PLANT SCIENCE BULLETIN

A Publication of the Botanical Society of America, Inc.

VOLUME 2 JULY, 1956 NUMBER 3

Time For Another Look: A Point of View

GEORGE S. AVERY, JR.
Brooklyn Botanic Garden

When young in botanical teaching, I used to pride myself in not knowing plants. In an occasional talk before a horticultural group or a garden club, I would be asked about this plant or that. Could I tell someone how to grow a particular garden gem? Or—could I identify a twig or leaf someone had brought in? Of course I couldn't. Mine was the scientific end. I could speak learnedly of plant growth and development and the "why" of things (I thought). But identify or know how to grow a plant? Or how to control a few common plant pests and diseases? No, this was not for me. Mine was an age of experimental science, and I was determined to be part of it. To know plants, particularly cultivated varieties, was for the amateurs, garden clubbers and the like. Unfortunately, I was not alone, and judging from conversations with many younger (and older!) colleagues in the botanical field, the same view is still commonly held. For decades a feeling of aversion for cultivated plants has pervaded the botanical atmosphere. We botanists seem to have abdicated to others any common knowledge of every-day useful plants, while we knock about in the upper levels of the botanical atmosphere. Just how sound is this from the standpoint of either student or teacher?

Registration in the colleges and universities, as a whole, is several fold greater than it was 25 short years ago. Yet while this growth has occurred, registration in botany courses has generally dwindled, or at best, little more than held its own. Biology courses have sprung into seeming popularity but this apparent success is misleading insofar as the emphasis on botany is concerned. Is something the matter, or is it just the era we are living in?

While we have been little more than holding our own with numbers of students, we might take a look at a purely volunteer movement that scarcely existed 25 years ago—the garden clubs. Today there are a half-million members, a significant percentage of them men. We as botanists have neither taken advantage of this enthusiastic movement, nor have we contributed to it. Some people hold the view that the feminine contingent of garden clubbers is held together by tea parties. This may be partly true. I don't decry it, for we have tea at our seminars. Most people in the garden club movement are learning about plants, how to grow them, and how to landscape their homes and dress up their towns with ornamental plants. In how many introductory botany courses—the ones that too few students take—are students even *alerted* to the world of ornamental plants, much less what can be done with them at the home and community level.

A well-known automobile manufacturer used to advertise, "There's a Ford in Your Future." My view is that there are plants in most people's futures, but we botanists as a rule are not helping people get ready for the plants ahead, much less the years ahead.

Take a quick look at contemporary culture in America. We have an industrial society, with increasing leisure for everyone. Technical know-how has been in a sharp uptrend for a long time. Indeed, mental capital has been growing on a broad front. We are living in a surprisingly enlightened do-it-yourself era, which can be enjoyed at all levels of talent from the not-so-bright on up to the gifted. Aside from gadgetry, gardening is the universal interest of a great number of people. Why can't we give more of the one-course botany students some botany with a horticultural slant? Why shouldn't they know fifty or a hundred ornamental plants and how to grow them? This would serve well as a starting point for many who wish to satisfy their creative urge by growing plants. Courses in art and music appreciation have prospered. There are Sunday painters and amateur musicians whose original interest was stirred by the one appreciation course that came their way. Why not a course in the appreciation and culture of a hundred kinds of great ornamental plants—that have come from the Alps, the Himalayas or the Atlas Mountains, from China, Tibet, or the Eastern Mediterranean region. Or from Canada and the U. S. A.! Students who become familiar with these will remember them and find pleasure in new discoveries as life goes along—for there are many treasures in the world of ornamental plants. We might even enjoy learning a few ourselves!

* * * *

Handbooks for use in botany courses—where there is an accent on horticulture.

For teachers who may not have made the discovery, the Brooklyn Botanic Garden publisihes at low cost (as a public service) a quarterly called *Plants & Gardens*. Three of the four yearly issues are on special subjects such as soils, flowering trees, flowering shrubs, pruning, hormone control of growth, etc., and these are especially reprinted as 64- to 112-page paper bound HANDBOOKS. They are profusely illustrated, printed on book paper, and are being effectively used in many botany courses by teachers who feel that students should have access to horticultural apsects of the subject. A postcard addressed to the Garden at 1000 Washington Avenue, Brooklyn 25, will bring a list of the handbooks available.

Plant Science Bulletin

HARRY J. FULLER, Editor
203 Nat. Hist. Bldg., University of Illinois
Urbana, Illinois

Guest Editor of this issue: GEORGE S. AVERY, JR.

EDITORIAL BOARD

George S. Avery, Jr.	Brooklyn Botanic Garden
Harlan P. Banks	Cornell University
Harriet Creighton	Wellesley College
Sydney S. Greenfield	Rutgers University
Paul B. Sears	Yale University

JULY, 1956 • VOLUME 2, NO. 3

THIS ISSUE

Editorial

Much of this issue is devoted to the teaching of botany, and to an interesting appraisal of us-who-teach-it. The subject is of vital and continuing interest to most of us.

One hundred years ago botany courses, natural history, or whatever, were chiefly of taxonomic content. A large proportion of the population lived in what we now call "the country." In that different America it was a daily experience for people to see and know wild plants. Today by far the most of us live in cities or suburbs, and the old approach has become inadequate.

Over the century the development of subject matter in botany courses has naturally paralleled scientific advances in the field. Course content has been built up that is important to us botanists, but how does it apply to the life of urban laymen? What are we giving them? What real guidance does the college catalog offer? The textbook? How can most students know that we as teachers can help open the door to a life-enriching experience? Or can we? We speak grandly of "world view." Superb! Let's continue. But what of our homes and the communities we live in? What are our longer term objectives? What basic botanical subject matter, ideas or inspiration do we want students to hold on to that will make future life more rewarding? What can we give them that they can *do something about* in later life, something related to their homes, their children and their communities. Mightn't we reasonably set up a goal of know-how that would be useful to alumni perhaps 5, 10, or 20 years after college?

In the America of today and the growing ever-changing America of the future, botany faces a challenge. Whether we can meet it, or are to continue along the old traditional paths that may lead to extinction—is the question. The articles in this issue suggest that many teachers are thinking about ways of meeting the challenge. But words alone are not enough, no matter how dynamic and thought-provoking they may be. We need a program that will make general botany courses a more central and vital part of the undergraduate curriculum.

How to Get More Students into Science

E. M. HILDEBRAND

Today proportionately few students are interested in courses in science in the lower schools. One ultimate result: there are fewer science teachers, and fewer people going into scientific careers. The shortage of teachers of science leaves no one to encourage and help develop students with science potential. This has led, in turn, to innumerable comments in the daily press, with all sorts of remedies being suggested. For getting a quick increase in numbers of students going into scientific fields, one bold commentator advocates . . . "force the student to become an engineer or scientist."

It is my view that neither force nor persuasion are necessary to recruit future teachers in science.

The general public is becoming aware of the plight (or is it a blight") that the professional education people have imposed on the curriculums of our elementary and secondary schools. In truth, courses in the lower schools have been gradually emasculated of the basic cultural units of scholarship, including science and the arts. Today's children in many elementary and secondary schools are to a considerable extent prevented from doing basic work in English, mathematics and science. This deficiency discourages them from electing science in high school because it is "too hard."

A generous share of the blame rests with those responsible for teacher-training courses. In general, teacher-training curricula are overloaded with courses in methods and are deficient in courses with substance. Such science curricula for education majors provide a year's course (6 hours credit) in the life sciences (zoology and botany). These freshman life science courses are usually taught as pre-professional, basically technical science courses with no practical or interest-getting features. Hence, the inadequate preparation of grade school teachers—even if they happen to possess a scientific bent. The same observation is largely true for other non-science majors in colleges and universities. It has been too widely assumed that science majors do not need anything practical, anything they can use later as parents and citizens. It is unfortunate that the conventional approach of college instructors in the life sciences today is pre-professional and technical, with a minimum of practical interpretation and almost no interest-getting qualities.

Technically, natural science is a tremendous field;

practically, it is as simple as a house plant or flower bed. The wise teacher knows he must study nature with his students, and in that part of the curriculum set aside for science.

For those who seriously want to stimulate the flow of students into scientific fields, here is a suggestion. Help teachers of elementary and high schools seek summer schools with one question uppermost in their minds: Where can I get a course in natural science which has a practical and interest-getting slant? In the whole country there must be at least a few such courses. Schools which develop such courses will do more than anything else at this juncture to solve the problem of interesting more students in science. The well-trained teacher will take ideas back home and put them to work successfully. If the teacher-training planners will take their cue from such examples, the future will almost certainly produce its needed share of science personnel. Inspired and properly trained teachers with a soundly thought out curriculum do not need newspaper-article-counsel to help youths find their way into scientific careers. The point is that the groundwork must be laid chiefly in elementary schools. High schools cannot be quite as effective. The college years are definitely too late.

Research and the Teacher of General Botany

VICTOR A. GREULACH
University of North Carolina

There is some belief that a close correlation exists between research ability and activity, and excellence as a teacher of general botany. In my view, this is an opinion with little or no evidence to support it. An alternative opinion—that there is no correlation between the two, appears to be at least equally tenable. To insist that any good teacher of general botany must also be an active investigator is equivalent, I think, to insisting that any good musician must also be a composer.

For the discussion presented here, teachers are classified into four intergrading groups, with, of course, intragroup variations:

	can	*can't*
do	1	3
don't	2	4

Groups 1 and 2 consist of individuals who have the abilities and personality traits which make for a good teacher of introductory courses, the difference being that the group 2 teachers do a little more than the minimum work necessary to keep the course going. While this may be due to laziness it is perhaps more likely to be due to excessive obligations of other types: too many other courses, too much committee work or administrative duties, too much time devoted to scientific societies, or too much time devoted to research. By working hard on his course, a group 3 teacher may to a large extent make up for his personal deficiencies. Both group 2 and group 3 teachers may give quite well-taught courses, and we must rely on them since there are not enough group 1 teachers to go around. The group 4 teachers are, of course, the really poor ones. They may have considerable ability in other lines but are out of place as teachers of introductory courses. Departmental associates and administrators should take all possible steps to help group 2 teachers upgrade themselves to group 1, and group 4 to group 3. Unfortunately, some individuals slip in the reverse direction, and some—through no fault of their own—simply do not have the type of personality that is part of a good teacher.

Research workers might be classified in a similar fashion with the four groups labeled, however, a, b, c, and d. The group (a) investigators are responsible for the major research contributions, while the equally capable group (b) investigators for some reason or another contribute rarely if at all. The group (c) individuals lack the abilities required for effective research and probably realize it, but due to internal or external pressures continue to flood editors with manuscripts which are at best mediocre. Unlike the group 4 teachers, the group (d) individuals are to be commended for not attempting the impossible.

If there is, indeed, no correlation between teaching and research abilities and activities, then there are—as set forth here, some 16 classes of individuals as regards abilities and activities in both teaching and research. (1a, 1b, 1c, 1d, 2a, etc.) Space does not permit analysis of each group, but the reader will easily do this for himself. If, in the process he is able to recognize even one individual he knows who falls in each of the 16 classes, the validity of the no-correlation hypothesis should receive a boost. While any department head might prefer to staff his department entirely with class 1a individuals, any group 1 teacher should be equally acceptable as far as teaching the general course is concerned.

Perhaps the most important point is that every effort should be made by departmental and other administrators to give staff members assignments in line with their abilities. For example, class 1c and 1d individuals should be associated with the introductory course, or at least with undergraduate teaching, while class 3a or 4a indivduals definitely belong in a research laboratory, or at least in graduate courses (if one is willing to concede that teachers of graduate students do not need the vital spark). The group 2c and 3b individuals should be encouraged to drop activities in which their abilities are limited and advance to groups 1d and 4a, respectively.

The group 4d individuals, who may be quite intelligent and possess quite marked abilities along other lines,

[1] Based on a presentation at the meeting of the Teaching Section of the Botanical Society of America, East Lansing, Michigan, September 7, 1955.

are obviously in the wrong occupation. The fortunate ones are those who discovered this soon enough (or were discharged early enough) to get into a more suitable line of work. Unfortunately, some such individuals have held on beyond the point of no return. Such misfits need not represent a total loss to a department. They may have considerable interest and ability in some of the more peripheral departmental or institutional activities such as various maintenance operations, committee work, or even administrative work. If so, the burden of such tasks might well be placed upon them, relieving those staff members who have more marked abilities as teachers or investigators.

The principal reasons given by those who insist that research activity is essential for superior teaching of introductory courses are that it keeps the teacher from becoming stale and that it keeps him abreast of current developments. The first is a better reason than the second, for as a research worker he is keeping up with a limited field which probably receives little or no attention in the general course. There are other, and perhaps often better, ways of achieving these worthy aims.

One which is likely to be more valuable to the teacher than a comparable amount of time devoted to research, and which is the sort of thing that would help the teacher advance from group 2 to group 1, is the extensive reading of books, review articles, abstracts, and a few outstanding papers relating to all phases of the general course. A logical extension of such reading activity would be of service as a communications link between research scientists and students and the general public through the writing of textbooks, review papers for other teachers of general courses, popular books and articles, or by participation in radio and television programs. The teacher of the introductory course is in a particularly favorable position for such service. Of course, the question of abilities (and probably different ones than those required for either teaching or research) again enters the picture.

Other things which can help to keep the teacher and his course alive are regular attendance at scientific meetings, continuing interest and effort in improving the objectives, methods, and testing program of the course, and research in science teaching. Through such activities a teacher can help raise himself from group 2 to group 1.

Teaching a general course with maximum effectiveness can be a full-time job in itself, a job which can be stimulating and rewarding. There is always a need for more teachers who are willing to devote their full efforts to good teaching at the introductory level, or at least to undergraduate teaching. However, as long as research productivity is the principal criterion involved in advancement it will continue to be difficult to find people willing to center their efforts on the general course.

The validity of the ideas presented here depends in part on the assumption that the talents, abilities and personality traits making for a good teacher or a good investigator are basically hereditary, or at least determined by early environmental factors, and so are not developable by any amount of effort during college days or later. The assumption is also made that such talents may be quite distinct from intelligence as usually understood, although better than average intelligence and a degree of judgment are certainly prerequisites in the complex of required talents for either teaching or research. In short, while any teacher may be able to provide students with the needed information, techniques, and attitudes, we can never be really good teachers and investigators without the essential native talents, just as an untalented music student can never be made into a really good musician or composer.

The significance of the points discussed here appears to be great enough to warrant more extensive studies, studies that might lead to the subsequent development of more valid and reliable techniques for locating, training and using most effectively the best available talent for both research and teaching.

Doorstep Botany

R. W. SCHERY
Scotts, Marysville, O.

Cornell's E. L. Palmer has argued eloquently that teachers should take notice of and analyze and instruct from the everyday surroundings of school grounds and campus. Most of us who have taught botany at the university level have gone little beyond trees and other woody campus plantings.

Every student has a speaking acquaintance with lawns, a familiarity providing common ground for classroom discussion. Yet this ecological laboratory at everyone's doorstep is often overlooked. The ebb and flow of species dominance, the rhythm of the seasons and interplay of events, are often less obscured by subtle side influences here than in so-called natural habitats. Consideration of the "universal" lawn community can lead in almost any direction to biologic principles. It is sufficiently refined as an ecologic system to underscore relationships, and sufficiently responsive that months rather than years suffice to illustrate cause and effect.

Why go long distances to point out simple ecological situations, unless it be for the pleasure of the trip? Although advanced students and professional researchers will make special efforts that call for miles of travel and some expense, to reach isolated habitats where the impact of man has been little felt, this is beyond practicality for large elementary groups.

But man is increasingly a part of the scene; and ecological principles, if applicable in the majestic solitudes, are equally applicable in the prosaic near-at-hand—wherever living things react to environment.

It seems to me that an invaluable teaching aid is by-passed, if students are lectured and laboratoried, instructed with drawings, texts, isolated or preserved specimens, while the dynamic system that is the lawn just outside the door is ignored. Though classes can seldom get to the wilderness, the same vital responses that one finds in natural areas (competition for space, light, and preferred habitat) can be "discovered" in the lawn. The lawn is a microcosm of sorts. With a few leading clues, skill in assignments, and a simple schooling in plant identification, even rank beginners sense and then come to appreciate the universal interplay of species and environment.

In recent years I have looked at lawns (and certain lawn grasses) in many parts of the country. These inspections have raised more questions than have been answered. The commercial importance of lawn grasses has focused attention on them and voluminous publications exist. I find we know much of the "how," but reasonably little of the "why."

The latter would seem the more fundamental educational desideratum, but its exploration is achieved only when the lawn is regarded as a dynamic system, not as a specialized crop on extremely expensive cropland. The beginner has as much chance to learn here as has the "expert" with channelized thinking. The excitement of discovery lurks in the nearby grass and weeds. Perhaps a few browse-point suggestions will stimulate further ideas:

Species composition and density: under high vs. low cut (as fairway vs. rough on golf course); south vs. north slope; tree shade vs. sun; slope vs. level; fertilized vs. unfed; edges vs. continuous sod; over buried pipes or other disturbances vs. usual soil; clippings left vs. clippings removed; etc.

Species behavior seasonally: rhizoming vs. tillering related to season; low vs. upright seasonal growth (photoperiod and temperature response); summer fadeout from forcing and exhaustion of food reserves (timing of watering, fertilizing, etc.); first appearance and growth progress (as crabgrass relationship to temperature and light); reasons for certain weeds in certain places; stimulus for flowering (for example, bluegrass inflorescence in June is determined about Christmas before); threshold values for grass or weed germination, greening, flowering, etc.; root growth vs. topgrowth; morphologic difference of seeding vs. vegetative shoot; etc.

Competition between species or strains: apparent antibiotic effect of certain species and compatibility of others (as ryegrass antagonism in critical environments); adaptability and eventual dominance of certain races or phenotypes; soil building and interplay (clover disappearance under high fertility); tree root competition; annual vs. perennial "way of life"; self-elimination (matting and smothering); etc.

Adaptation: how certain species exhibit flexibility in adapting to the (artificially) close-mown lawn, while others fail; seeding mechanisms of annuals *(Poa annua,* crabgrass, goosegrass, carpetweed, knotweed, etc.), and vegetative perpetuation of perennials (stolons, rhizomes, prostrate growth); success of asexual reproduction compared to sexual; apomixis, cleistogamy.

For travelers and vacationers: where and why certain species flourish or peter out (bermuda-bluegrass boundary; southern and northern limits of onion or other weeds; crabgrass, bermuda, Zoysia, dallis grass "belts" and "kingdoms"); regional climatic studies (middle latitudes have superimposed diurnal and seasonal temperature maxima, making summer—for the grass—hotter than it appears); etc.

Micro-environment studies: cooling effect of turf, temperature differences at soil depths and above-ground heights; leaf blanket and the sod; frost action; earthworm activity; humidification; root response to insulation (clippings, height of mowing, etc.).

Exploring these or similar avenues relates theory to reality, sets no bounds to exploration. Any avenue could lead to advanced work in physiology, genetics, anatomy, ecology, and so on—or could terminate with just a simple but better understanding of the living world that is a part of everyday life.

There might even be practical carry-over into adulthood, making the task of lawn-tending lighter, or at least understandable. Perhaps here's a facet of botany that will "stick," after credits have been achieved, diploma filed, and terminology forgotten.

Applied Botany in Liberal Arts Colleges

J. FISHER STANFIELD
Miami University

Horticultural pursuits represent the greatest recreational activity in America. With millions of dollars spent in this fashion each year, it is amazing that more time is not devoted to this facet of Plant Science in the average college curriculum. For many years I have been interested in this aspect of the subject and have developed a one-semester, non-prerequisite course designed to meet the needs of the average student who wants and/or needs to know something of value economically and æsthetically in regard to plant life. Millions of homes are being erected each year and yet the average person knows nothing about the simplest approach to the planning and planting of the home grounds. It was the aim in developing this course to offer suggestive rather than elaborate material. It would be futile to teach the taxonomy of the forms used but it is surprising what can be done with slides, illustrations, and a few observational walks. Information thus obtained is shown to be worth much in the life of the individual as well as providing recreation-potential for those so minded. A running account of the course is offered here and details will be included in a syllabus to be prepared later.

Each course would be different since it would depend upon the interest and training of the instructor; far too many botanists know little of plants utilized in the garden and landscape and are also deficient in the simple practicalities of plant propagation. It takes some effort to build a course, but local materials are usually ample for illustrative purposes. One opens doors and natural curiosity and appreciation carries the student as needs dictate.

With the usual introduction outlining the aims and approach, one moves quickly into a few basic ideas. A film may show the work of the plant as an entity and its reaction to environmental factors. There is also included here a short discussion of the principles of taxonomy, or the naming of plants, to remove the odium of this part of Plant Science and bring some rudimentary understanding of the meaning of a scientific name. Any gardener should know this and a homeowner would be lost without some appreciation of it. The use of the genus name as a common name is stressed since it is often used in this way; examples are given and this procedure has worked out satisfactorily for students with no training whatsoever in biological science.

At this time there is also introduced a simple treatment of reproduction in plants, something which is omitted in the usual garden book. A film or two aid in this sequence to show pollination and the development of new varieties; hybrid seeds are explained and the work of the flower in general. This is followed by a discussion of propagation of plants since this is so common a practice in gardening; examples are presented of the various plant parts used and costs, seasonal availability, and storage are discussed. Budding and grafting are introduced and one may well include an exercise on bench grafting; the writer has had 80% success in this exercise; it requires considerable preparation and time but is worth it. These grafted trees (usually flowering crabs) are available to the students in May; the grafting is done in January or February since this is a second-semester course.

Some knowledge of soils and fertilizers is most basic in gardening because the entire procedure is futile if the grower knows nothing of simple principles. While soil structure is discussed, much emphasis is placed on humus and the development of the humus content. Commercial types of fertilizer are introduced, including rate of application and the utilization of the three basic fertilizer elements. Hydroponics is touched on, with the essential elements and some demonstrations. General comments on soil preparation also enter the picture.

A natural development from this approach is a study of lawns, types of grasses suitable for various situations and general elementary know-how in lawn making and keeping. A unit intercalated here deals with shade plants and shady situations. There is also some reference to terraces and a list of plants for both habitats is given for the records kept by the students.

Trees are the next sequence and this involves a discussion of the place of trees in the landscaping plan. These data are in various books on the subject. Points in the selection of trees are stressed, and common trees are discussed with good and bad points. Quite often catalogues are purchased and passed out to the students since they cannot procure them easily with dormitory addresses; most companies are cooperative and the cost is not prohibitive. At this point a discussion of the different commonly planted evergreens is injected, with demonstrations; students learn the major groups.

A discussion of factors in the selection of a site or a lot may be brought in at this point—a very realistic presentation. The cost of lots and landscape plantings is brought out for various localities.

A discussion of shrubs in the landscaping plan follows, with a treatment of fundamental principles of foundation planting. Various sources and materials may be utilized here as the background of the instructor permits. It is frequently advantageous to ask a trained landscape architect to speak to the class at this point—as availability and funds permit. This is one of the more difficult units and requires much study by the average instructor; it grows with time. Various plans are given out for completion by the students with all factors considered. These are criticized and discussed.

Perennials may be discussed with slides to illustrate the plants. In this part of the course, sequence of flowering is stressed and outlines of beds may be used for filling in. Reference to catalogues helps here and some few plants are learned.

A film on annuals and gardens plus a listing of plants to start in June finishes the semester if time permits. At least the student knows the types of plants and how they are used. A collection of colored slides is at hand for use as needed.

For presentation, as may have been gathered from the foregoing, the course is divided into general units the development of which is definitely subjective. There is no text as such and a laboratory fee of three dollars is charged. Routine use is made of the library reserve shelf, as well as popular magazines, mimeographed material, and various bulletins that are accumulated as the opportunity offers (many companies are glad to send the requisite number on request). Motion pictures are available from various sources and the current guides to free films is an excellent place to begin. "Stenofax" stencils take care of any elaborate plans and they last indefinitely; this approach is useful in the preparation of landscaping materials. The instructor makes his own colored slides for general use in each unit (the 3¼ x 4 slides have been found more useful for many presentations). Hundreds of Kodachromes accumulated over a period of years, often make it possible to show the same property in a developmental sequence as growth proceeds; seasonal change pictures are also of value. Various demonstration materials may be used as facilities dictate; there is no stereotyped pattern. For example, a simple exhibit of flowering shrubs in May in sequence of flowering is always of interest.

This barest of outlines will serve to illustrate the potentialities of such a course; it might well be richened to cover two semesters and be quite effective. Ten years have demonstrated the effectiveness of this offering as an elective to complete non-laboratory science requirements. In open competition it has stood the test. The title of Economic Botany has been used with a mention of plants in relation to the home. The general approach is useful for extension courses and also adult education. It is not an easy course to teach since a rich general background, versatility, wide interests, and enthusiasm are necessary requisites. It is amazing how much useful and practical data may be included in three semester hours of work presented to non-majors.

Some Thoughts on General Botany Courses. Another Way to Judge Their Content

BETTY F. THOMSON
Connecticut College

In my desk drawer I keep a folder into which go miscellaneous bits of paper bearing notations of "Shocking sayings of colleagues," or "What intelligent people should know about plants and don't." The purpose of the collection is to keep me in focus on the things that a student ought to learn from a general botany course, considering it as either a course about plants or, more generally, a course about science. It points out clearly that somewhere in these highly educated people's pasts someone has failed to teach them the most fundamental facts of life in the plant world. For example, almost every year along in March, someone says, "Spring is on the way because look: the trees have buds on them now." Another one says in complete incredulity, "But you *can't* make cuttings from *tomatoes*, can you?" They all go on planting trees and shrubs too close together and setting out potential forest giants directly under the telephone wire. They succumb to the organic gardening mania ("chemical fertilizers are poisonous to plants and humans") or wonder why their seedlings planted in pure vermiculite stop growing. These are matters of fact that one may perhaps be forgiven for not knowing. But think how many conversations you have had with even bright people that show a complete ignorance of what it means to draw valid conclusions from limited evidence, or even of the necessity of evidence as a check on the exercise of pure deductive reasoning from generalizations that are shaky to begin with.

Cogitating on these notes has led me to certain conclusions about what ought to be included in a general botany course, or in the general biology that includes or supplants it, to warrant its place in the required curriculum. For this purpose botany or biology should make a solid contribution to a student's world view, become a part of his lifetime equipment for thinking intelligently about things that may be far removed from the precise subject matter of a beginning botany course. It seems to me that the contributions such a course can make fall into several categories:

The nature of science. What it is and how it operates.

Somewhere along the line there should be an explicit consideration of the basic assumptions of science, and even of the fact that the scientific world *does* make assumptions. For example, we rarely stop to state our beliefs that natural phenomena have natural causes, and that the natural world is orderly and is amenable to being comprehended by man.

The Scientific Method usually gets some attention, if only lip service. We describe the cycle of observation, inference, experiment, inference, hypothesis, experiment, etc. But then we drop the subject and spend our time on a careful exposition of the current conclusions of science. Without going to the extreme of the historical case study method, we could place much more emphasis on the *evidence* for our conclusions, *why* we believe what we do, and make it clear that conclusions are always tentative, no matter how inescapable they may seem at the time. We should also be sure to make clear what is meant by a "natural law."

Another means of conveying the true nature of experimental science would be to devise more laboratory experiments that ask questions to which the student has no preconceived answers. Still better, of course, are genuine research projects where the answer is not known. This can absorb endless quantities of time, energy, ingenuity, imagination, space and equipment if it is done in a thoroughgoing way. But even including a few distractors in the more usual kinds of class experiment can have a salutary and unsettling effect on the student who likes the security of the known and predictable. For example, in the old stand-by to show the role of chlorophyll in photosynthesis by using a variegated leaf, one can use a plant that contains anthocyanin and ask what role this pigment plays in the process; or in phototropism and geotropism experiments using oat coleoptiles, one can put hoods on the geotropic and well as the phototropic group. In both cases the student ordinarily has no idea what to expect and as a result has to look closely and with an open mind to see what actually happens.

One elementary but profitable thing we can do is to be sure that class exercises are formulated to "determine whether" rather than to "show that"—a point of view that could well carry over into many other kinds of investigation! Every researcher in pure science has repeatedly found himself in a tight corner trying to explain briefly to non-scientist friends the "use" of what he is doing. An adequate course in any science ought to convey the nature of the relationship between pure research, leading to understanding, and technological development, leading to utilization.

Biological concepts that permeate non-scientific areas of our culture.

These might center around evolution and heredity, with a consideration of the complex nature of the interaction between heredity and environment. Such ideas may be encountered in almost any area of thought that concerns itself with man, and that includes all the social sciences and humanities.

Consequences of man's manipulation of the natural world.

Certainly everyone should have some understanding of the basically synthesizing nature of green plants, the necessary decompositional as well as synthetic activities of fungi, and the dependence of animals, with their relatively limited synthetic capacities, on the plant world. To think intelligently about conservation, in all the manifold ways that term is used, a responsible citizen should know what resources are renewable and what non-renewable, wherein they differ and why it matters. He should understand as concretely as possible the interactions of plants, animals and soil, and how much simpler and surer it is to work *with* rather than against nature.

Understanding and enjoyment of one's surroundings.

Certainly one of the marks of a civilized person is the capacity to see and enjoy the world around him. It is generally true that the more one knows of what he is looking at, the more he sees in it; and in turn, the more he sees, the greater his enjoyment, whether the subject is architecture and painting or old-field succession or ornamental plantings. Judging by the contents of textbooks, the field of ecology has at last got a foot in the door of most general botany courses. But ornamental plants are still stepchildren in most botany departments.

One kind of project that can at least sensitize students to the possibilities and acquaint them with some of the more familiar ornamentals is a simple end-of-the-year landscaping project. We do it by providing a mimeographed ground plan and simplified elevation views, drawn to scale, of one or two houses or buildings on which all existing plants are to be plotted, with their sizes, positions and identities. Then the effectiveness of the planting is evaluated and suggestions made for changes to improve it. The results are hardly masterpieces; but I am sure that the people who have done a reasonably careful job on this project will never again see a foundation planting as a green blur.

There is no subject in the spectrum of learning that offers greater possibilities than botany for opening this kind of window and serving as a point of departure for lifelong avocational pleasures; and we are foolish, if not irresponsible, to ignore such potential by-products of our subject.

As every successful teacher knows, there is more than one way to kill a cat. These thoughts are offered merely as a help toward deciding which cat it is that we want to kill.

Botany For Non-Botanists

BENEDICT A. HALL
State University Teachers College, Cortland, New York

Most of us who teach elementary botany know that few of our students will ever become professional botanists. This fact should lead us to reassess our teaching in terms of its contribution to the education of non-botanists.

Much of the value of a botany course, to the general student, lies in its broad concepts. Such concepts draw botany out of the pigeonholes into which so much of our teaching retreats and help integrate it into the student's world view. Here are a few such concepts.

1) *The unity of the world, and man's place in it.* Despite his unique characteristics, man is an animal, not sharply separated from the rest of the animal kingdom. Likewise, the similarities between plants and animals are more fundamental than the differences, although the differences are more readily apparent. Few people realize how much men and plants have in common, in cellular structure, for example, or reproductive mechanisms. This unity extends even further, bridging the apparent gap between the living and inanimate worlds, since the same physical processes underly both.

2) *The continuity of the living world.* The living world is continuous within itself, as well as with the inanimate environment. There is genetical continuity between cells, between organisms and, through evolution, between species. The living world is part of a universe of everlasting change, in which the basic reality is *process*, not immutable absolutes.

3) *The relative importance of organism and environment.* Arguments on this subject are usually endless and often meaningless. The organism and environment are as inseparable as the two faces of a coin. The phenomena that we call Life consist in large part of interactions between organism and environment.

4) *The predominance of interdependence over independence in the living world.* No organism lives to itself alone: each is dependent in various ways upon other organisms and upon the non-living environment. Knowledge of man's place in this scheme of interdependence is essential to an understanding of many problems of conservation and of human sociology.

5) *The role of energy.* Energy changes play the same basic part in life processes as they do in other physical and chemical processes. The study of life processes in terms of the energy changes they involve lends coherence to these processes and illustrates their relation to inorganic processes.

6) *The nature of science.* Botany can contribute to the student's understanding of science as a major human activity. The teacher should propagandize against popular misconceptions of science. The student should be shown how the diverse scientific specialties are becoming synthesized into an increasingly coherent world view, science thus replacing in our minds a monstrous, chaotic world with an intelligible, orderly one.

We succeed better in presenting science to our students as a body of information than as a method of obtaining knowledge. Our students need less second-hand scientific information, and more direct experience in observing and thinking scientifically. They must be encouraged to practice scientific methods, not merely be told about them. They need to experience the creative aspects of science. This calls for imagination at its highest levels as well as precise logic and undeviating conformity with the facts of experience.

We distinguish for convenience between the sciences and the humanities. Yet in a real sense botany, like the other sciences, *is* a humanity: a product of human needs and human effort; an enterprise highly individual yet at the same time vastly cooperative. Botany, like other sciences, has weighty social implications.

The foregoing concepts cannot be restricted to definite places in a course outline, but ought to be referred to repeatedly when the subject matter under consideration illustrates them. Thus, for example, in dealing with reproduction in plants, one could illustrate the far-reaching unity of the living world by stressing the striking similarities between sexual reproduction in plants and man. Instead of supplying the chapter headings of a botany course, then, these concepts should serve rather as unifying threads woven through the entire course, binding it together into a coherent whole.

There are less tangible values in botany, none the less valuable because they are difficult to measure. These consist largely of attitudes that are better communicated by the teacher's example than by precept. They are what might be called the "overtones" of a good botany course. One of them is the heightened awareness of what a well-known writer has called "the wonder of the world." This awareness involves both intellectual comprehension and an appreciation of the beauty that is so conspicuous an aspect of the plant world. Another such attitude is enthusiasm, a contagious virus that can be transmitted to students only by a teacher who is infected with it himself. Certain scientific attitudes, such as intellectual integrity, are also best communicated by the teacher's good example: by his readiness to say, "I don't know," or the patience and objectivity with which he meets questions and objections.

Admittedly, it is easier to formulate a list of such concepts and values than to establish them in the minds of students. Yet a teacher will fail to get them across unless he himself has them clearly in mind as goals to aim toward.

SPECIMENS, SEEDS NEEDED

William Easterly needs flower buds, pressed specimens, and seeds of any of the 6 species of *Ptilimnium* for a morphological study. He will pay for the material on delivery. Write him for details at the Department of Biology, West Virginia University, Morgantown.

Messrs. Shutts and Wilson of the Botany Dept., Indiana University, seek the following:

For Thomas K. Wilson: Viable seeds, samples of mature wood, and preserved flowers of any of the species of the Canellaceae.

For C. F. Shutts: Viable seeds of any of the species of the Lauraceae (except avocado and sassafras), and the Hernandiaceae.

If anyone has these materials available, but finds them difficult to ship because of prohibitive cost, lack of preservative, regulations, etc., please contact Messrs. Shutts and Wilson.

WANTED

Dr. Jack McCormick of the American Museum of Natural History, New York 24, N. Y., is compiling a list of published bibliographies on all phases of botany. Will anyone contact him who may have titles of bibliographies to add to this list.

J. S. Bubar, W. F. Grant, and E. O. Callen of the Depts. of Agronomy, Genetics, and Plant Pathology, respectively, of Macdonald College of McGill University, are compiling and extending information on the taxonomy, cytology, genetics, geographical distribution and ecology of European and American species of the genus *Lotus* (Birdsfoot Trefoil and Deervetch). If anyone can collect seed or has any information they wish to contribute to this project, they are invited to write to any of the above at Macdonald College, Prov. Quebec, Canada.

PERSONAL

Paul R. Burkholder goes on July 1st to his new post of Director of Research at the Brooklyn Botanic Garden.

Frederik Børgesen, eminent Danish phycologist and a Corresponding Member of the Bot. Soc. died on March 22, 1956. Born in Copenhagen January 1, 1866, Børgesen received a Dr. phil. degree at the University in 1904. His major professional post was that of Librarian of the Botanical Garden Library, 1900-1935. Of independent means he traveled extensively. During his exceedingly long and productive career (he published to the end!), he established himself as an authority on the marine algae of the Faeroes, the Danish West Indies, the Canary Islands, Ceylon, India, and Mauritius. During his early years he also worked on fresh-water algae.

Elmer D. Merrill, emeritus director of the Arnold Arboretum, and earlier of the N. Y. Botanical Garden, died February 25, 1956. The latter institution is raising a memorial fund to bear his name.

Howard E. Pulling, who taught plant physiology at Wellesley from 1919 to his retirement in 1952, died April 25, 1956.

Edmund W. Sinnott, Graduate Dean at Yale, president of Bot. Soc. in 1937, former Editor of Amer. Jour. Bot., president of AAAS in 1948, etc., will retire from his post at Yale on June 30, 1956. Members of Bot. Soc., grateful to him for his active interest in and work for the Society, wish him a long and happy period of retirement.

James Small, Professor of Botany, Queen's University of Belfast, Belfast, North Ireland, died in late November, 1955.

MEMBERSHIP COMMITTEE

Let's get the membership of the Society up to 2000 for the beginning of our 51st year. We gain members, we lose members, and we stay at about 1900. The present make-up of the Membership Committee is listed below. From any one of its members or from the Secretary of the Society you can get application blanks to supplement your personal membership-invitation to fellow botanists.

C. Ritchie Bell
Richard K. Benjamin
Harold C. Bold
Charles Heimsch
Theodore T. Kozlowski
Elsie Quarterman
Lora M. Shields
John A. Schmitt, Jr.
William L. Stern,
Chairman

SUMMER INSTITUTES

As this issue of the PLANT SCIENCE BULLETIN comes from the press, the Summer Institute of Botany for College Teachers will be under way at Cornell (July 2-August 11).

Guest lecturers include: Herbert L. Mason, Plant Geography; Ernest C. Abbe, Anatomy of Primary Body; Robert E. Emerson, Photosynthesis; David R. Goddard, Respiration; Robert Bandurski, Nitrogen Metabolism; Gilbert M. Smith, The Algae; D. S. Van Fleet, Histochemical Approach to Anatomy; Arthur Galston, Light Effects; Harold Bold, The Algae, and Non Vascular Cryptogams; Ernest M. Gifford, Jr., Comparative Studies of Shoot Apices; Kenneth Thimann, Growth; Ernest Ball, Application of Surgical Techniques in Anatomy.

Harlan P. Banks is Director of the Institute.

The University of Michigan will hold its Seventh Annual Summer Session Biological Symposium, July 9-20, 1956. The theme of this year's Symposium is MODERN APPROACHES TO SYSTEMATIC BIOLOGY. The program is as follows: July 9-11, Alfred A. Emerson, University of Chicago, on the overall picture of modern approaches to systematics; July 11-13, R. D. Gibbs, McGill University, on the chemical approaches; July 16-18, Hampton L. Carson, Washington University, on the cytogenetic approaches; and July 18-20, David D. Keck, New York Botanical Garden, experimental studies on the nature of species.

All persons who are interested are welcome.

Dr. Warren H. Wagner, Jr. is Chairman of the Committee for the Symposium.

SUMMER INSTITUTES IN 1957

There is a good possibility that the National Science Foundation will be able to support more summer institutes for teachers next summer than it has this summer. The Foundation would like to receive plans from colleges and universities willing to undertake such programs. Institutions desiring to run programs for high school or for college teachers should submit proposals before September 1, 1956. From the Foundation can be obtained information needed for making the application. It is hoped that several botany departments, either alone or in conjunction with zoology departments, will make application for financial help in running a summer institute to help improve the teaching of plant science both in high schools and in colleges and universities. That there is a real and wide spread interest in attending such sessions is clear from the number of applications received by the Committee for the Institute run by the Botany Department at Cornell this summer for the Society.

NEW BOOKS

Darlington, C. D.—CHROMOSOME BOTANY. George Allen & Unwin Ltd., London.

Hylander, Clarence J.—THE WORLD OF PLANT LIFE. 2nd ed. Macmillan Co., New York.

Johnson, Willis H., R. A. Laubengayer and L. E. DeLanney—GENERAL BIOLOGY. Henry Holt and Co., New York.

Royal Horticultural Society—DICTIONARY OF GARDENING. 4 vols. 2nd ed. Oxford Univ. Press.

Thomas, Meirion—PLANT PHYSIOLOGY. 4th ed. rev. Philosophical Library, New York.

Weaver, J. E. and F. W. Albertson—GRASSLANDS OF THE GREAT PLAINS; THEIR NATURE AND USE. Johnsen Publishing Co., Lincoln, Nebraska.

MENDEL MUSEUM NOW AT ILLINOIS

The Univ. of Illinois has purchased the Mendel Museum located until recently at Mary Washington College. This museum was organized by the late Hugo Iltis, best known for his biography of Mendel, shortly after his arrival in the U. S. A. from Czechoslovakia whence he fled in 1939 because of his opposition to the Nazis. This museum contains Mendeliana which Iltis brought with him or later assembled as well as additions illustrating developments in genetics. Among some 160 different items in the museum is the large oil portrait of Mendel by J. O. Flatter. The true Mendel relics, unquestionably the most valuable part of the museum, include letters in his hand acknowledging the receipt of the questions for his examination in geology (1850), for his examination in physics (1850), and an order for several varieties of pear trees. There is also his sketch of a trellis, a collection of pear leaves on which Mendel had written the varietal names, and a work book page on which data are entered. Iltis had assembled a more extensive collection of Mendeliana at the Brünn Museum which he first organized, but the fate of this collection remains unknown and it appears to have been lost or destroyed. It may be that, few though they are, the Mendeliana of the present collection include the only extant manuscripts in Mendel's hand.

It rarely happens that the foundation of a new scientific discipline comes from the work of a single individual but it is undoubtedly true that Mendel's discovery in 1865 of the laws of inheritance marked the birth of a new science. Ignored and misunderstood, his epochal work was forgotten until his principles were rediscovered in 1900 and by then most of his scientific records had been discarded.

Future Textbook Writers Please Note

HARRIET B. CREIGHTON
Wellesley College

There have been and now are some admirable textbooks in the botanical field. I continue to enjoy using some of them as teaching tools in general botany, even though many are heavy with terminology, are slanted almost entirely toward preprofessional students, and have changed surprisingly little in the past 50 years (except as new discoveries have added subject matter here and there).

Textbook concepts need re-thinking if we botanists are willing to concede that the world has changed around us. Our extra-marital union with the zoologists in giving courses in biology can't be said to have enriched student experience very much. It may have juggled subject matter, but has not appreciably affected our goals for students, nor how we are getting students to work toward those goals.

For a long time we seem to have relied on textbooks to point the way, yet in their very makeup they are little more than cyclopedias of fact. A student once referred to them as "a compass without a needle." Our teaching techniques should doubtless supply the "needle"—but what I want to say here applies not to teaching methods, but to textbooks.

First a point about the sins of omission in existing texts. Look back through their prefaces and discover that "fundamental principles" are almost invariably mentioned as something that will be set forth in the text. To the consternation of students, some of whom later become teachers, it is well nigh impossible to find clear statements of these principles in the text. Evidently, botanists (or biologists) have not succeeded in making them understandable, because faculty curriculum committees usually made up of people who have been exposed to biology in their college days, are insistent that in the "improved" courses they urge be given, the principles of botany (or biology) must be emphasized. In what both students and faculty say, two suggestions are implicit. First, principles should be labeled principles and discussed as such, and second, the meaning and the implication of these principles should be made more clear.

The fundamental principles or laws of biology are the statements of general truths about organisms, just as the principles of physics and chemistry are general statements about the behavior of energy and matter. A collection of all the biological principles would give us the epitome of our science!

Since there is such general insistence in curriculum discussions that biological principles be taught, one would expect to be able to find many concise expositions of them in texts. Such is not the case, as a perusal of introductory texts will make immediately evident. It seems strange that they are so buried in texts, even those using "Principles of . . ." as their titles. In fact, nowadays the beginning student would expect to find principles set up in bold-face type, the way new terms are set out in many texts to make them inescapable. Even in the summaries at the ends of chapters, statements of principles are hard to find. In a once much-discussed Harvard Report there is not even an example of a principle given in the paragraphs proposing "A course in the Principles of Biological Science."

Among the principles that should be set forth as "principles" in the texts-of-the-future, I humbly submit the following:* All organisms come from pre-existing organisms; all organisms grow; all organisms develop a characteristic form; all organisms have a characteristic life history; all organisms inherit certain potentialities from their progenitors and transmit certain potentialities to their descendants; all organisms have the possibility of sudden change in their hereditary potentialities; all organisms are sensitive to changes in their environment.

In addition to sharpening and shortening their presentation of principles, authors of future texts might well give attention to a second point—a comment that many students in general botany make year after year: "I wanted (or expected) something more practical." Textbooks can help us give it to them. Other articles in this issue of the P. S. B. present points of view relative to more practical subject matter that might profitably invade the minds of young authors-to-be.

In the future let us have texts that include both principles (a presentation of botanical science, as science), and practice (how to use it in everyday life). Such books students will keep and use throughout their lives. Isn't this a worthwhile aim? Textbooks in any subject that quickly find their way to the second-hand book shelf rarely achieve much influence in anyone's life.

Open Land Around the Campus

How to Get it, How to Use it.

RICHARD H. GOODWIN
Connecticut College

Everyone in the educational world is aware that rather serious shortages are developing in our educational facilities. Too frequently the problems confronting colleges and universities as a result of continuing growth, are of little concern to the faculties of these institutions, although their happy solution may be of the greatest importance.

One of the especially difficult phases of the expansion problem is "living space." Many older institutions have become hemmed in on all sides by city. In such instances the restful beauty of campuses has had to be sacrificed

* For more extended treatment, see *Survey of Biological Progress*, Vol. 1, pages 8-12. Academic Press, New York, 1949.

for space for new buildings, or adjoining real estate has had to be acquired at great expense and houses razed to make room for new buildings. The story of what has happened at Connecticut College may be worth recounting, if it can be of some use in shaping the future of campuses still in the making.

Connecticut College, founded in 1911, was originally situated on farm land at the northern edge of New London, a city today of some 35,000 inhabitants. In 1931 the College established an arboretum on a 65-acre portion of the original land holdings. The administration of the arboretum was placed in the hands of the botany department. An association was formed of lay groups and individuals interested in supporting and developing the arboretum, and a special advisory committee was also established.

It soon became evident to George Avery, then Director of the Arboretum, and to members of the Advisory Committee that the acquisition of additional land around the College was of the utmost importance to the development of the Arboretum as a community institution and to the preservation of the College setting. So in 1936 action was begun on the first of eleven separate land purchases, which have totalled about 215 acres. This property, all immediately adjacent to the College campus and adjoining it on three sides, was purchased with gifts large and small, from hundreds of public spirited persons and organizations. Total gifts exceed $50,000. A large share of this sum came from individuals who were not so much interested in the academic objectives of the College.

This land purchase program, carried out over a period of 20 years, was consummated in a nick of time. Within the past 10 years at least 65 new houses representing a capital investment of approximately $1,000,000 have been constructed on the immediate boundaries of the newly-acquired property. If one-half of the acreage acquired by the Arboretum had been thus developed, over 800 homes could have been built, raising the value of the property to at least $10,000,000. Obviously the acquisition of land after such a building development would be financially impossible.

The dividends accruing to the College and also to the community from the addition of this "undeveloped" land are scarcely to be measured by monetary standards. How can an auditor assess the aesthetic values of natural beauty, or the absence of a noisy and not always clean industry across the street? The Arboretum's acres are serving as a recreation ground for all sorts of people. Miles of bridle trails make a riding program possible for the students and local citizens. New London, like so many of our growing towns and cities, has neglected to develop an adequate park system. The Arboretum is serving a large part of the community in this capacity. Thousands of visitors find refreshment and inspiration in the peace and quiet of its walks each year.

One of the most unusual tracts which has been acquired is Mamacoke Island, a 40-acre rocky, wooded peninsula projecting into the Thames River and connected to the mainland by a salt marsh. The terms of the gift of this piece of land provide that the island be preserved in its natural state and that the College hold this property in trust for the enjoyment of future generations.

From an educational standpoint, there are living collections of plants and numerous wild habitats within a five-minute walk of the door of the laboratory that provide the natural scientist with a teaching tool which is often difficult of access in less fortunately situated colleges. One hundred acres of Arboretum have been set aside as a Natural Area— which includes woodland, ledges, bog, rovine, thicket and open field. Here various research projects have been initiated in which students are participating. Detailed mapping of permanent vegetation quadrats has been completed as the beginning of a long-range ecological investigation. Paleoecological studies of pollen profiles in the bogs and breeding bird censuses have also been undertaken. These projects, carried out by undergraduate students under faculty guidance, have stimulated strong interest in and understanding of basic research. Some of this work has been done during the summer months on a full-time basis, financed by research grants.

Elsewhere in the Arboretum other types of experiments are going forward on the effectiveness of herbicides in manipulating the native vegetation and on the establishment of special types of ecological communities which may be especially useful to man. For example, it may be possible by selective use of chemicals to establish stable shrub cover suitable for power-line rights-of-way, which will not only save the power companies maintenance expense but also provide better wild life cover.

While present Arboretum programs are naturally tied in with the work of the College, the future offers all sorts of possibilities for broader enterprises that can include popular education for the larger community. This gives an opportunity for College and community groups to work hand in hand, to their mutual advantage.

As conservation in all meanings of the word becomes increasingly urgent throughout the world, our educational istitutions must lead the way in taking constructive action. We can at least set worthwhile and down-to-earth examples. It is my hope, and that of many friends associated with the Arboretum, that what has been accomplished at Connecticut College may provide stimulus and encouragement to other institutions—or situations—where such development is still possible.

AMERICAN MIDLAND NATURALIST

The American Midland Naturalist (Arthur L. Schipper, Notre Dame, Editor) has recently announced certain changes in policy. Subscription rate will be advanced to $10 per year, and outside financial subsidy will be required for papers exceeding 20 pages, for tabular material in excess of two pages, and for illustrations the cost of which exceeds $10.