae, based on papers published by the nominee during the last two full calendar years (2005-2006). The award is limited to residents of North America, and only papers published in the English language are considered.

Nominations for the 2007 award should include a list of all of the nominee's work to be considered for the 2005-2006 period, and a statement of the nominee's merits addressed to the committee.

Nominations for the 2007 Darbaker Award should be sent by April 30, 2007 to the chair of the Darbaker Award Committee, Dr. Martha Cook, Department of Biological Sciences, Campus Box 4120, Illinois State University, Normal IL, 61790-4120; email mecook1@ilstu.edu. E-mail nominations preferred.

BSA Science Education News and Notes

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

PlantingScience—BSA-led student research and science mentoring program

A hearty thank you to the BSA scientist mentors who made 2006 a wonderful year for the students and teachers participating in the PlantingScience project! We would love to recognize each of you by name, but hope you do not mind if we refer readers to your shining faces instead: http://www.plantingscience.org/index.php?module=pagesetter&tid=5&filter=sipscientist:eq:1&tpl=scientists

Spring, and the Spring PlantingScience Session, are coming this February-March. In addition to hosting the spring session, we will be active at national meetings. Will you be in St. Louis for the

National Science Teachers Association meetings? If so, please join us on April 1 for a PlantingScience workshop. Carol Stuessy will present an analysis of student-scientist dialogs at the National Association of Research in Science Teaching meeting in New Orleans.

And, of course, there is much more going on behind the scenes, particularly grant-writing and partnership-building. In late April we are looking forward to productive Steering Committee meeting, including representatives of the American Society of Plant Biologists, who have officially accepted the BSA's invitation to partner in this project. Please email chemingway@botany.org if you have questions/comments about the online inquiry and mentorship program, or would like to know how to become more involved.

BSA Collaboration with AAAS BioSciEdNet (BEN) Digital Libraries Portal

The BSA has been a BEN collaborator since 2003, and our involvement this year stepped up. BSA IT Manager Rob Brandt participated in the December Technical Committee Meeting. Gordon Uno, representing the AIBS, and Claire Hemingway, representing the BSA, joined the BEN Advisory Board. Over 900 images from the BSA Online Image Collection can be accessed through the portal and that number will increase soon as additional images from our collection are annotated and harvested . With help from BSA members, Rob is testing new BEN portal tools for contributing and reviewing resources. If you haven't taken advantage of this great resource, peruse the possibilities at http://www.biosciednet.org/portal/.

Spotlight on BSA Member Contributions to Science Education

Hot off the press, with glowing reviews!
Rice, Stanley A. 2006. *Encyclopedia of Evolution*. New York: Facts on File.

Stanley Rice, associate professor of biology at the Department of Biological Sciences at Southeastern Oklahoma State University in Durant, OK, has an impressive track record of contributing to the BSA Teaching Section, as well as the Oklahoma Academy of Sciences, the National Association of Biology Teachers, and Project Kaleidoscope. His recently published (nearly 500 page) compendium covers current understandings, historical developments, biographical sketches, major misconceptions, and thought-provoking essays. Consider this review: "Rice's masterful, unique work serves student, educator, and citizen alike."—Lynn Margulis, Ph.D., Distinguished University Professor, University of Massachusetts-Amherst
(note: this book is listed in the books received for review in this issue of PSB.)

Science Education in the National News

Enrollment increases projected to continue—Have you noticed your classes filling to overflowing? Over the last 14 years, enrollment in elementary and secondary schools increased by 18%, enrollment in colleges and universities increased by a whopping 25%. By 2015, enrollment is projected to increase another 6% for precolleges and 15% for colleges.

Hussar. W.J. and Bailey, T.M. 2006. Projections of Education Statistics to 2015 (NCES 2006-084). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.
http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2006084

Stating the case for reform across education levels—Several recent reports, all available online, cover the gamut from city public school performance indicators to international college completion rankings. The findings are mixed, with improvements in some areas and much work yet to do in many others. A few highlights are noted below.

Although the US ranks 4th in the world in number of students enrolled in college, the rank drops to 17th for students completing college degrees. This international perspective sets the stage for National Report Card on Higher Education prepared by the National Center for Public Policy and Higher Education. State-by-state summaries are available on measures of preparation, participation, affordability, completion, benefits, and learning.

Measuring Up 2006, The National Report Card on Higher Education
http://measuringup.highereducation.org/about/

Students living in 10 major cities demonstrate poorer understanding of science compared to the national average. The percentage of 4th graders in urban districts demonstrating a basic understanding ranged from 35-60% versus 66% nationally, and that of 8th graders was lower yet (22-52% versus 57% nationally). Test questions included understanding of both content and process of science. Of great concern are indications that students lack of the skills and reasoning needed to learn science, and could not read simple charts or follow elementary experiments. The National Assessment of Education Progress (NEAP) conducted this study on urban public school districts in 2005 as part of the Nation's Report Card on academic achievement of elementary and secondary students in the US.

The Nation's Report Card, Science Report for the Trial Urban District Assessment

http://nationsreportcard.gov/tuda_science/

According to the Education Week's annual report, which tracks state K-12 performance and policies regarding student readiness, states appear to be tackling college-preparedness. Although only 11 states have formal definitions of college readiness, 26 have joined the American Diploma Project network, which seeks to better align high school graduation requirements with college readiness standards.

Quality Counts 2007 From Cradle to Career: Connecting American Education from Birth to Adulthood
http://www.edweek.org/ew/articles/2007/01/04/17execsum.h26.html

Editor's Choice. Botany in Science Education Journals

Boyd, Amy. Plants and Perpetrators: Forensic Investigation in the Biology Classroom. *American Biology Teacher Online* http://www.nabt/sites/S1/File/pdf/068-09-0025.pdf Students become sleuths as they apply their knowledge of plant anatomy and morphology to solve a murder mystery.

Zheng, Zhi-Liang. Use of the *g11* Mutant and the *CA-rop2* Transgenic Plants of *Arabidopsis thaliana* in the Biology Laboratory Course. *American Biology Teacher Online* http://www.nabt/sites/S1/File/pdf/068-09-0026.pdf Provide students with a real research environment while teaching genetics laboratory techniques and analytical skills.

Kevan, Peter G., Franco DiGiovanni, Rong H. Ho, Hiasatomo Taki, Kriastyn A Ferguson, and Agata K. Pawlowski. 2006. A Simple Method for Collecting Airborne Pollen. *Journal of Biological Education* 40(4):181-183. What perfect timing to have the instructions for constructing and using a simple "megastigma" for trapping airborne pollen now that many anemophilous trees, with their inconspicuous flowers, are coming into bloom. Though not hi-tech (spring clothes pins, plastic plant labels and clear sticky tape) the authors describe some quantitative results that students can obtain to monitor pollen rain.

Newell, Sandra, J. Does Herbicide Resistance Have a Cost in Brassica rapa? *American Biology Teacher* 68(9):530-535. Bring the ecology of transgenic plants into the classroom with an inquiry into the competitive abilities of herbicide-resistant and susceptible strains of *Brassica rapa*.

Ross, Paulinen, Diedre Tronson and Raymond J. Ritchie. 2006. Modelling Photosynthesis to Increase Conceptual Understanding. *Journal of Biological Education* 40(2):84-88. Photosynthesis has long been recognized as one of the most conceptually difficult subjects to teach in introductory courses with many deeply engrained misconceptions. The methodology of this paper supplements the traditional lecture with physical model building, a diagramming assignment, and role-playing targeted to particular misconceptions.

Teplitski, Max and McMahon, Margaret J. Problem-Based Learning and Creative Instructional Approaches for Laboratory Exercises in Introductory Crop Science. *Journal of Natural Resources and Life Science Education* Winter 2006. The implementation of problem-based learning (PBL) and other inquiry-driven educational techniques is often resisted by both faculty and students, who may not be comfortable with this learning/instructional style. We present here a hybrid approach, which combines elements of expository education with inquiry-driven laboratory exercises and educational games...

Weck, Robert and Robb VanPutte. 2006. A Simple & Rapid ELISA for Detecting Aflatoxin Contamination in Corn. *The American Biology Teacher* 68(8):492-495. For about $3.00 per student group you can introduce the ELISA technique for a evaluation of the presence or absence of fungal aflatoxin in corn, peanuts, or other whole fruits. Sensitivity of the assay can be adjusted from 20 to 200 ppb which covers the range from acceptable for food or feed (<20ppm) to subject to confiscation (>100 ppm). The authors provide several examples of further discussion or analysis that can proceed from student results.

Announcements

In Memoriam:

Jack Myers, 1913–2006

Jack Edgar Myers, whose career featured the unusual combination of serving science education and research, and serving children as science editor of *Highlights* magazine, died of cancer on December 28 in his Austin, Texas apartment at Westminster Manor. He was 93.

Myers, a member of the Botanical Society of American who wasnamed to the prestigious National Academy of Sciences in 1975, earned numerous other honors for contributing to the understanding of photosynthesis, phototrophic growth, and the physiology of algae, including the Charles F. Kettering Award from the American Society of Plant Physiologists. In the presentation of the Kettering Award, Myers' wide influence on the field was emphasized, along with recognition that his "career shows in an exemplary manner how wide ranging scientific achievement can be combined with humanism, modesty, and wisdom." In 1998, the American Society of Gravitational and Space Biology awarded Myers their highest honor, the Founders Award, for his seminal work that provided the foundation for practical applications of algae as a source of food in the closed environments needed for space exploration.

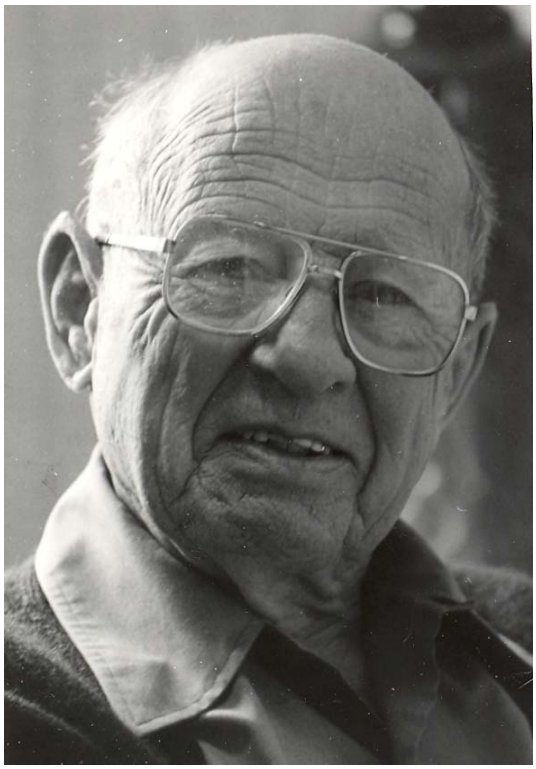
Following his appointment to the University of Texas faculty in 1941, he spent 58 years there, taking emeritus status in 1980 but continuing to occupy his lab and actively conduct research until 1999. He authored more than one hundred papers for scientific journals and publications.

Myers called himself lucky for being able to "work as a scientist…there was always another challenge because there was always another question."

That approach and a devotion to the scientific process guided Myers' work at Highlights for Children, Inc., an educational publishing company founded sixty years ago by his parents, Garry Cleveland and Caroline Clark Myers. Writing for children, Jack Myers later recalled, was "a challenge I hadn't counted on, but my Pop was of a mind that, 'You can do this. You're a scientist, aren't you?'"

His duties as science editor began in 1958. To author articles, he sought out scientists "who have a great insight into their subjects. The limitation is that it is hard to find people who will write in the language that kids will find sufficiently easy to be interesting." In a typical reaction to a submitted piece, he once wrote: "I think the author was trying to teach about a tidal marsh – not tell a story and make it an exciting place…If we're going to have a 'muddy adventure,' something has to happen. And we really can't have an adventure if we must catalog all the kinds of things that can happen in a marsh."

Highlights magazine editor Christine French Clark noted that "Uncle Jack," as everyone at the magazine office called him, had everyone's "great respect as a scientist and an editor and a writer who speaks to kids in a very honest, forthright way."



Jack Myers in the 1990's

As part of his *Highlights* job, Myers responded to as many as 400 letters a year from young readers who asked him virtually everything from the difference between frogs and toads to why human skin wrinkles in water. His answers often were disarming. When a child asked why "every dog I know goes around and around in circles before lying down," Myers answered, "I have heard the idea that the circling…is a behavior inherited from wild ancestors. That sounds reasonable enough though I cannot be sure it is the best explanation. If you find a better explanation, please let me know."

For Myers, science was "the search for understanding of our world. All the fun and excitement is in the search. That's where the action is." He decried the teaching of science "as a

collection of facts….When it becomes a bunch of facts, it is a sterile and rather unexciting subject. But the real fact is that science is an open-ended endeavor and never deals in certainty. Kids do not get much exposure to how we know. I think it makes science a lot more fun, and it does a lot more useful service for *Highlights* to treat the question: How do you find something out?"

Jack Myers was born on July 10, 1913, in Boyd's Mills, Pennsylvania, one of three children. He recalled having been a "mediocre student" until ninth grade, when he was "fired up" by his teachers of English, mathematics, and general science, the last having had, in Myers' words, "a remarkable ability to stimulate real interest in science among his students."

Myers attended Juniata College in Huntingdon, Pennsylvania, for his undergraduate work, which included a major in chemistry. He earned a master's degree in 1935 from Montana State University, and then chose the University of Minnesota for his doctoral work, concentrating on plant photosynthesis and achieving degree status in 1939.

He had chosen Minnesota in part because Evelyn De Turck, a friend from undergraduate days, had taken a job in Minneapolis, with plans to do graduate studies at the university. "By 1937," said Myers, "we decided to get married. We pooled our incomes. Mine was $66 a month and hers was $33. Depression days! You could do it then on that amount of money." They had four daughters and he was devoted to his wife and children. Mrs. Myers died in 1997.

In 1960, when his younger brother, Garry Cleveland Myers, Jr. and his wife Mary died in a plane crash, Jack, Evelyn and their daughters expanded their family to include five additional children. Garry Myers, Jr. was the senior business executive of Highlights for Children, Inc. from 1949 until his death. As a result of this tragedy, Jack Myers also stepped into a leadership role on the Highlights corporate Board of Directors. He served as a mentor to his nephews, Garry Cleveland Myers, III, longtime executive who was CEO of Highlights for Children from 1981 through his death in 2005, and Kent L. Brown, Jr., who started in the editorial offices in 1971 and is now Editor-in-Chief, and to his grand-nephew, Kent S. Johnson, who is the current CEO of the company. Myers' influence extended to four generations of the entire Myers family: he combined a great sense of humor, personal ethics, wisdom, humility, and soft-spoken thoughtfulness to lead through inter-generational transitions, always nurturing a strong commitment to family unity and to stewardship of the Highlights corporation.

In 1939, Myers was awarded a National Research Council postdoctoral fellowship and joined the staff of the Smithsonian Institution in Washington, D.C., to concentrate on his studies in photosynthesis.

The University of Texas recruited him in 1941 as an assistant professor of zoology. Promotions followed: to associate professor in 1946 and professor in 1948. In 1956, his title expanded to professor of botany and zoology. During his years at the University of Texas, he earned honors for teaching and, in 1959, won a Guggenheim Fellowship.

In 1993, the College of Natural Sciences at the University of Texas named Myers to its Hall of Honor. A colleague wrote: "Jack Myers has been, and continues to be, a true hands-on research scientist – a molecular biologist 50 years before this discipline became a recognizable field of research. He is the consummate faculty member in the best sense of the word, and one who has a pure interest in the learning enjoyed by others as well as by himself." In 2006, Norman Hackerman, chemistry professor emeritus and former President of The University of Texas at Austin, described Myers "as a pure scientist, very interested in understanding nature better – and he was a good guy besides."

Along with his academic papers and the countless articles he wrote for *Highlights*, Myers had a number of books published which focused on young readers and the scientific process, these include: *Can Birds Get Lost?, What Makes Popcorn Pop?,* and *What Happened to the Mammoths?*

In the 1990's Myers devoted considerable time to training, inspiring and mentoring young science and nature writers with an interest in writing for children. Much of that work was done at the annual conferences of the Highlights Foundation Writers Workshop held in Chautauqua, NY.

Myers is survived by his four daughters and their husbands: Shirley and Fred Wendlandt of Mullin, Texas; Jacquelyn and Jim Leonard of Lakeway, Texas; Linda and Allan Anderson of Ashland, Oregon, and Kathleen and Steve Holland of Spicewood, Texas, as well as ten grandchildren and seven great-grandchildren.

Myers is also survived by four of his brother's five children and their spouses: Tom Myers of Austin; Fred and Jennifer Myers of Austin; Patricia and John Mikelson of Columbus, Ohio, and Marie Jolene Rich of Portland, Maine, as well as their six children and six grandchildren..

Contributions in the memory of Jack Myers may be sent to the Jack Myers Scholarship Fund, Highlights

Foundation, 814 Court Street, Honesdale, Pennsylvania 18431 or to Hospice Austin, 4107 Spicewood Springs, Rd., Suite 100, Austin, Texas 78759.

Kingsley R. Stern, 1927-2006

Kingsley R. Stern received his undergraduate education at Wheaton College, where he majored in botany. In graduate school, he continued his studies in botany, while minoring in zoology and horticulture. He received his Master's Degree from the University of Michigan at Ann Arbor, and his Ph.D. from the University of Minnesota at Minneapolis. He took additional graduate courses at the University of Illinois in Urbana, and at the Hopkins Marine Station of Stanford University in Pacific Grove, California.

While pursuing his studies, Dr. Stern held part-time positions as an instructor in biology at Hamline University, and an instructor in botany at the University of Minnesota, where he received a Conway McMillan Research Fellowship. After accepting a position as Assistant Professor of Botany at California State University in Chico, he was promoted to Associate, and then Full Professor. In 1987, while on leave, he was a Visiting Professor of Botany at the Manoa campus of the University of Hawaii.

During his tenure at California State University, Dr. Stern taught eight different courses, several of which he introduced to the curriculum, and has been on the committees of over 50 graduate students. To date, an estimated 15,000 students have enrolled in his classes. He has received several grants from the National Science Foundation in support of biosystematic investigations in Fumariaceae (Fumitory family). These investigations, which included studies at the Swedish National Pollen Laboratory in Stockholm, eventually led to the publication of about 20 research papers in professional journals.

Among many of Dr. Stern's accomplishments, he was very well known for authoring the botany textbook, *Introductory Plant Biology,* which is in its 10th Edition. Over 200,000 copies of the book have been sold since the first edition was published in 1979, and it is still used at universities and colleges across the United States and many parts of the world. At the time of his death, Kingsley Stern had just completed the 11th Edition.

Professor Stern taught at California State University, Chico, from 1961 until his retirement in 1994. Dr. Stern's academic awards include being named Outstanding Professor at California State University in 1993, and receiving the school's Distinguished Service award in 1999 for establishing and developing the University Herbarium, which grew from 2,000 to more than 74,000 specimens (now 92,000 specimens). Dr. Stern was most recently honored at the 100th Meeting of the Botanical Society of America, where he accompanied many world-famous botanists in recognition with the Society's Centennial Award (Chico News citation for Kingsley in receiving the BSA Centannial Award). Kingsley Stern will long be remembered for his attention to detail and dedication to high standards, along with a refreshing sense of humor. His enthusiasm for the botanical world captivated those around him, including his family, for many decades. Living relatives include his wife, Janet; son, Kevin; daughter Sharon; brothers: Merold and Chester; sister, Grace.

Personalia

Dr. Meredith Blackwell, Boyd Professor, Department of Biological Sciences, Louisiana State University, Baton Rouge, was awarded the **2006 William H. Weston award for Excellence in Teaching** by the Mycological Society of America. The Weston Award is presented annually to an outstanding teacher of mycology at the graduate and/or graduate levels. In addition to her involvement with the Botanical Society, including authoring the Alexopolous article in ***PSB* 52(1):2-11**, Meredith is well known to members of the Mycological Society of America where she has been Eastern Councillor (1981-82), Secretary (1986-88), Vice President (1990-91), and President (1992-93). In 1983 she received the C.J. Alexopoulos Prize and in 2003 was awarded the Distinguished Mycologist award. In 1996 she was made a Centenary Fellow of the British Mycological Society. In addition to her numerous research publications, particularly on insect/fungal relationships, she is co-author of the standard university textbook, *Introductory Mycology*.

Dr. James S. Miller Appointed Dean and Vice President for Science at The New York Botanical Garden

The New York Botanical Garden is pleased to announce that James S. Miller, Ph.D., currently William L. Brown Curator of Economic Botany at Missouri Botanical Garden, has accepted the position of Dean and Vice President for Science at The New York Botanical Garden,. Dr. Miller will take up his new position in New York on or around February 1, 2007.

In accepting this appointment, Dr. Miler noted, "I am very excited about joining the staff of The New York Botanical Garden and the opportunity to work with a group of scientists who are conducting research that is so critical for understanding and preserving the natural resources upon which humans depend for our quality of life."

The position of Dean and Vice President for Science at the International Plant Science Center of The New York Botanical Garden leads strategic positioning, planning, and administration for all areas of science at the Botanical Garden. Dr. Miller will hold an endowed chair, the Rupert C. Barneby Curatorship, named in honor of the legendary New York Botanical Garden scientist, scholar, and humanist who made enduring contributions to the field of botany during a career spanning nearly half a century. Dr. Miller will report to the Director of the Botanical Garden, Dr. Kim E. Tripp.

The position of Vice President for Science has been open at The New York Botanical Garden since June 1, 2006 when Dr. Dennis Wm. Stevenson took a new position at the Botanical Garden as Vice President for Laboratory Research.

Dr. Miller comes to The New York Botanical Garden with an impressive record across the breadth of arenas of responsibility that the Dean will lead in this new position. He received his Ph.D. in Biology from St. Louis University, Missouri. Dr. Miler has extensive field work experience in Latin America, Africa, and Madagascar. He has a solid track record of collaborative work with laboratory-based projects and successfully built the William L. Brown Center for Plant Genetic Resources into a world-class research operation dedicated to the study and conservation of useful plants. As director of the William L. Brown Center, Dr. Miller has been responsible for fund-raising and creation of a strategic plan for the Center, for developing research programs and field stations internationally, and for managing diverse plant science staff and students. At the same time, Dr. Miler has seamlessly continued a successful personal research and publication program working with the Boraginaceae, a plant family of shrubs, trees, and herbs found worldwide, totaling about 2,000 species in 100 genera.

Dr. Miller is a member of the Scientific Advisory Board for te National Center for Natural Products Research at the University of Mississippi, the advisory board for Agribusiness in Sustainable Natural African Plant Products, the Science Liaison Committee for the Donald Danforth Plant Science Center, the advisory panel for botanicals for the United States Pharmacopeia, and the Science Advisory Board for Sequoia Sciences. Dr. Miller also serves as Adjunct Professor at the university of Missouri, St. Louis.

Symposia, Conferences, Meetings

The Biology Graduate Student Association and the University of Central Florida Biology Department welcome all undergraduate, graduate and post-doc students to the 4th annual **Southeastern Ecology and Evolution Conference.** Events include a keynote speaker on Friday night and an informal social at the campus bar. There will be a Saturday night social, silent auction, field trips and many other opportunities to meet fellow researchers from the southeastern states.

WHERE? The University of Central Florida, Orlando.

WHEN? 16-18 March 2007

COST OF ATTENDANCE? $30 before and $40 after 16 February 2007. That buys you admission to the conference, a t-shirt, a tote bag, a buffet dinner, continental breakfasts and snacks, and many priceless opportunities to network with your peers.

For information about registration, guidelines and deadline for abstract submission, conference schedule, event sign-up, and hotel accommodations please see our website: http://biology.ucf.edu/seec/index.html.

We can't wait to see you in March!

THE TWELFTH SYMPOSIUM ON THE NATURAL HISTORY OF THE BAHAMAS

June 21-25, 2007
Gerace Research Center
San Salvador, Bahamas

Since 1984, the Gerace Research Center (formerly the Bahamian Field Station) has hosted a biennial conference on the Natural History of the Bahamas. This year's conference will be the 12th in the series, and will address a wide variety of topics in all aspects of the natural history of the islands. The purpose of the conference is three fold - 1) to provide a forum for the presentation of results of current natural scientific research being conducted in the Bahamas and nearby areas, 2) to provide an informal setting to facilitate contacts and cooperation between scientists working in the Bahamas and similar areas, 3) to promote the growth of knowledge in the general area of Bahamian terrestrial and marine sciences. Dr. Peter J. Mumby from the University of Exeter, England, deliver the keynote address. Technical sessions will be in the morning and evening and will include one or more poster sessions. Afternoons will be devoted to a choice of field excursions to various points of interest on San Salvador. Interested authors are invited to contribute to the symposium program by giving oral or poster presentations. REGISTRATION is available on-line by following the link below - please note this is due by April 2, 2007. ABSTRACTS are due May 1, 2007 - see "Notes for Presenters" link below for information. Papers will be published in the Proceedings *of the Twelfth Symposium on the Natural History of the Bahamas*. See the links below for more information.

http://www.geraceresearchcenter.com/NH07symposium.htm

Positions Available

Curator
William L. Brown Center for Plant Genetic Resources
St. Louis, Missouri

The William L. Brown Center is located at the Missouri Botanical Garden, one of the top three botanical and research organizations in the world.

The William L. Brown Center's portfolio of programs includes natural products discovery partnerships, ethnobotany, the study of medicinal plants, database of useful plants, community-based conservation, and natural resource management. We envision a future emphasis on the wild relatives of cultivated plants and their conservation.

The Missouri Botanical Garden's scientists and staff work cooperatively with individuals, governments and non-governmental agencies around the world to strengthen their scientific capabilities and conservation efforts.

The Garden is searching for a successful leader, scholar and administrator to direct the William L. Brown Center for Plant Genetic Resources. The center's staff includes seven Ph. D. level research scientists and their associated support staff. Current efforts include the Associate Program in the Madagascar International Cooperative Biodiversity Group project. In addition to directing this project the Curator helps establish priorities, oversees the budget, and coordinates the relationships with other nationwide programs.

The successful candidate possesses a Ph.D. in botany or related field of plant sciences, a record of productivity in collections-based economic botany, and experience coordinating teams of research scientists. The individual has demonstrated ability to lead a nationally-prominent research group. Experience includes a successful record raising grant and contract funding. Many programs of the William L. Brown Center involve access to and transfer of plant genetic resources so significant experience with the legal and ethical issues related to the collection and use of plant material, often with commercial partners, and an understanding of material transfer issues is a must. The ideal candidate possesses experience with public promotion of programs, including strong public speaking skills and negotiating international

agreements with institutions in other countries.

Interested parties are invited to send their curriculum vitae to Job #F215 Human Resource Management, Missouri Botanical Garden, 2345 Tower Grove Avenue, St. Louis, Missouri 63110 or apply online at www.mobot.org. Letters of reference will be requested.

Award Opportunities

GRANTS FOR ORNAMENTAL HORTICULTURE

The Stanley Smith Horticultural Trust invites applications for grants up to $20,000 for education and research in ornamental horticulture. Not-for-profit botanical gardens, arboreta, and tax-exempt organizations are eligible. The deadline for applications is August 15, 2007. For current guidelines, contact Thomas F. Daniel, Grants Director, SSHT, Dept. of Botany, California Academy of Sciences, 875 Howard St., San Francisco, CA 94103, USA (email:tdaniel@calacademy.org).

Thomas F. Daniel, Dept. of Botany, California Academy of Sciences, 875 Howard
St., San Francisco, CA 94103
tel. 415-321-8358

Other

PROTECTED AREA IN MADAGASCAR BENEFITS BIODIVERSITY, DEVELOPMENT

Botanical Garden Research Leads to Preservation of Species-Rich Montagne des Français

Research by Missouri Botanical Garden scientists who identified the biological importance of Montagne des Français - a rocky area on Madagascar's northern tip rich in highly diverse and unusual plants and animals - has convinced the Malagasy government to grant it Temporary Protected Area status. This completes the first of three steps necessary to create a permanent protected area through the efforts of the International Cooperative Biodiversity Group (ICBG), a partnership that includes the Garden.

"It's not every day that we are directly part of the creation of a new protected area that emerges as a result of our science," said Dr. Jim Miller, who heads the Garden's William L. Brown Center for Plant Genetic Resources. "This is real conservation impact through our research program."

Montagne des Français is a limestone massif, an impressive outcrop of calcareous and sandstone rocks located 10 kilometers south of the provincial capital of Antsiranana, or Diego Suarez. The ICBG's Madagascar program aims to discover new natural products that could be developed as pharmaceuticals or agrochemicals in a manner that promotes both conservation and economic progress in the island nation off the southeast coast of Africa.

The ICBGs are supported by the Fogarty International Center of the National Institutes of Health (NIH) with support from NIH, the National Science Foundation, and the United States Department of Agriculture. The Madagascar-ICBG is a partnership of Virginia Polytechnic Institute and State University, the Missouri Botanical Garden, Conservation International, Esai Research, Dow Agrosciences, and three governmental research organizations in Madagascar: the Centre National d'Application des Recherches Pharmaceutiques, the Centre National de Recherche de l'Environment, and the Centre National de Recherches Océanographiques.

In 2005 Missouri Botanical Garden botanists coordinated a conservation assessment of Montagne des Français that revealed large areas of natural vegetation surviving in dry deciduous forests and rocky areas. Researchers found 215 species of higher plants, five primates, 12 small mammals, 56 bird species, 40 reptile species, and 19 amphibian species. Among these were several known only from this site, and others classified as critically endangered.

Their research also revealed an alarming loss of natural habitats, however, due mainly to the exploitation of wood for the production of charcoal to sell in Diego Suarez.

The designation of Montagne des Français as a Temporary Protected Area was a complicated process, requiring consultation and agreement with the full range of stakeholders and a provisional delimitation, said Miller. The process was conducted by the semi-governmental organization Service d'Appui à la Gestion de l'Environment (SAGE), with support from Conservation International.

Financial support from the ICBG's industrial partners has been used to support development projects in surrounding villages. All projects promote

sustainable natural resource use, including improvements in animal husbandry for better production of cattle, chickens, and ducks; training to improve efficiency of vegetable farming; wells and irrigation; and reforestation in the newly protected reserve. These projects aim to decrease poverty in the local villages by reducing the tendency to abuse and exploit natural resources, and providing alternative means of making a living other than highly destructive charcoal production.

The final two stages of the process leading to the establishment of Montagne des Français as a formally protected area should be completed in two more years. The site has enormous potential to generate income from ecotourism because of its dramatic scenery, interesting and attractive flora and fauna, and proximity to Diego Suarez and Ramena Beach.

"We are proud that ICBG-Madagascar has been able to create a win-win situation for both humans and nature," said Miller.

MISSOURI BOTANICAL GARDEN'S RECYCLING PROGRAM SAVES 70,000 POUNDS OF HORTICULTURAL PLASTIC FROM LANDFILLS

(ST. LOUIS): The Missouri Botanical Garden's Plastic Pot Recycling Program set a new record during the 2006 collection period by saving 70,000 pounds of waste from landfills. Since the program's inception in 1997, over one-half million pounds of pots and trays have been collected and recycled, completing an environmentally-friendly circle for areagardeners.

The William T. Kemper Center for Home Gardening at St. Louis's Missouri Botanical Garden leads the initiative to collect plastic gardening containers, polystyrene and polypropylene cell packs and trays over six weekends every May and June. Garden workers and 62 volunteers donated 480 man hours to the 2006 effort, collecting approximately 700 pounds of plastic per hour over the course of 102 operating hours. Four local gardening centers and two municipal recycling centers also contributed to the project's efforts. About 20,000 pounds of horticultural waste was collected by Waldbart & Sons, For the Garden by Haefners, Summerwinds at Timber Creek, Schmittels Nursery, City of Kirkwood Recycling Center and City of St. Peters Recycling Center.

"There is an infectious nature about gardeners wanting to do the right thing and recycle their pots and trays," said Dr. Steven Cline, manager of the Kemper Center and Pot Recycling Program founder and manager. "We continue to see increased participation each year, which has inspired us to expand the program by acquiring new granulation machinery and developing a better way to handle the mix of plastic. We have also found that off-site collections are extremely productive, and feel the future of this effort lies in this satellite collection approach."

Since 2003, the Garden has partnered with Environmental Recycling, Inc. (ERI) to transform the amassed horticultural waste into durable black plastic lumber through the Pots to Planks program. Grants from the Missouri Environmental Improvement and Energy Resource Authority, in partnership with the Missouri Department of Natural Resources, assisted the Garden's 2004 purchase of grinding equipment. In 2005, grants from the St. Louis-Jefferson Solid Waste Management District and support from Monrovia Growers contributed to additional purchases, aiding the Garden's capabilities to process the ever-expanding volume of the collections. The equipment processes plastic into small chips that are easier and more cost-effective to transport for recycling.

In the last three years, the collection was processed into over 2,500 planks of plastic lumber available for public purchase as raised garden beds or composting bins. Due to rising petroleum and transportations costs, the program changed direction in 2006 while maintaining its dedication to reuse of recycled plastic. Currently, the horticultural regrind is sold for the production of railroad ties and landscape timbers for use in retaining walls or as landscape elements. Each seven-by-nine-inch timber is eight-and-one-half feet long and weighs about 280 pounds. Plastic landscape timbers last longer than regular wooden ties and will never rot, warp or splinter. They can be cut with a circular saw and drilled similar to wooden lumber. A colorant is molded in and sealant is unnecessary as the plastic is water and pest resistant.

Landscape timbers are available for sale to contractors for $39.95 each. Sale proceeds are used to sustain the Plastic Pot Recycling program. To purchase plastic landscape timbers, call the Kemper Center at (314) 577-9441. For more information on the Plastic Pot Recycling program, visit www.mobot.org/hort/activ/plasticpots.shtml or call (314) 577-9561.

Books Reviewed

The Ecology of Plants, 2nd ed. Gurevitch, Jessica, Samuel M. Scheiner, and Gordon A. Fox. 2006. ISBN 0-87893-294-1 (Cloth US$96.95) 518 pp. Sinauer Associates, P.O. Box 407, Sunderland, MA 01375-0407.

Ecology of Plants is a welcome addition to the ecology bookshelf. In comparison with the first edition, this updated and revised version incorporates additional color photographs, recent research findings, and a comprehensive look at ecology with the focus on plants. The book covers all main ecological topics, ranging from organismal physiological ecology, population ecology, community ecology and ecosystem ecology. Also included are chapters on biomes, human impacts and evolutionary ecology. The book is comprised of five parts (Individual and Environment, Populations and Evolution, Communities, Ecosystems and Landscapes, and Global Patterns and Processes) with 3-5 chapters per part.

I found that this book competes well with several major ecology textbooks that are used to teach introductory ecology. Indeed, outstanding chapters in Plant Ecology include the treatment of population dynamics, landscape ecology, and community ecology. For example, the chapter on population dynamics provides a thorough overview of the techniques and applications of matrix models and the importance of stochasticity in population dynamics. The chapter on community ecology provides an excellent summary of the development and application of multivariate ordination techniques, a topic usually not included in introductory ecology texts.

In all chapters, the writing is quick paced and oftentimes humorous. While the authors clearly have their opinions, they include a wide spectrum of workers in the field, identifying them by their full name, often including pictures, and summarizing their research findings. This approach humanizes the field and should make the book more appealing to students. All chapters provide a comprehensive historical view of the topic, with reference to both classical and modern approaches. While the book clearly achieves its aim to present the ecology of

plants, I found a lot of typos, some unclear figure captions, and numerous repeated literature cited entries, suggesting that some additional proofreading could have been useful. It is unfortunate that these minor errors stand out so prominently.

For some of us in departments where Botany is being eliminated as a requirement for Biology majors but Ecology is still required, this text could be used to get some plant biology in the curriculum. Our more animal-minded ecologist colleagues would be upset though, as some key ecological concepts, developed with animal models, are not included. The text would be very appropriate for a stand-alone course in plant ecology at both the undergraduate and graduate levels. Each chapter ends with Questions for Further Study and a list of additional readings, both classic references and additional resources. I encourage the authors to include a teacher's guide in the next edition of this very useful book.

-John B. Pascarella, Valdosta State University, Valdosta, Georgia.

An Enthusiasm for Orchids: Sex and Deception in Plant Evolution. Alcock, John. 2006. ISBN 0-19-518274-X. (Cloth US$) 302 pp. Oxford University Press, 198 Madison Avenue, New York, NY 10016-4314.

It is clear from the beginning that the author has a very deep enthusiasm for orchids, and as expected from the title this was not expected to be a book directed at the professional botanist. It is however a good medium for anyones first foray into evolutionary plant biology. This book takes on an adaptationist discussion of orchid natural history and evolution, focusing on the sexual deception employed by many orchid species to attract pollinators. Orchids provide a unique group for the study of plant adaptations given their especially complicated pollinator interactions. This is clearly outlined in the first two chapters by the author, John Alcock, who has published numerous books on subjects within evolutionary biology. This book, which focuses primarily on Australian orchid taxa, nicely illustrates the marvelous 'contrivances" that these orchids use for pollination with numerous color photos of the plants and their pollinators. There is a brief overview of many basic methods and principles in systematics from nomenclature and methods in molecular systematics. Beyond these relevant topics there are many additional concepts discussed throughout the book from behavior (both animal and a broadly defined plant behavior) to creationism and how orchid natural history can be useful in understanding and/or belaying these differing perspectives.

The author is an established entomologist and this lends a unique entomological perspective on orchid evolution thought out the book, one which he brings to bear nicely in the chapter on "Adaptation and Maladaptations". As an orchidologist I found this discussion most interesting of all as it provided a different and refreshing look at the orchid- pollinator dynamic. All too often orchids are described as malicious aggressors who have virtually enslaved pollinators into doing their will. Yet in this chapter Alcock nicely explains a number of hypotheses which suggest that pollinators are not completely unwitting participants, but are also driving the evolution of orchids in ways which I had not previously thought of; these plants exhibit exquisite and very convincing adaptations for pollination by deception. Additionally, orchids are not only responding by evolving novel mechanisms to attract pollinators but pollinators are also evolving means to discover and elude orchid deception, thus perpetuating an evolutionary "arms race" of sorts between pollinator and orchid. As part of this chapter there is also a somewhat long discussion of human physiology and psychology of sorts; he explains MHC and how human perception favors pretty things, which seems out of place in a book on orchids, but it does however in some way get to the general overall phenomenon or specter of "orchid fever" and explains the enthusiasm orchids elicit.

One chapter provides a concise, informative history of plant evolution discussing how evolution and speciation results in these unique adaptations within and between species; he also establishes the concept of the most recent common ancestor and how we observe and understand the relationships between plants. This is followed by an explanation of the ways in which in which systematists name organisms and the problems and concepts which this process entails. The remaining chapters lay out issues surrounding the biodiversity and conservation of orchids. These issues while not unique to orchids *per se*, are important and if orchids can be used to describe and encourage conservation practices, I applaud the use of them; any medium which can drive home the message of conservation of natural resources and biodiversity to the larger populace is worth noting.

While generally being an easy read, the book is often prosaic and verbose in ways which make it difficult at times to trudge through. The various tangents taken throughout the text can also be distracting. For example there are a number of forays into personal history, which, while being insightful, I found unnecessary, adding little or no contribution to the material. The author never claims to be a botanist, which is obvious especially when botanical terminology is misapplied or unused (antennae are not anthers). In addition there are two major points which are discussed *ad nauseum*. Alcock uses a rather broad definition of behavior stretching the term to its limits, suggesting plant mechanistic and chemical responses to stimuli are in some ways analogous to the psycho-neuro-muscular behaviors of animals. His examples range from humans to both orchid and non-orchidaceous plants and the "just so" evolutionary explanations are at times difficult to accept. The second area, that being his nearly chapter long look at the misconceptions of intelligent design creationism I also felt was unwarranted and did nothing to forward the book. As an evolutionary biologist, I too understand the desperate need for these sorts of discussions, but feel that this was not an appropriate venue.

In conclusion, *An Enthusiasm for orchids: Sex and Deception in Plant Evolution* is still an interesting book, and as someone who has personally taught or been directly associated with instructors teaching evolutionary biology, this book can provide good examples of plant adaptations which are desperately needed in these sort of classrooms which tend to focus more often on animal examples. While there are some detractions, the book overall provides many interesting points which would be of interest to some readers, and for me at least I will see orchid evolution from a much different perspective…. through compound eyes!!!

-Erik P. Rothacker, Evolution, Ecology and Organismal Biology, Ohio State University

Teaming with Microbes: A Gardener's Guide to the Soil Food Web. Lowenfels, Jeff and Wayne Lewis. 2006. ISBN-13: 978-0-88192-777-1, ISBN-10: 0881927775 (hardcover, US $24.95). 196pp. Timber Press, Inc. Portland, Oregon, USA.

As a horticulturist and a botanist, I couldn't help but be intrigued by a book whose dedication to the authors' wives included the statement, "They remained silent when we took the molasses from the cupboard."

The authors, both gardening enthusiasts in Alaska, present an interesting premise: They strive to convince the rest of us gardeners that the most efficient way to a healthy garden is through an understanding of what lies beneath – the soil and the organisms that live there. The preface states that what sets this book apart is its "strong emphasis on the biology and microbiology of soils" and indeed they formatted their work as a one-two punch – first the science, then the application. The first eleven chapters cover "The Basic Science" and the following nine discuss "Applying Soil Food Web Science to Yard and Garden Care".

The basic science presented by the authors introduces the reader to some introductory concepts of the SFW concept, general soil science, and the organisms that contribute to the development and maintenance of healthy soils. The first chapter, "What is the Soil Food Web and Why Should Gardeners Care," discusses the principles of the SFW – mainly that the interconnectedness of the activity of plants and the soil organisms contribute to a soil chemistry and composition that help plants grow. While a bit anthropomorphic in its terminology, the basic ecological concepts presented are sound and easy to understand.

Chapter Two, "Classic Soil Science" provides a primer on soil chemistry. The authors valiantly struggle with providing good information while avoiding overly technical terminology. The introduction to soil formation processes, soil profiles, porosity, structure and texture are well-written for a lay audience with a few exceptions – terms like "chelating agents", "oxidation", and "reduction" are not defined and probably not in the common vocabulary of an average gardener. I would have liked to see the authors take the opportunity in this chapter to explain the relationship between pH and nutrient availability to their readers as well.

Chapters three through eleven cover the organisms that are found in soil and that contribute to its formation and health. Unfortunately the authors mistakenly refer to this group as the "soil biology" (the study of soil) instead of the "soil biota" (the living portion of the soil), or more simply, the soil's organisms or inhabitants. Beyond that vocabulary *faux pas*, each chapter sufficiently describes the general life cycle and both beneficial and harmful activities of the various groups – bacteria, fungi, algae, slime molds, protozoa, nematodes, arthropods, earthworms, gastropods, as well as a cursory look at reptiles, mammals, and birds. The

variety of organisms discussed gives the reader a real respect for the shredding, burrowing, binding, interactions among organisms and the decay that occurs underfoot and underappreciated. The text has frequent reminders of the chemical contributions to the soil from the activities of these organisms, particularly as relates to nitrogen availability and pH. I would hope that in the next edition, the authors correctly classify the poorly named "blue-green algae" with the bacteria where they belong (as Cyanobacteria instead of as the defunct Cyanophyta).

It is clear that the authors' passion and expertise lie in the second part of the book in which they demonstrate how to incorporate the philosophy of the soil food web into one's garden practices. Throughout this section, they list their Soil Food Web Gardening Rules (repeated in the appendix) as they apply to the topic at hand. In chapter twelve, "How the Soil Food Web Applies to Gardening", the authors promote the idea that a healthy soil and its inhabitants act as a reservoir for nutrients thus preventing their loss to the habitat. The biota improves the structure of the soil, encourages healthy competition among the organisms, and specifically influences nitrogen availability in the root zone. In addition, the authors promote the idea that different plants respond better to different ratios of bacterial and fungal decomposers in their soil.

It seems from the book and through some of the resources listed that the majority of the research supporting the SFW approach has been done by Dr. Elaine Ingham. In fact she wrote the preface, and some of the examples in the book are reproduced from her company, Soil Foodweb, Inc. I find the philosophy of the book intuitively appealing, but more independent research into the respective roles of bacterial and fungal decomposition in gardens would have lent more weight to the authors' recommendations.

Chapter thirteen provides a useful soil assessment tool for a homeowner in order to establish the current soil conditions in various areas of the garden. Anyone can follow the guidelines to see what sorts of organisms are already present in their soil, and the authors wisely advise using a professional service for a nutrient analysis of the soil.

Chapters fourteen through seventeen are the heart of the work. In these chapters, the authors discuss mulches, composts and compost teas and how each of these soil amendment tools can be used to its best advantage. These soil additives can be customized to meet the nutrient release needs of various sorts of gardens. The introduction to the whys and hows of hot composting is excellent– including the importance of temperature and C:N ratios – and the brief coverage of vermicomposting and cold composting presents all the basics. All sorts of organic mulches are discussed in terms of their roles in nitrogen robbing and habitat qualities for bacteria and fungi decomposers in addition to the usual coverage of the ability of mulch to stabilize soil temperature, suppress weed growth and reduce surface evaporation.

The chapter on compost teas presents a wonderfully thorough explanation of why actively aerated compost teas can truly be "black gold" for gardening. As someone unfamiliar with the concept of these actively aerated teas, I was happy that the authors included instructions and some schematics for how to construct a home system and how to apply the teas. Their enthusiasm for the process and results from compost teas is contagious and makes you want to head to the home improvement store to get supplies – and to the cupboard for the molasses.

The book finishes with chapters that look at specific garden types – lawns, mixed borders of herbaceous and woody perennials, and annual flower and vegetable gardens – and whether bacterially or fungally dominated decomposition nourishes those plants best. The coverage of lawns was very welcome – applications of herbicides and pesticides on lawns are often overdone and contribute to soil and water pollution problems. Perhaps this presentation of the importance of each of the soil's inhabitants to the overall soil system health will convince some gardeners to reduce chemical usage. The final chapters give a simple gardening calendar for SFW enhancement and a motivational note about old growth forests having done alright on their own.

As a gardener, I enjoyed the easy-to-read text and found the gardening approaches sound and the recommendations quite practical. The botanist in me thought some of the motivational hype was a bit naïve – old growth forests are being invaded by aggressive introduced weeds too – but the enthusiasm for a paradigm shift in thinking of our soils as another living system in the garden and that our role as gardeners includes responsible stewardship of that system as well as the plants anchored in it is well-overdue. The authors do a fine job at selling the care of the soil as a co-requisite for successful care of the garden plants. While **Teaming with Microbes** is not an appropriate choice for a college-level soils class, gardeners interested in more holistic approach to their landscapes will find good ideas and approaches.

- Linda MK Johnson, Department of Biology, Chemistry and Environmental Science, Christopher Newport University, Newport News, VA, 23606.

Fusarium Laboratory Manual. Leslie, John and Brett Summerell. 2006. ISBN 0-8138-1919-9 (Paper US$124.99) 400pp. Blackwell Publishing Professional, 2121 State Avenue, Amers, IA 50014-8300.

The *Fusarium* Laboratory Manual, with photographs by S. Bullock, succeeds in providing a clear, encyclopedic, and easy-to-use guide to working with *Fusarium* in the laboratory. It is filled with excellent text and figures and will be useful for anyone working with *Fusarium*.

Fusarium is a genus which presents ample work for both mycologists as well as for those working on flowering plants, since so many species in this genus are either important pathogens or saprobes associated with crop plants. Many of the saprobes enter sick plants secondarily, and so understanding *Fusarium* is important for sorting out which is the actual pathogen killing a plant. *Fusarium* is a problematic genus which has varied wildly in size over the past centruy, rising from a handful of species to around a thousand, which were subsequently reduced to some dozens. That last number has been relatively stable in decent decades.

Fusarium is also problematic because morphological identification of species and forms can be extremely difficult. Thus, culture methods are critical for those dealing with these fungi, making this book invaluable. This manual is not the first of its type, it and previous such works having come from the frequent workshops held by those working on *Fusarium*. The *Fusarium* Laboratory Manual opens with a general discussion of the genus and its taxonomy, its importance as a source of pathogens as well as a source of secondary metabolites used as raw materials for industrial processes. Many of the industrial products in that category include growth-promoters fed to animals.

The *Fusarium* Laboratory Manual then turns in successive chapters to methods of collection and isolation from various biotic and abiotic sources, growth and maintenance of cultures (including many recipes for media), and then interaction between species and forms. This last area occupies two chapters, first covering vegetative compatibility, which governs formation of heterokaryons between two species, and second covering sexual reproduction in *Fusarium*. The last chapter presented before any taxonomic information is given deals with DNA analysis, including ample detail on methods such as CTAB maxipreps of *Fusarium*'s DNA.

The last major section of the book deals with taxonomy, principally with individual species, subspecies, and forms. Each species is presented in a few pages, including diagnostic character. Perhaps most notable for each is an excellent photograph of the horn-shaped macroconidia. Overall, the text is outstanding—crystal clear with so much detailed information that anyone who has had a few basic courses in Biology could start to work with *Fusarium*. The black-and-white pictures are also outstanding, with great clarity, and over 2400 references from the literature are provided at the end of The *Fusarium* Laboratory Manual.

Who should buy it? Every college and university laboratory, for a start. Also, anyone working on *Fusarium*, or on plant pathology more generally, as well as those faculty looking for an excellent resource with lots of ideas for upper level laboratories. Buy a copy today.

-Douglas Darnowski, Indiana University South

Ecology of Phytoplankton. Reynolds, C. 2006. ISBN 978-0-521-84413-0 (hardback) IBSN 978-0-521-60519-9 (paperback). xiv + 535 pp. Cambridge University Press, Cambridge.

There is a common expression: "The third time is the charm." Since that saying may strongly imply that the first two attempts were unsuccessful it is definitely not appropriate for books on phytoplankton ecology by Colin Reynolds. But it is true that his third book, *Ecology of Phytoplankton*, is a more complete, comprehensive treatment of the subject. In fact, the inclusion of marine phytoplankton certainly makes this volume a more useful and more important offering than the significant, but more narrowly focused first book, *The Ecology of Freshwater Phytoplankton* (published 1984) or the very focused second book, *Vegetation Processes in the Pelagic: A Model for Ecosystem Theory* (published in 1997). Some readers might quibble that the marine phytoplankton coverage in this volume is by no means equivalent to that for the freshwater phytoplankton; however, the coverage of marine organisms is an important, welcomed addition that makes this book an equally welcomed and important addition to the roster of available books dealing with both freshwater and marine phytoplankton.

Ecology of Phytoplankton is an impressive compilation of information of phytoplankton ecology and covers everything from some basic taxonomy of the phytoplankton to detailed discussions of the multifaceted topic of phytoplankton mortality and loss processes. The book comprises eight chapters, a glossary, a list of units, symbols, and abbreviations (three pp.), an extensive list of references (60 pp.), and four indices (totaling 28 pp.). The indices are to the lakes, rivers and seas mentioned, the genera and species of phytoplankton mentioned, the genera and species of other organisms, and a general index.

A major contribution of this book is the new perspective the author provides based on the years of research results in his lab and others worldwide. That is, Reynolds can and does revisit ideas perhaps only very speculatively offered in 1984 or 1997. He indicates whether the additional science has proven or disproved earlier notions, or, in some cases, whether the basic questions remain unresolved. Given the breadth and depth of the topical coverage, *Ecology of Phytoplankton* should be an invaluable reference for both those working directly in the area of phytoplankton ecology and those whose research interests are more tangential. Students should find this book valuable as a reference for specific topics of phytoplankton ecology and it could, perhaps, be used as text for an advanced course in phytoplankton ecology.

As impressive as this volume is, it would have been enhanced by the addition of colored plates in Chapter 1, wherein the taxa are introduced. Also, in my copy of the book at least one figure (viz. 3.1) is horribly printed. The inclusion of summaries at the end of each chapter was, of course, an excellent idea; however, I found the summaries to be a bit less comprehensive than they might have been. On the other hand, a *ca.* two-page summary per chapter is probably more feasible and appropriate than a longer summary. These minor criticisms of the book do not detract from its significance as a major contribution to the study of phytoplankton. Given the importance of phytoplankton to the global ecology and given the rich morphological and physiological diversity of the algae that are the phytoplankton, Colin Reynolds has provided a very comprehensive and insightful book that will be an important resource for limnologists, oceanographers, and ecologists who are interested in the pasturage of the seas, lakes, and rivers.

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Arabidopsis Protocols. Salinas,Julio and Jose J. Sanchez-Serrano Second Edition. Series: (Methods in Molecular Biology Series; 323), March 2006, ISBN 1-58829-395-5 (hard cover 135.00), 469 pp, Humana Press Inc. 999 Riverview Drive, Suite 208, Totawa NJ 07512.

The book *Arabidopsis Protocols* by Julio Salinas and Jose J. Sanchez-Serrano is essentially an advanced laboratory manual for plant molecular biology. The book is conveniently organized into six sections. In section I, individual and joint contributors discuss methods for growing of *Arabidopsis* and related plants. Included in the section are methods for handling seeds, growing plants, grafting and cryopreservation of suspension cultures. Genetic analyses in *Arabidopsis* is the subject of section II, where QTL analysis, high-throughput TILLING, mapping of untagged mutations, PCR-based screening for mutations, gene identification and related procedures are presented. Section III focuses on transient and stable transformation of *Arabidopsis*. Agrobacterium-mediated transformation, transient expression assays, functional analysis of transcription factors by microparticle bombardment, somatic embryogenesis and strategies for use of reporter genes are discussed. Section IV of the book focuses on transcriptomics. This section includes RNA extraction strategies and microarray data analysis. Section V of the book deals with proteomics. Methods for isolation of nuclear and membrane proteins, and 2-dimemntional electrophoresis are included. Metabolomics is the subject of section VI where methods for metabolite and hormone profiling in *Arabidopsis* are presented.

This book is a compendium of modern protocols in plant molecular biology; with direct reference to *Arabidopsis*. In each section, protocols used in various aspects of traditional and modern research topics are presented with amazing clarity. At the end of each protocol or set of protocols, the expert contributors documented common problems and the cautionary measures to be observed by the users. This book should prove to be a highly helpful laboratory companion for beginners and established researchers in molecular biology, particularly those whose research deal with *Arabidopsis* and related plants.

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Advances in Photosynthesis and Respiration, volume 20 (Series Editor: Govindjee). ISBN 1-4020-3323-0. Springer, 2005. 1215 pages, hardcover. 295.00 (Euros)

Discoveries in Photosynthesis is a new edited volume out of the "Advances in Photosynthesis and Respiration" series that draws its inspiration from the phrase that "life is bottled sunshine" ascribed to Wynwood Reade in his 1924 *Martyrdom of Man.* It is the first comprehensive scholarly attempt to gather original materials in order to understand the long and complex history of photosynthesis research. Edited by a distinguished set of researchers in the area on the occasion of the new millennium, the volume is every inch as impressive as its important subject demands. At 1262 pages of text (the book stands at 1304 pages in total), it includes 111 papers, by 132 researchers, from no less than 19 countries. Its coverage and perspectives are equally vast, including not only historical overviews, timelines and biographical tributes, but also detailed "mini-reviews" on critical processes, techniques and applications, institutional sites and laboratories, and comparative national perspectives. It is chock-full of historically important photographs, most never published, along with relevant illustrations, figures, and graphs (some in beautiful color), appropriate to each subject. It is, in short, a monumental effort.

The book begins with a suite of papers by the editors in a section titled "editorials." Here the editors, Govindjee, J. T. Beatty, H. Gest, J. F. Allen offer useful historical highlights of photosynthesis research. This is followed by a section titled "overviews and timelines," that includes further contributions by some of the editors and other authors and a brief section on "tributes" to major contributors like Robert Hill, James Franck, Hans Gaffron, and Samuel Ruben. This is followed by five more technical sections on "excitation energy transfer," "reaction centers," "oxygen evolution," "light-harvesting and pigment-protein complexes," and "electron transport and ATP synthesis" usually written by scientific experts in each area. This is followed by the next set of sections on "techniques and applications," "biogenesis and membrane architecture," "reductive and assimilatory processes," and "transport, regulation and adaptation." Two further sections are dedicated to larger themes in "genetics" and "evolution," which leads to a section dedicated exclusively to institutional and national sites. These include "the Laboratory of Photosynthesis" and its successors in Gif-sur-Yvette, in France, the Charles F. Kettering Research Laboratory, and three papers on the history of photosynthesis research in Russia and the Soviet Union. The volume closes with a series of retrospective contributions.

Taken as a whole, the volume is an impressive collection of historical perspectives on photosynthesis research by some of the leading researchers in the area. My own favorite contribution is modest in ambition, scope, and length, but is nonetheless one of the most important in the volume. Written by H. Gest, the article is titled "History of the word *photosynthesis* and evolution of its definition." It explores the etymology and historical use of the term "photosynthesis." According to Gest, before 1893 or so, the term "assimilation" had been used to describe anabolic metabolism in both plants and animals. The term "photosynthesis" as well as "photosyntax" was first introduced by Charles Reid Barnes at the Madison, Wisconsin meeting of the *American Association for the Advancement of Science.* Gest rightly gives credit to Charles Reid Barnes for introducing the more accurate terminology that gained currency. Science is very much about the importance of definitions, which Gest acknowledges with an appropriate reminder from the great chemist, Antoine Lavoisier who substituted the concept of "oxygen" for the bankrupt notion of "phlogiston." Here, there is one small point that I would add to Gest's historical reconstruction. It was at that same meeting that Charles Reid Barnes was instrumental to drafting the "minority report" that would go on to create the *Botanical Society of America,* earning for himself the designation of "founding father of the new society." In simultaneously serving as the inventor and promoter of the term "photosynthesis" and in founding the new botanical society, Barnes reminds us that even though some present-day botanists, plant biologists and plant scientists may see themselves as engaged in very different projects, all share a common point of origin.

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Characterization of the Cellulosic Cell Wall. Stokke, Douglas and Leslie Groom (eds.). 2006. ISBN 0-8138-0439-6 (Cloth US$149.99) 352 pp. Blackwell Publishing Professional, 2121 State Avenue, Ames, IA. 50014-8300.

These are the proceedings of a workshop held in August of 2003, organized by the editors, and sponsored by the USDA Forest Service, Southern Research Station; the Society of Wood Science and Technology; and Iowa State University. There are 19 chapters, divided between reviews and papers (defined by having a materials and methods section).

Opening a 2006 symposium volume struck me like seeing a colleague photographing data on a copy stand for slides. As copy stands have vanished with the ubiquity of powerpoint projectors, the symposium volume has succumbed to the journal article. But while few of us mourn the copy stand, we may lament the passing of the symposium volume. If there is cause to bring together a clade of researchers for a few days, then so too there is cause to produce a lasting record of the enterprise.

To succeed, any book must read well. The act of reading is aided by the arts of the designer as well as those of the writer. A book printed in smudged letters, though written by Darwin, will read poorly. In the present volume, design and stylistic elements are mixed. The typography is first rate. The font is strong and the page design is attractive. The front page of each article omits the volume information, making it impossible to cite correctly from a photocopy. The front page also omits author affiliations, forcing the interested reader to consult an alphabetical list at the front, a nuisance particularly for multi-authored papers. The bibliographies are inconsistent, with some omitting titles or author names when more than two, seemingly random handling of journal issue numbers, and erratic capitalization. Most seriously, many figures are poorly designed. It mystifies me why scientists, whose output is so often graphical, are so indifferent to graphic design. Besides ugliness, some figure legends mis-identify symbols, and the identical image is reproduced in two different figures (this happened in two articles). The latter is technically fraud but I am sure the instances here reflect carelessness rather than deception; I mention it to underscore the lack of attention given to the figures.

The stated aims of the conference were to bring together researches working on wood science, cellulose, and biomaterials from a variety of disciplines. In view of the challenges and opportunities offered by cellulosic biomass as an alternative to oil, the editors remark: “No longer is it prudent of keep the molecular biologist isolated from the structural engineer.” Despite this, there are no molecular papers, *genome* has no entry in the index. There are no papers on cell wall biosynthesis. Many papers are aimed at facilitating turning wood into boards or paper, but only one is aimed at fuel. Instead almost all of the papers are about methods to characterize the physical or chemical properties of wood. The volume thus lives up to its title if not to the editors’ preface.

I am a reasonable target for this book: My research has been involved with primary cell walls, not wood, and it was valuable to read up on methods for secondary cell wall analysis and on the viewpoints of wood scientists. I learned from all of the articles and found references to check in all of them. Although the writing is uneven, most of the papers are short and to the point; it is convenient to have an entrée to various analytical methods in one book. The reference lists contain few citations after 2003 but I doubt that is a significant limitation.

Many techniques are represented, ranging from imaging (atomic force microscopy, scanning electron microscopy), materials science (stress-strain curves, on single fibers), chemistry (sugar-linkage analysis), and spectroscopy (X-ray diffraction, NMR, FTIR). A few papers deal explicitly with anatomy; for example, molecular types will enjoy learning where to find true secondary xylem in arabidopsis. A few papers deal with physiology, including an essay that argues persuasively that the evolution of wood is driven by the demands of water transport rather than supporting the plant. But most of the papers are about how to analyze the properties of wood, for example a paper that shows how to estimate wood stiffness from density and a simple X-ray diffraction parameter. A topic covered from several different angles is the spatial variation within a tree, including early and late wood as well as wood from the top, middle, and bottom of the trunk. Anyone with an interest in the cell wall will find many useful methods and concepts illustrated here.

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CRC World Dictionary of Grasses. Umberto Quattrocchi. 2006. 3 volumes. ISBN-10: 0-8493-1303-1, ISBN-13: 978-08493-1303-1. (Cloth US$ 650.00) xiv + 2383pp CRC Press (Taylor and Francis Group)

Few scientists can claim a career similar to Umberto Quattrocchi. Originally a political scientist and acclaimed M.D., he started pursuing his love for botany after retirement form medical practice, while at the same time holding a professorship in political science. His previous work "*CRC World Dictionary of Plant Names*" became a bestseller, and received various awards.

The "*CRC World Dictionary of Grasses*" is a remarkable work and continuation of Quattrocchi's excellent botanical writing. While, as the author points out himself, such a work will always be in progress, the dictionary presents an unparalleled achievement.

Grasses represent one of the largest plant groups, have worldwide distribution, and are probably the economically most important plant family, including food crops like wheat, rice, corn that feed the largest part of the world population. Given this importance, a short general introduction into the subject would have been a plus. The work is set up as a real dictionary, presenting more than 800 grass genera with thousands of species in alphabetical order. This system is very easy to follow.

Quattrocchi has painstakingly researched a huge number of, often obscure, references in multiple languages. Every genus, species and lower taxon includes a very detailed synonymy. The genus (but not the species) names are followed by an explanation of their etymology, data on species numbers, worldwide distribution, taxonomic affiliation, and a detailed taxonomic description of the genus, followed by a comprehensive bibliography for every genus. The respective bibliography sections are excellent, but reference book and journal titles only, without giving author names, and it would be very helpful to have a complete bibliography accompanying this set, e.g. in form of a searchable CD.

The species descriptions follow the same structure as the genera: The scientific names are followed by the synonyms, notes on distribution, a shortened botanical description, remarks on uses, an outline on habitat requirements of the species, and bibliographic references, and vernacular names in multiple languages. The information available for a species naturally varies, from little more than a name for rare species, to more than a page for economically important species like sugarcane. The etymological and taxonomic information are easy enough to find. This makes the dictionary an excellent resource for systematics. The information on plant uses and growth conditions follow directly after the botanical description however, without any break or any indication of the subject. This makes the information rather tedious to find, since the reader had to read through the whole description. It would be much easier if every species description would include categories like "Distribution", "Description", "Uses", "Ecology" and "Bibliography". Again, a searchable CD would remedy this inconvenience.

While the taxonomic bibliography for every species is impeccable, the information on distribution, uses and vernacular names is rather fragmentary and contains numerous errors. *Poa annua* for example, one of the now most globally distributed grasses, is mentioned as distributed in "Europe", *Loilum perenne*, component of many seed-grass mixtures is supposed to occur in "Europe and Egypt to Morocco" only, wheat is listed only for the "Mediterranean", while sugarcane is said to be "pantropical", barley is listed for "Europe and Eurasia", and *Zea mays* seems to occur only in "America, Mexico and Guatemala". Here the work lacks consistency and contains large number of errors. The section on vernacular names is comprehensive, but again very difficult to use. Names are arranged in alphabetical order within every language, but the languages themselves are somehow arranged alphabetically by continent, but not consistently. English is always mentioned first (followed by Italian, French and Spanish in case of sugarcane), Latin American countries come before African and Asian nations. In addition, countries (e.g. Brazil, Colombia, Cameroon, India etc.) are mixed up with languages (e.g. English, Arabic, Yoruba, Ladakhi), and within countries (e.g. Mexico), the author does often not indicate which language or language group an indigenous plant name belongs to. This again makes it very difficult to find and use the respective information.

The work concludes with a comprehensive bibliography, although it is not clear what literature has been included and why. Most references cited under genera and species are not mentioned in the bibliography, while some genus or species descriptions stated in the bibliography are not referenced under the respective taxonomic sections. This is again a lack of consistency.

The World Dictionary of Grasses has very few errors or typos, which is remarkable for a work of such scope. The mayor shortfalls are inconsistencies in the descriptions of plant distribution, uses and indigenous names. Most serious is however the

lack of a searchable CD that could be taken into the field.

This 3-volume set is a monumental work indeed, and will be essential to any library linked to botany, ecology, ethnobotany, general plant science, agriculture or horticulture. It is a great resource for systematic botanists, and has value for whoever else might be interested in grasses. At $ 650 the set is far from cheap, but surely worth the investment.

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Flora of the Venezuelan Guayana. Volume 9, Rutaceae – Zygophyllaceae. Paul E. Berry, Kay Yatskievych and Bruce K. Holst, editors. 2005. ISBN 1-930723-47-4 (cloth, US$85.00) xv + 608 pp. Missouri Botanical Garden Press, St. Louis.

This is the concluding volume of the taxonomic treatment of the native and naturalized vascular plants that occur in southern Venezuelan states of Amazonas, Bolívar, and Delta Amacuro. The flora area covers almost 500,000 km^2 and includes famous tabletop mountains (tepuis) known for their high plant endemism. The whole project was initiated by Julian Steyermark in the early 1980s. He also wrote draft treatments for a number of families and envisioned that the flora would be published in two volumes by 1988. However, Julian Steyermark died in 1988 and only thanks to the above listed editors and about 200 contributing authors the complete flora (nine volumes) has been published during the period of 1995 – 2005. Steyermark's essential contribution has been fully recognized: his name is listed as the first among the editor names on the covers of all nine volumes. The resulting treatment includes descriptions and keys to almost 10,000 vascular plant species. More than 98% of the species are native, ca. 23% are endemic to Venezuelan Guayana and ca. 40% are endemic to the Guayana Shield. About half of the species are illustrated.

This final volume includes 48 families – Rutaceae to Zygophyllaceae – in alphabetic order, plus three families that have been recognized after publication of Cronquist's *System* (Bonnetiaceae, Muntingiaceae, Picramniaceae) and one family previously omitted (Ceratophyllaceae). The largest families covered by this volume are Xyridaceae (95 species), Sapotaceae (85), Sapindaceae (83), and Solanaceae (79). One family – Tepuianthaceae (four species in the flora)– is endemic to the Guyana Shield. In total, the volume includes 190 genera and 971 species. Among them, 503 are illustrated by black-and-white drawings, mostly by Bruno Manara.

The *Flora of the Venezuelan Guayana* represents the first comprehensive inventory and identification guide for vascular plants of such an extensive region of northern South America. Julian Steyermark would be proud to see this fine piece of work. The editors and contributing authors should be congratulated for this monumental achievement!

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Genera Orchidacearum. Volume 3 (Part 2) and Volume 4 (Part 1). Pridgeon, Alec M., Phillip J. Cribb, Mark W. Chase, and Finn N. Rasmussen (eds). 2003, and 2005. ISBN 0-19-850711-9 and 0-19-85712-7 (Cloth, US$175.00 each) xvii + 36- and xxii + 672 pp. Oxford University Press, Oxford.

A remarkable series of great potential, *Genera Orchidacearum*, yet to be completed, is already the *vade mecum* of information and interpretation on orchid systematics told through the medium of generic analysis. Volumes 3(2) and 4(1) are two fo the projected six-part ensemble, two of which, Volume 1 and Volume 2(1), have already appeared. Volume 3(2) treats 114 genera and Volume 4(1), 209 genera in 13 tribes. In each volume, the genera have been detailed by one or more specialists concentrating on one or more aspects of information: e.g., description, distribution, anatomy, morphology, palynology, pollination, cytogenetics, phytochemistry, phylogenetics, ecology. And, in some cases, cultivation and uses. There are taxonomic notes with associated pertinent literature citations for many of the genera.

Volume 3(2) includes all of subfamilies Orchidoideae and Vanilloideae. Orchidoideae is organized into several tribes, but Vanilloideae comprises only two tribes. Each volume ends in a glossary of terms, an exhaustive list of references, and index to scientific names, and a subject index. In Volume 3(2) the paginated alphabetical list of genera comes at the end of the book, but in Volume 4(1) this list more conveniently appears in the front matter where it is easily accessible. Almost all genera are illustrated by detailed line drawings of consistently good character with features sharply delineated. Both gross characters and dissections are clearly labeled and described. In both volumes, colored illustrations of fine quality are present. In volume 3(2) there is one group of colored pictures and in Volume 4(1) there are two groups. Colored illustrations include both floral depictions and habitat portrayals.

Both of these volumes represent comprehensive, meticulously edited texts and there are few reasons for negative criticisms. But at least one needs to be addressed: *Corallorhiza* in Volume 4(1) is described in one instance as rootless (which it is!) and further along in the same treatment there is a paragraph outlining the anatomy of the root! This contradiction may have arisen owing to a misinterpretation of the cited literature. Porembski and Barthlott (1988) noted the occurrence of velamen in the subtribe Corallorhizinae (=Calypsoeae sensu Dressler 1993) in which it does occur in some genera. Furthermore, the description of the root of *Corallorhiza* in *Genera Orchidacearum* was apparently taken from Porembski and Barthlott's characterization of the *Calanthe* type valemen to which in their appendix table *Corallorhiza striata* is assigned.

Overall, Volumes 3(2) and 4(1) are exemplary of the careful and thorough work of the editors and contributors. It is well to recognize the dedication of these scientists with the "guts" to venture into the morass of genera that comprise Orchidaceae. These volumes, and those to come, will long remain as standards of excellence and comprehensiveness toward which future workers should aspire.

-William Louis Stern, The Kampong, 4013 Douglas Road, Coconut Grove, Florida, 33133.

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Porembski, S. and W. Barthlott. 1988. Velamen radicum micromorphology and classification of Orchidaceae. *Nordic Journal of Botany* 8: 117-137.

Illustrated Flora of East Texas, Volume I. George M. Diggs Jr., Barney L. Lipscomb, Monique D. Reed, O'Kennon, Robert J. 2006. Sida Botanical Miscellany, No. 26. BRIT Press, xvii + 1594pp. (hardcover). US$ 89.95; ISBN 1-889878-12-X; ISSN 0833-1475.

Few books are so well researched and written that it is almost impossible to avoid superlatives when reviewing them. The first volume of the "Illustrated Flora of East Texas" project falls into this category.

When Diggs, Lipscomb & O'Kennon published "Shinners & Mahler's Flora of North Central Texas" in 1999, it seemed hardly possible to produce an even more in-depth treatment of a local flora. This first publication if the "Illustrated Texas Flora Project," a collaboration between the Botanical Research Institute of Texas and Austin College, set a new standard, and became an immediate classic.

In the first volume of the "Illustrated Flora of East Texas", the same authors, joined by M.D. Reed, show that even their previous monumental work could be improved upon. East Texas comprises an area of about 62,600 square miles (162,000 square kilometers, or about 40 million acres), roughly a space the size of entire Georgia. The region stretches from the border of Texas with Arkansas and Louisiana west to the fringes of the Blackland Prairies around Waco, and from the border with Oklahoma to Austin and San Antonio in the South. This comprises the vegetation areas of the Pineywoods, the Post Oak savannah, Blackland Prairie, and the Red River Area. The flora of this vast region includes 3,402 species (3,660 taxa), which is more than two-thirds of all species known from Texas, or almost 20% of the combined flora of the U.S. and Canada. Volume One covers ferns, gymnosperms and monocotyledons, and includes 1,060 species (1,131 taxa).

The introductory chapter is considerably extended in comparison to the author's previous work. The subchapters on geology, soils and climate of East Texas are detailed for a flora, and provide a solid background. Distribution, geology, soils, vegetation, settlement history, vegetation units and conservation status of each vegetation formation (Pineywoods, Post Oak Savannah, Blackland Prairie and Red River) are then discussed in even greater detail. Two unique areas, Caddo Lake and the Big Thicket, finalize the discussion of the main vegetation units of the region. Far from finished, the introductory chapter provides additional information on the origin and diversity of the regional flora, its conservation status, and gives an almost too detailed historic overview on the botanical exploration of the region.

A series of 200 excellent color photographs of representative taxa precedes the main taxonomic section with keys to the major groups of vascular plants, pteridiophyte, gymnosperm, and monocot families. As in their previous work, the authors have put great efforts in structuring their keys, which work flawlessly. To make the keys more indicative the authors included many term definitions in parenthesis. The taxon descriptions include a wealth of information on origin and etymology of the Latin and vernacular names, synonymy, taxonomic considerations, ecology, distribution, ethnobotany and economic uses, possible poisonous effects, and of course diagnostic features. Added maps show the distribution of every species for all counties of Texas. While this is a great addition of information, the printing quality of the maps could be better. In addition, maps pages are scattered throughout the book, and the individual species do not have a cross reference to their respective map page. This makes it harder to use this information. Since the flora covers almost 20% of all species occurring in the U.S. and Canada it would be even better if the distribution maps could give an indication for the continental distribution of a species.

To make the use of the flora easier for non-specialists, the authors included line drawings of key features for all species covered. This definitely helps to make the flora accessible and useful to a much wider readership. The drawings do sometimes suffer from size reduction, but this is compensated by a clearer print quality than in the author's previous work. It would be helpful however if every drawing would be accompanied by a scale bar.

Twenty-five appendices complete this great work. Appendices 2-7 are remarkable. They provide an excellent introduction to systematics, taxonomy, phylogeny and the debate on cladistics, that will serve laymen as well as students. Information about plant collection, endemic and endangered species, conservation organizations in Texas and especially a suggested reading list on Texan botany are very helpful to the non-professional reader. By providing detailed suggestions for the use of native and introduced species as ornamentals, species important for wildlife and as host plants for Lepidoptera, and by listing sources for native species, the authors provide comprehensive information for gardeners, landscapers and conservation planners. Appendix 21 gives a great introduction to nineteen commercially important timber trees of East Texas. Only four gymnosperm species (3 species of Pinus and Taxodium distichum) fall in the frame of Volume I however, and the inclusion of this appendix is a little surprising. Every species is describes in great detail, and a separate color plate provides a line drawing, distribution map and color photographs of wood, bark, leaves, and other characteristic features.

The Flora concludes with a comprehensive glossary of botanical terms that provides also a good reference for the use of other floras. The reference section is most impressive, and provides more than 3,000 citations on every aspect of Botany in Texas, as well as sources to literature on every taxon represented.

The Flora of East Texas has remarkably few errors for such a monumental work. A few improvements would make it easier to use: An accompanying, searchable CD would be of great value, and should be part of the final flora set. Once all volumes are available, the keys should be published in a small, separate volume that could be easily taken to the field. Finally, the line drawings are clearer than in author's previous work. The thinner paper used for the Flora of East Texas allows the back of a page to shine through to the front. This makes reading harder.

It is not only a tremendous contribution to botanical esearch in East Texas. The tremendous number of pecies treated makes the flora useful for a much arger territory, and as such it is a milestone for otanists in Texas, Oklahoma, Arkansas and ouisiana. It includes virtually all taxa that are also overed in the "Flora of North Central Texas", and can replace this work for readers with a wider geographic focus. It is absolutely essential for the library of any botanist in the region, and will be invaluable for ecologists, conservationists, natural resource professionals, foresters, students, landowners, educators, gardeners, and whoever else might be interested in Texan plants, and with a price of less than $90 the Flora of East Texas is a real bargain.

-Rainer W. Bussmann PhD, Associate Professor, Vice-President and Scientific Director, Nature andCulture International 508 El Paso St. Austin, TX 78704

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Agroecology in Action: Extending Alternative Agriculture through Social Networks. Warner, Keith Douglass. 2007. ISBN 0-262-73180-0 (Paper US$25.00) The MIT Press, 55 Hayward Street, Cambridge, MA 02142.

Biological Control of Plant Diseases. Chincholkar, S.b. and K.G. Mukeriji (eds.) 2007. ISBN 1-56022-328-6 (Paper US$49.95) 426 pp. Haworth Food and Agricultural Products Press, 10 Alice Street., Binghamton, NY 13904-1580.

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