THE ARBORETA OF NORTHERN EUROPE

AND

THE STATUS OF INTRODUCTORY BOTANY IN THE LOWER DIVISION BIOLOGICAL SCIENCES

A SABBATICAL RESEARCH REPORT
FOR THE FALL SEMESTER 1984-85

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STATEMENT OF PURPOSE

The purpose of my sabbatical leave was two-fold: to investigate the structure, content, and functions of the arboreta of northern Europe, and to investigate the status of introductory botany as a basic course in the Lower Division biological sciences. A report on each of the two phases of the sabbatical will be developed separately and in this order.

THE ARBORETA OF NORTHERN EUROPE

INTRODUCTION

The first half of my sabbatical, beginning with the first week of September, 1984, was given to surveying the arboreta of northern Europe. Information was drawn from visits to arboreta and interviews with arboretum directors in West Germany, Finland, Sweden, Norway, Denmark, The Netherlands, and Belgium.

Botanic gardens, or arboreta, are of particular fascination to botanists because they represent collections of living plants both from the immediate area and worldwide. These collections often include plants accumulated from expeditions or from other gardens which have made expeditions, making possible the study and display of plants that otherwise would be accessible only to people residing in remote places or to the widely traveled.

THE ARBORETA

The botanic gardens of Northern Europe have singular importance. Many of them date back to the 17th century (Helsinki, Turku, Uppsala). Some of them were founded as private gardens by reigning monarchs (Uppsala). Early gardens were founded as medicine gardens where medicinal plants were grown. Later, an emerging interest in the systematic study and cultivation of plants was influenced by naturalists such as Carolus Linnaeus, the famous plant taxonomist of Sweden. Linnaeus, his contemporaries and students, engaged in expeditions to North America,

Latin America, and Africa to collect plants of potential economic value. Returning home, their efforts to grow these plants marked the beginnings of recent horticultural research. The development and promotion of gardening and horticulture thus became one of the main tasks of these gardens. Subsequent additions to these plant collections were obtained from other botanic gardens and later expeditions.

Since none of the gardens has sufficient resources to collect and maintain all or even a large part of plants worldwide, each garden must be selective. The characteristics of each garden is determined by its location, the interests of its director, the history of its expeditions, its trades, the research and commercial needs of the university and/or municipality owning the garden, and funding limitations.

Most gardens have representative samplings of plants native to that area. This is more easily accomplished in northern Europe where the number of native, or endemic, species is much smaller than in temperate-tropical areas. There are only four major species of trees, gymnosperm and angiosperm, endemic to the forests of Finland. Beyond the endemic species, each garden has certain unique interests. In the arboretum greenhouses (conservatories), in particular, there is a conspicuous fascination with tropical plants (bromeliads, orchids, cacti, giant waterlilies, lotuses, tropical crops, ferns, cycads, citrus, African succulents, and mesembryanthemums).

The gardens were each arranged in sections - woody plants, herbaceous plants, economic plants (cereals, vegetables, fodder plants, spices), beds of plants arranged systematically according

to plant families, ornamental plants (perennials, spring bulbs, annuals, collections of old-fashioned ornamentals), and rock gardens.

Due to the tendency of water-logging in the heavy soils of northern Europe, Finland in particular, gardens have had to make improvement in the soils to make possible the growing of a wide array of trees, shrubs, and woody climbers. The correcting of soil texture and pH were common.

Serving both the amateur and the professional, both the young and the old, the botanic gardens fulfilled any of a number of aims. Their functions included:

1) Education - they provide educational information in botany to people of all ages and professional background on type and location of native habitats, common and scientific names, plant communities, and plant evolution.

2) Research - they give easy access to both graduate and professional researchers for taxonomic, anatomic, and physiologic study.

3) Horticulture - they help develop interest in the commercial cultivation of plants for the growing of flowers, fruits and vegetables, landscape architecture, and nursery culture

4) Nature Protection - they attempt to protect the original habitats of a particular country or geographical area (Finno-Scandinavia) from changes in the balance of nature as brought on by agricultural cultivation and heavy forestation.

5) Gene Pools - they collect and maintain threatened and endangered species, both locally and worldwide, that are at risk of becoming extinct in their endemic setting. With some species, the only remaining authentic forms are protected in botanic gardens.

6) Community Education and Information - they encourage public interest in the cultivation and use of fruits, vegetables, nuts, and mushrooms; they cooperate with plant societies in seasonal flower shows; they demonstrate the uses of plant materials for decorations and display.

7) Leisure and Recreation - they provide a sanctuary in which people can refurbish their spirits while strolling, sitting, feeding domestic birds, or engaging in selected recreation.

Each of the botanic gardens visited viewed itself as serving various of these functions. The extent to which they were able to develop their acreage (hectacreage), the size of the collection, and the diversity of the functions was determined by the leadership of the directors, the garden's relationship with the municipality or university, and with sustained sources of funding.

DESCRIPTIONS OF ARBORETA

The descriptions of the gardens will be arranged according to the approximate order of visit. The salient features of each garden will be given.

WEST GERMANY

Munich. Each of the three West German gardens visited were larger in size than most of the Scandinavian gardens. All were very well kept. This one, the Botanisher Garten, was within the city and, as with the more developed gardens, charged admission. It was laid out both according to plant families and according to plant communities. Of particular interest were splendid stands of alpine conifers. There were extensive shows of blooming dahlias and roses, both of which were much in evidence throughout the towns of West Germany. There was a systematic garden.

The greenhouses were expansive, with interconnecting corridors. The atmosphere of each large room was maintained at a different temperature/humidity to accommodate different habitats. One was a cactus room containing familiar California/Arizona species.

An indoor sit-down restaurant was on the grounds. The grounds were well-cared for and plants well-labeled. The garden was very attractive.

Frankfurt am Main. The Palmengarten is within and controlled by the city of Frankfurt. Containing an extensive collection, it includes some 250 species of palms, 4500 species of orchids, 3500 species of cacti and succulents, plus bromelias, begonias, camellias, azaleas, chrysanthemums, and fuchsias. Large new greenhouses have recently been built.

Organized along both scientific and recreational lines, this garden was for all people. The grounds included open air facilities (for concerts, balls, and festivals), a restaurant, coffee terraces, picnic and play lawns, a miniature railway, a boating

pond, a mini-golf course, and playgrounds.

Hamburg. Affiliated with the university, the garden has been relocated at the western edge of the city. Being a newly designed and organized arboretum, it has used landscaping effects which accent specific plant communities, particularly those of the north.

A striking garden, it was also uniquely instructional. In the center of the grounds there is a large systematic garden featuring orders of flowering plants arranged in a pattern of phylogenetic (natural evolutionary) classification beginning with the order magnoliales. Set in a large park-like area, clusters of small gardens diverge via walkways from the magnolias. In each "order" cluster were planted type specimens of the most common plant families of that order. It was the most novel and understandable attempt we observed anywhere to acquaint the public with phylogenetic classification. All of the West German arboreta we visited were exceptionally fine in both layout and content.

FINLAND

Turku. Located in a natural historical preserve several kilometers outside the city, this small university-related garden was not as sophisticated nor as well funded as those in West Germany. While the size of the collection was fair, the garden obviously faced problems with drainage and high soil acidity. While the plants were well-labeled, they were not arranged as creatively as those in arboreta previously visited. Yet, it was most encouraging to see attempts to maintain a smaller garden under severe climatic conditions.

Helsinki. The arboretum in Helsinki, Annikki Palmen, is located adjacent to the university, which is near the heart of the city. Both small in size and number of species, specimens were well selected and labeled

I had a sitting with the director of the arboretum/herbarium, Dr. Ilkka Kukkonen, who explained the functions of the garden and the nature of some of their research. The more northern latitudes have far fewer native species, more severe temperature extremes, more cloudiness and precipitation, and shorter growing periods. These factors, plus a conspicuous limitation in funding, contributed to a less auspicious garden. Yet, Dr. Kukkonen is a competent researcher with impressive credentials and connections with botanists worldwide, including several from Rancho Santa Ana Botanic Garden in Claremont. There appeared to be little or no relationship between the smaller garden and quality of research produced.

SWEDEN

Stockholm. Near the northern edge of the city, the botanic garden is adjacent to the university. Obviously an older garden, the greenhouses were small and not particularly well-tended. There was a good array of Finno-Scandinavian plants, with an excellent display of economic/garden plants, some commercial and others exotic. Included were numerous cultivars of cabbage, both loose- and tight-headed forms.

Throughout northern Europe we saw cabbages of sidely diversified cultivars, in many shapes and colors. In every open market there were large selections of huge cabbage heads. Because cabbages need cool weather for good head formation, their cultivation is

ideal for northern Europe. Rich in vitamins and minerals and adapted for winter storage, it is eaten raw, boiled or stewed, or fermented as sauerkraut.

An additional feature of the Stockholm arboretum was an adjacent indoor nursery, in which a wide variety of garden and indoor cultivars were being sold. Once owned by the arboretum, it is now privately owned. Its closeness to the arboretum is a drawing card for people to also visit the arboretum.

Uppsala. There are two gardens of significance in this historic university town. The first is the small Linnetradgarden, Linnaeus' own botanical garden, still with some plants dating from his period and the entire garden laid out in accordance with his sexual system of classification.

The second, and much larger, is the Botaniska Tradgarden i Uppsala. Established by the king and later given to the university, the garden is today one of the largest in Sweden. Well-organized and labeled, the garden specializes in anemone, Scandinavian plants, ornamental/economic plants, and roses.

Of particular value was an excellent interview with Dr. Orjan Nilsson, the head gardener (director). He explained the several aspects to the garden's collection - interests of gardeners, popular interests (cacti do well in the dry air of Swedish homes), continuation of those plant groups already well represented from earlier collections, preserving old cultivars (gene bank for plants once popular and perhaps of demand in the future) such as wild rose stock.

The garden was also engaged in the study of commercial plants for possible introduction into Sweden. Contracting with commer-

cial companies, both domestic and foreign, the garden experimentally profiles the suitability of plants to the environmental conditions of Sweden (soil, precipitation, temperature, light). The garden also serves the various botany departments of the University of Uppsala (systematics, physiological, ecological) and the School of Agriculture.

To develop public interest, the garden develops special materials for public school tours, emphasizes economic plants, educates the public to type species of the various plant families, and provides some plants for sale.

All of the gardeners hired by the Botaniska Tradgarden have earned doctorate degrees. The head gardener knew Dr. Lyman Benson and Dr. Philip Munz personally, and had reading knowledge of Dr. Sherwin Carlquist, all botanists formerly or presently of the Rancho Santa Ana Botanic Garden, Claremont.

Gothenburg. The Botanisher Garten of Gothenberg is a gigantic garden operated by the city in conjunction with the university. It is the largest garden in Scandinavia and is about 60 years old. About 10 percent of it is in formal garden, about 20 percent in nature preserve, and the remainder in plantings of woody communities, with a number of trees of each species, particularly those of Asia. Typical of the gardens of Scandinavia, there was no charged admission.

I had an excellent interview with the garden's director, Dr. Gunnar Weimarck. The garden has seven major aims - educational, research, horticultural, nature protection, gene pool, public information, and leisure/recreational. Perhaps this garden, of the Scandinavian ones, came closest to the West German gardens

in developing a full range of aims.

Particularly impressive was the gardens participation in Project Linnaeus - the maintenance of gene pools of endangered native species. One such, Sophora toromiro from Easter Island, is extinct in its endemic setting and its only authentic forms are thought to exist in this garden.

Of highlight also were the greenhouses. As well-kept as any we visited anywhere, their collection emphasized orchids, primulas, cacti, and tropical rainforest plants.

NORWAY

Oslo. The botanic garden in Oslo, the Botanisk Have, is rather expansive with a large collection. It is operated jointly by the university and by the state. While its pattern of layout was similar to that of comparable gardens, it displayed a fine stand of alpine trees. Its systematic garden was typical of other gardens. Since our visit came on Sunday, we were unable to make contact with any of the staff. Near the university, the garden is adjacent to the national zoological museum, museum of minerology and geology, and the paleontological museum - a location all of which also attracts people into the botanic garden.

Bergen. There were two botanic gardens to be visited in the Bergen, Norway area on the west coast of Norway. One is very small within the city next to the university, the other is much larger and under development about 15 kilometers outside Bergen. The smaller garden has a very modest collection of limited value. The larger garden is being developed at Milde. Named Det Norske Arboret (the Norwegian Arboretum), this replacement garden is

located on a rocky peninsula with a long shoreline.

The functions of the new garden are research, education, and recreation, with an aim of creating a pleasurable experience for visitors and thereby stimulating interest in botany. At present the garden is building up a fine collection of northern European trees, azaleas, and rhododendrons. The director of the garden and his wife, Dr. and Mrs. Paul Sondergard, hosted my wife and I as guests in their home. Dr. Sondergard detailed the complexities of politics and protocol of working for a Norwegian city and university by a Danish-born director. Although not completed, the garden has a spectacular location and shows promise of excellent design with major emphasis on plant communities of the north.

DENMARK

Copenhagen. Located well within the city of Copenhagen, this large arboretum is very accessible to walk-in visitors from the inner city. On this sunny October Sunday afternoon there were people of all ages in the garden - sitting in the sun, feeding ducks in the ponds, and inspecting greenhouse collections.

While not largest in size, this garden featured the greatest number of taxa of any garden visited. Included were extensive stands of trees (Asian, European, American), particularly a great diversity of pines and other conifers. The rock gardens were very well organized and displayed. The conservatories (greenhouses) were large and high, with an extensive and congested selection of tropical, semitropical, and desert plants (many cacti and orchids). While crowded, the collection was well-labeled.

Aarhus. Although a rather spacious layout, this university-located garden had little to distinguish it from other gardens. Present was the rock garden, array of trees, the semi-circularly arranged systematic garden, and greenhouses (closed). So many of the older gardens of Scandinavia were laid out the same way and without sense of creativity. It was refreshing to visit the newer gardens (Milde, Hamburg) in which caution was thrown to the wind and "radical" new landscaping designs were being used.

One liability of visiting gardens on weekdays in the fall of the year was that some displays were closed. True in this garden, we were unable to gain entrance to the conservatory.

THE NETHERLANDS

Utrecht. At the garden of the University of Utrecht, the Botanische Tuinen Rijkuniversiteit, I had a long interview with the head of the garden and a tour of the grounds. The university has a novel arrangement with four to five separate gardens at different locations, each with a different concentration - greenhouses, trees, rock garden, economic plants, etc. This garden, at the main university was devoted to a rock garden, a systematic section, and some trees. While it charged no admission, it was not administered to attract the public the way other gardens were - no maps, no pictures of flowers, only a small Dutch-language pamphlet.

Totally funded by, and under the control of, the university, the garden saw itself as existing primarily to serve the professional needs of the university. The garden had little interest in being of help to the professional nursery industry, the bulb industry (of which Holland has such fame), serving as guardians

of rare or once popular plants (gene pools), nor being the collector of endangered species. There was something formal and austere about the whole arrangement. The garden was once used by the lower division botany students at the university, but no longer. While its rock gardens were well laid out (more impressive since there are no natural rock outcroppings in Holland, and all rocks had to be imported), the garden had limited attraction to the public.

Leiden. Mark this one off to experience. This visit was an exercise in frustration. Many of the older Dutch cities are impossibly congested, with swarms of bicycling students, and with little parking. By the time we located the garden, found distant parking, walked up and down canals, we arrived at the garden to find it had just closed. While the garden had a favorable accounting of taxa (kinds of plants), it was quite small in size. No more need be said of this exercise in futility.

BELGIUM

Ghent. Probably benefitting from expeditions into Belgian colonial lands, this arboretum had the best collection of palms and other semi-tropical plants seen anywhere. Citrus, cycads, and bananas replaced the bromeliads and orchids. Its array of taxa was extensive. Arriving toward the end of the day, we had no chance to speak to the garden director.

Meise. Designated as the National Botanic Garden of Belgium, this huge, park-like arboretum is located about 12 kilometers north of Brussels. Included were huge expanses of immaculately groomed

lawns. The deciduous trees, sycamores, beeches, chestnuts, and maples were the largest I have ever seen. In the early afternoon on this weekday the conservatories were closed. Yet the many park benches were lined with dozens of older people basking in the bright sunlight of this late October day. We were sorry to miss seeing the conservatories, whose contents, we had to assume, would have been displayed as carefully as the garden plantings. There was an aristocratic air to the gardens - a restaurant with outside veranda, carillion sounding on the quarter hour from the town cathedral, people casually yet carefully dressed, groundsmen in uniform, and an old castle on one of the several lakes. All seemed prepared, lest at any moment the monarch might choose to show up. In fact, the grounds seemed a bit too formal - too little emphasis on botanical instruction and systematics. Yet colored brochures with map and pictures of herbaceous flowers in bloom were available. Unique among gardens visited, this one provided valuable contrast to the other ones we saw.

Brussels. This small, in size and collection, university garden located near the hub of the capital was sparsely planted and poorly labeled. The conservatory was lacking for custodial attention, which was reflected in the small number of people touring the grounds. This garden was perhaps the most underdisplayed and poorly kept of any we visited. It deserves no further comment.

DIRECTORY OF ARBORETA

Country	Location	Status	Area 1 hectacre = 2.47 acres	Taxa	Specialties
West Germany	Munich	Government	20 hect-acres (ha)		Alpines, cacti, insectivorous, African succulents, Crassula, Mesembryanthemums
	Frankfurt am Main	Municipal	22 ha	10,000	Orcids, cacti, bromeliads, Araceae, Erica, Calluna, Camellias, Fuchsia, Pelargoniums, alpine plants
	Hamburg	University	24 ha	12,000	Mesembryanthemums, Mandevilla
Finland	Turku	University	7 ha	7,000	
	Helsinki	University	5 ha	4,000	
Sweden	Stockholm	University	7.79 ha	9,000	
	Uppsala	University	13.5 ha	10,000	Anemone, Scandinavian plants, ornamental/economic plants, annuals, Cotoneasters, Paeonia
	Gothenburg	Municipal	175 ha	12,000	Rhododendrons, trees of northern hemisphere, rock garden, orchids, succulents
Norway	Oslo	University/ State	14 ha	8,000	Rock garden, alpine plants
	Milde	University	50 ha		Rhododendrons, conifers
	Bergen	University	1.6 ha		Rhododendrons, Primula

Country	Location	Status	Area	Taxa	Specialties
Denmark	Copenhagen	University	9.75 ha	25,000	Begonia, Commelinaceae, Peperomia, orchids (Thailand)
	Aarhus	University	15 ha		Sedum, plants of Thailand and Ecuador
Netherlands	Utrecht	Government	7 ha	3,000	Rock garden plants, systematic garden
	Leiden	Government	2.63 ha	8,000	Araceae, ferns, cycads, bromeliads, Japanese plants
Belgium	Ghent	Government	2.75 ha	10,000	Orchids, bromeliads, Araceae, succulents, Hoya
	Meise	Government	93 ha	15,000	Araceae, Begonia, cycads, orchids, succulents
	Brussels	University	5 ha	3,000	Paeonia, Rhododendrons, Armeria, Agrostis

CONCLUSIONS

I was excited to see the first arboreta. I dutifully took (and continued to take) many 35 mm slides of blooming flowers and exotic plants. While intrigued by all of the gardens, I nonetheless eventually encountered a feeling of sameness about them. But after weathering the "sameness" phase of my reactions, I began to perceive differences in function and purpose of the gardens. After visiting multiple gardens in a given country, and those in seven different countries, these subtle differences seemed to reflect that people and culture. The Germans were most industrious and creative - leading to a disdaining remark by a Dutch host that he fatigued of it being said that the Germans always do everything best. While the arboreta of Denmark, Norway, and Sweden were smaller, there was careful attention given to detail; a bit less so, perhaps, in Finland. Each of these countries demonstrated concern for multi-functional gardens - education, research, preservation, community interest, horticultural value. The gardens of Holland presented the greatest paradox - too businesslike, too frugal, an admitted lack of interest in service to the commercial industry - all in a country with worldwide reputation in floriculture. Other than Ghent, the gardens of Belgium seemed to be either too aristocratic or insufficiently cared for.

Yet the people of northern Europe have a love affair with flowers - more so than do Americans. I saw thousands of commercial greenhouses - even in Finland. Few home windows were without flowers or plants. Every train station and public market had

beautiful flower displays. Bunches of cut flowers were being carried by university students, professional people, housewives, and children - even by bicycle-riding businessmen on their way home. Perhaps flowers are part of the survival formula needed for the long winter days of little sunlight. To me it has become appropriate that the father of modern taxonomy, Linnaeus, was a Swede.

HUMAN SEXUALITY RESEARCH

As an additional part of my sabbatical agreement, I made some contact with and observations of the sex education and behavior of the Scandinavians. While in Stockholm I visited with Dr. Maj-Briht Bergstrom-Walan of the Human Sexuality Institute of Stockholm. This institute has conducted research on the sexual behavior of the Swedish people in particular, and has produced some excellent films, two of which are in the Mt. San Antonio film library.

In its research, the Institute has found that half of all Swedes have had sexual intercourse before the age of 18, and of these 45 percent knew each other for more than six months before they made love the first time. Of those surveyed, 88 percent of both sexes wanted first intercourse to take place at the time it did, and more than 80 percent attempted to prevent conception during their first sexual experience. These research findings bode well for the required program in the public schools of Sweden in which all school children participate in elementary and high school sex education involving the anatomy and physiology of the reproductive system and in ways to prevent conception.

By contrast, research in the United States has shown that here only about 14 percent of youth make efforts to prevent conception during first intercourse. Additional research here also shows that among those young persons receiving sex education, the time of first intercourse occurs at a later age and these are more likely to take effective steps to avert conception than those not receiving sex education.

The Human Sexuality Institute has also been involved in efforts

to help normalize sex education for the handicapped, with special efforts being made to help blind students. Using living adult male and female models, these students are given the opportunity to fully touch the models' genitals, locate pubic hair, and feel the roundness of the hips. The Institute has also shared in efforts to normalize appropriate sexual expression among patients in hospitals for the physically disabled.

In Scandinavia there appeared to be less denial of a person's sexuality as a part of his or her anatomy and behavior than in the United States. We noticed this in public statuary in which the genitals of both the male and female are openly and accurately detailed, rather than covered by the hands or a fig leaf. To this there appeared to be no element of sensation or undue fascination by passing persons.

There did not seem to be any great contrast between the "adult" sex shops in our cities and the much touted sex shops of Scandinavia. In Copenhagen, for instance, where the exterior walls of sex shops were painted in gaudy bright reds and the merchandise was amply displayed behind large plate glass windows for young and old alike to view, the array of items was little different from our Southern California stores. The same erotic full-color glossy magazines, films, tapes, and sexual devices seen here were found there. Yet these stores were not being overrun with hordes of young people in avid search of vivid erotica. The same customer types seen in the sex shops here were found there.

Overall, there seemed to be a sense of openness by the Scandinavians to sexuality as a normal desirable part of behavior, yet without the same degree of sensationalism that seems to accompany sexuality in the media here.

THE STATUS OF INTRODUCTORY BOTANY IN THE LOWER DIVISION BIOLOGICAL SCIENCES

INTRODUCTION

The second half of my sabbatical leave, beginning with the first week of November, 1984, was spent visiting colleges and universities in the mid-Atlantic states, including ones that have gained regional and national reputations in the teaching of botany and the biological sciences.

The purpose of visiting each campus was to investigate the introductory biology courses for biological science majors, with particular attention to the placement and teaching of introductory botany in that, or those, major(s). In each visit I sought answers to:

1) The philosophy of the course
2) How the course fits into the natural science curriculum
3) The content of the course
4) Materials being used
5) Who is taking the course
6) Trends in enrollment
7) New innovations and technologies in teaching botany

Further, my investigation focused on whether an introductory botany was part of an introductory biology core of subjects and whether introductory botany was part of a botany/zoology integration.

Additional questions had to do with prerequisites required for introductory biology and/or botany, whether other programs feed students into introductory botany, whether one or two sem-

esters of introductory botany were taught, how many hours were spent in lecture and laboratory each week, and how many credit (ch) or semester (sh) hours were assigned to the course.

My visits to each school included interviews with department chairpersons and professors of botany and biology.

Several months prior to visiting each campus I wrote letter of introduction to each department chairperson introducing myself and my mission and requesting the privilege of visiting their campus. Prior to each visit I telephoned each school confirming my request for an appointment. Following each visit I followed up with letter expressing my appreciation and stating ways in which the interview was of help to this project.

Overall, I found great hospitality and cameraderie. Each of the professors made efforts to thoroughly explain their programs and completely process all of my queries. Many of them provided me with syllabi, lab schedules, majors information, and laboratory materials and manuals. I obtained catalogues from each of the schools visited.

COLLEGES AND UNIVERSITIES INVESTIGATED

The schools visited were located in Pennsylvania, New York, and New Jersey. The intention was to visit schools varying in size, public or private ownership, and undergraduate/graduate program. I was not able to visit every school listed in my sabbatical proposal, but was able to include three not in the proposal.

The 13 schools visited fell into four groups based on size, whether a two- or four-year school, and whether they granted

doctoral degrees in the biological sciences. The schools and their groupings included:

I. Universities (over 10,000 undergraduates) with Ph.D. programs in the biological sciences:

The Pennsylvania State University, University Park, PA
Rutgers, The State University of New Jersey, Busch Campus, Piscataway, NJ
Cornell University, Ithaca, NY

II. Universities (over 4,000 undergraduates) with no Ph.D. programs in the biological sciences:

Fairleigh Dickinson University, Florham-Madison Campus, Madison, NJ
State University of New York (SUNY) at Binghamton, Binghamton, NY
Millersville University, Millersville, PA
Shippensburg University, Shippensburg, PA

III. Private colleges and universities (enrollment over 2,000):

Drew University, Madison, NJ
Franklin and Marshall College, Lancaster, PA
Messiah College, Grantham, PA
Dickinson College, Carlisle, PA
Lebanon Valley College, Annville, PA

IV. Two-year community colleges:

Harrisburg Area Community College, Harrisburg, PA

DATA FROM INVESTIGATIONS

I have organized and compared the data from my visits several ways. Included is:

1. A cataloguing of biology/botany programs of each

campus. While the sequence of information may vary somewhat from campus to campus, I have included:

School - name and location

Size of school

Biology majors

Core biology courses in the major, giving course name and number, number of lecture and lab hours per week, number of credit (ch) or semester (sh) hours given for the course

Core courses in botany major (option, concentration, specialization), if one

Non-core botany courses

Introductory botany

Course philosophy of introductory biology/botany course

Who takes introductory botany

Trends in enrollment

Faculty contact

2. An overview data summary sheet comparing the schools

3. Sample syllabi from several schools (see appendices).

School	THE PENNSYLVANIA STATE UNIVERSITY (University Park, PA)
Size	43,000 undergraduate; 22,000 graduate
Biology Major 5 options:	Biology BOTANY Ecology General Biology Genetics and Developmental Biology Vertebrate Physiology
Introductory Biology (core courses) low.div. courses: # 1-399	Princ. of Biology I 101 (3 lec/3 lab):4 ch cell biology, biology of vertebrates, monerans, protists, and animals Princ. of Biology II 102 (3 lec/3 lab):4 ch plants and fungi, genetics of organisms and populations, evolution (text: Raven) (prerequisite - Bio 101) Environmental Biology 210 (lec):3 ch Genetics 222 (lec):3 ch Cell Biology 231 (lec):3 ch
Course Philosophy (Biology 101,102)	1) Broad view of plants and animals 2) Integrate principles of botany and zoology 3) Develop Skills in observation, analysis, and expression
Core Courses in Botany Option	Taxonomy of Seed Plants 414 (lec/lab):3 ch Comparative Plant Morphology 431 (lec):2 ch Lab in Comp. Plant Morphology 432 (lab):2 ch Plant Physiology 441 (lec):3 ch Plant Physiology 442 (lab):3 ch
Non-core Botany Courses	11 lower and upper division courses
--Introductory Botany	Princ. of Biology I 102 - above
Who Takes Princ. of Biology II (Botany)	All in biology major, including everyone from each of five options
Trends in Enrollment	Strong. Half of botany students in Princ. of Biology 102 are from colleges of agriculture, agronomy, and herticulture; half from an assortment of other colleges on campus
Faculty Contact	Dr. Carl Keener, Professor of Botany

School	RUTGERS, THE STATE UNIVERSITY OF NEW JERSEY BUSCH CAMPUS (Piscataway, NJ)
Size	47,000 undergraduate and graduate
Biology Major	Biological Sciences
10 specializations	Biological Sciences BOTANY Zoology Ecology Neurobiology and Behavior Physiology (Animal) Developmental Biology Genetics Microbiology Biomathematics Entomology Nutrition
Introductory Biology (core courses) low.div. courses: # 100-299	General Biology 101-102(3 lec/3 lab):4 ch/4 ch ecology, genetics, evolution, cell biology, physiology, population dynamics of plant/animal systems or General Biology - A Biochemical Approach 103-104 (3 lec/3 lab):4 ch/4 ch principles and applied aspects of biology using molecular and biochemical approach or Principles of Biology 105,106,107,108 (3 lec/3 lab cell structure/physiology, genetics, development, organ systems, behavior, ecology, evolution, scientific method
Course Philosophy	1) Broad view of plants and animals 2) Integrate the principles of plants and animals 3) Learn the scientific method
Core Courses for Botany Specialization	Principles of Botany 210 (lec/lab):4 ch Intro to Plant Physiology/Biochemistry 413 Plant Ecology 332 (lec/lab):4 ch Plant structure/evolution electives: 6-7
Non-core Botany Courses	10 lower and upper division courses
-- Introductory Botany	Princ. of Botany 210 (3 lec/3 lab):4 ch structure, function, diversity, reproduction of the plant kingdom (text: Raven) (prerequisite - Bio 101-102 or 103-104 or 105-108
Who Takes Botany 210	All in botany concentration
Trends in Enrollment	Poor to good in advanced botany courses. Very good in cellular/molecular biology courses
Faculty Contact	Dr. David E. Fairbrothers, Professor of Botany

School	CORNELL UNIVERSITY (Ithaca, NY)
Size	12,240 undergraduate; 4,760 graduate
Biology Major 10 concentrations)	Biological Sciences Animal Anatomy/Physiology Biochemistry BOTANY Cell Biology Ecology, Systematics, Evolution Genetics and Development Neurobiology and Behavior
Introductory Biology (core courses) low.div. courses: # 100-299	Biological Sciences 101-102 (w/ Bio Sc 103-104) (2 lec/2 lab):4 ch/4 ch chemistry, cell biology, energentics, anatomy, physiology, behavior Introductory Biology 105-106 (4 lec/0 lab): 4 ch/ biochemistry, physiology, genetics, 4 ch development, ecology, evolution, behavior, diversity
Course Philosophy (Biology 101-106)	1) Integrate principles of botany and zoology 2) Learn scientific method by designing and performing investigations 3) Learn research methodologies, analysis techniques, instrumentation, and lab methods 4) Learn fundamental concepts of biology
Core Courses for Botany Concentration	May take: Plant Biology 241 (lec/lab):3 ch Plant Physiology 242 (lec):3 ch Plant Physiology Lab 244 (dis/lab):2 ch Ethnobotany 246 (lec/lab):3 ch
Non-core Botany Courses	14 additional upper division courses
--Introductory Botany	Plant Biology 241 structure, reproduction, classification of angiosperms (text: Raven) (prerequisite - Bio Sc 101-102 (w/103-104) or Intro Bio 105-106)
Who Takes Plant Biology 241	All in botany concentration
Trends in Enrollment	Strong. Many botany students are from Plant Sciences (Pomology, Plant Breeding, Plant Protection, General Plant Science)
Faculty Contact	Dr. Karl Niklas, Associate Professor of Botany

School	FAIRLEIGH DICKINSON UNIVERSITY FLORHAM-MADISON CAMPUS (Madison, NJ)
Size	17,000 undergraduate and graduate
Biology Major 4 concentrations	Biology General Biology Marine Biology Environmental Biology Medical Technology
Core Courses in Biology Major low.div. courses # 100-299	Botany 201 Zoology 202 each (lec/lab):4 ch Cell Biology 203 Comparative Anatomy of Vertebrates 253 Genetics 256
Botany Courses in Major	Botany 201 Plant Morphology 329
--Introductory Botany	Botany 201 (2 lec/4 lab):4 ch anatomy/physiology, classification, ecology, genetics (text: Raven) (prerequsite - none)
Course Philosophy	1) Study the structure, function, and diversity of plants 2) Develop a broad view of plants 3) Learn the elements of classification 4) Learn the scientific method
Who Takes Botany 201	All biology majors, including everyone from each of the four concentrations
Trends in Botany Enrollment	Holding firm
Faculty Contact	Dr. R. Gordon Perry, Assistant Professor of Biological Sciences

School	STATE UNIVERSITY OF NEW YORK AT BINGHAMTON (Binghamton, NY)
Size	8,000 undergraduate; 3,000 graduate
Biology Majors	Biology - B.A. Biology - B.S.
Core Courses in Biology Major low.div. courses # 100-199	Cell and Molecular 113 (lec/disc): 1 course * Organisms and Populations 114 (lec/disc): 1 cour* Introductory Biology Lab 115 (lab): ½ course * Introductory Biology Lab 116 (lab): ½ course * (*) graduation requirements calculated in courses rather than semester or credit hours)
Introductory Biology (core courses)	Cell and Molecular 113 (3 lec/1 disc): 1 course * origin and evolution of cells, procaryotes and eucaryotes, energetics, metabolism, membranes, reproduction, genetics (prerequisite - none) Organisms and Populations 114 (3 lec/1 dis):1 cour structure/physiology of plants/animals, growth, ecology, animal behavior, evolution (prerequisite - none)
Course Philosophy	1) Study interrelationship and evolution of major plant and animal groups at organismic level 2) Integrate the principles of botany and zoology
--Introductory Botany	None (no survey, no core botany)
Non-core Botany Courses in Majors	+Botany 121 1 course (prereq - none) Plant Physiology 223 1 course (prereq - 113-116) Plant Anatomy 241 1 course (prereq - 121) Plant Systematics 242 1 course (prereq - 121) Morphology of Vascular Plants 243 1 course(pre Phycology 244 1 course (prereq - 121) 121) Bryoecology 245 1 course (prereq - 121)
Who Takes Botany Courses	Only interested students. No botany courses required any longer of biology majors
Trends in Enrollment	Down. Botany 121 enrollment now ½ of what it was two years ago when it was required of all biology majors
Faculty Contact	Dr. Patricia Bonamo, Associate Professor of Biology (+) although not in core, serves as introductory botany

School	MILLERSVILLE UNIVERSITY (Millersville, PA)
Size	4,950 undergraduate; 1,750 graduate
Biology Majors	Biology - B.A. Biology - B.S. Environmental Biology Marine Biology
specialized programs	Medical Technology Nuclear Medicine Technology Respiratory Therapy
Core Courses in Biology Major low.div. courses # 100-299	Populations and Organisms 103 Cells and Physiology 104 Seminar in Biology 408
Introductory Biology	Populations and Organisms 103 (3 lec/3 lab):4 sh integrated survey of multicellular organisms (text: Curtis) (prerequisite - none) Cells and Physiology 104 (3 lec/3 lab):4 sh cellular life, metabolism, cellular structures, reproduction, genetics, development, biochemistry, systems physiology (prerequisite - Bio 103)
Course Philosophy	1) Integrate the principles of botany/zoology 2) Interest students in introductory biology courses without going too deeply into advanced topics in lower division
Botany Courses in Majors	Lower Plants (field) 225 (lec/lab): 3 sh Plant Systematics (field) 325 (lec/lab):3 sh Developmental Plant Anatomy and Morphology 427 (lec/lab):3 sh Plant Physiology 436 (lec/lab):3 sh
-- Introductory Botany	None (no survey, no core botany)
Who Takes Botany Courses	All biology majors must select from a minimum of two of the above botany courses
Trends in Enrollment	In past, introductory botany and zoology was required of all biology majors, resulting in reduced enrollments in advanced botany courses. Replacing introductory botany and zoology with introductory biology courses has resulted in a major improvement in enrollment in the advanced courses required of biology majors
Faculty Contacts	Dr. David R. Dobbins, Associate Professor in Biology Dr. James C. Parks, Professor of Biology

School	SHIPPENSBURG UNIVERSITY (Shippensburg, PA)
Size	4,500 undergraduate; 1,000 graduate
Biology Major 5 concentrations	Biology General Biology BOTANY Zoology Marine Biology Environmental Biology
Core Courses in Biology Major low.div. courses # 100-299	General Botany 120 (lec/lab):4 sh General Zoology 110 (lec/lab):4 sh General Ecology 240 (lec/lab):3 sh Genetics 260 (lec/lab):3 sh Biology Seminar 300,301,302 1 sh each
Botany Courses in Botany Concentrat.	General Botany 120 Field Botany 125 Plant Physiology 255 Plant Growth and Development 355 Plant Morphology 377 Plant Taxonomy 420 each (lec/lab):3 sh Plant Pathology 423 Plant Ecology 445 Plant Anatomy 475
--Introductory Botany	General Botany 120 (3 lec/2 lab):4 sh cellular structure/physiology, growth/repair, development/reproduction, control, food, energy, inheritance, ecology (text: Raven) (prerequisite - none)
Course Philosophy	1) Acquire knowledge of structure, function, diversity, and significance of plants 2) Acquire a comparative picture of plants to animals and bacteria 3) Learn a scientific method
Who Takes Botany 120	All biology majors, including everyone from each of five concentrations. All students in Medical Technology Program
Trends in Botany Enrollment	Static, holding its own. Enrollment aided by big program in Medical Technology. 1/3 of Botany 120 students from biology majors, 2/3 from Medical Technology
Faculty Contact	Dr. Larry Klotz, Assistant Professor of Biology

School	DREW UNIVERSITY (Madison, NJ)
Size	1,700 undergraduate; 800 graduate (non-biology)
Biology Majors	Biology BOTANY Zoology
Core Courses in Biology Majors low.div. courses # 0-99	Introductory Biology 1 (lec/lab):4 sh Introductory Biology 2 (lec/lab):4 sh Botany 12 - Plant Structure and Function (lec/lab):4 sh /Zoology 13 - Vertebrate Structure and Development (lec/lab):4 sh or/Zoology 16 - Invertebrate Comparative Form and Function (lec/lab):4 sh /Biology 14 - Princ. of Microbiology (lec/lab):4 sh or/Biology 17 - Princ. of Ecology (lec):3 sh
Introductory Biology	Intro Biology 1,2 (3 lec/3 lab):4 sh/4 sh origins of life, cell structure/function, plant/animal diversity, genetics (text: Curtis)
--Introductory Botany	Botany 12 (2 lec/4 lab):4 sh structure, reproduction, growth, and development of green plants (text: Esau) (prerequisites - Biology 1,2)
Course Philosophy	1) Investigate the structure and diversity of plants 2) Develop a comprehensive view of plants 3) Learn the scientific method
Non-core Botany Courses in Majors	Mycology 105 each (lec/lab):4 sh Forest Ecology 106 Plant Growth and Development 107 Taxonomy of Flowering Plants 108 Chromosome Botany 113 Morphology and Paleobotany 114
Who Takes Botany 12	All botany and biology majors
Trends in Enrollment	Numbers of biology and botany majors is declining. Once taught a full year of botany. No feeding into botany and biology majors from majors such as agriculture, horticulture, or medical technology
Faculty Contact	Dr. Gary Smith, Chairperson, Botany

School	DICKINSON COLLEGE (Carlisle, PA)
Size	1,776 undergraduate
Biology Major	Biology
Core Courses in Biology Major low.div. courses # 100-299	General Biology 111 (lec/lab): one course* General Biology 112 (lec/lab): one course* (*) graduation requirements calculated in courses rather than semester or credit hours
Introductory Biology	General Biology 111 structure and function of living systems in plants; understanding of fundamental principles and methods used in biology (text: Johnson) (prerequisites - none) General Biology 112 structure and function of living systems in animals; understanding of fundamental principles and methods used in biology (text: Johnson) (prerequisites - none)
Course Philosophy	1) Give students broad view of animal/plant life 2) Develop skills of observation/analysis/expression; ability to evaluate data and draw conclusions; art of distinguishing between substance and accident 3) Integrate basic principles of botany/zoology
--Introductory Botany	General Biology 111
Non-core Botany Courses in Major	Field Study of Plants 222 each:one course* Algae and Fungi 223 Vascular Plants: Structure/Function 225 Lichens and Bryophytes 227
Who Takes Botany Courses	All biology majors required to take one of the above botany courses
Trends in Enrollment	Maintaining well. All students in the college must take 3 courses in the natural/mathematical sciences, 2 courses which must include a 2-semester lab sequence in biology, chemistry, environmental science, geology, or physics-astronomy
Faculty Contact	Dr. Paul Biebel, Professor of Biology

School	MESSIAH COLLEGE (Grantham, PA)
Size	1,780 undergraduate
Biology Major	Biology
Core Courses in Biology Major low.div. courses # 100-299	Botany 192 (lec/lab):3 sh Zoology 195 (lec/lab):3 sh Genetics 281 (lec/lab):3 sh Ecology 261 (lec/lab):3 sh Physiology 385 (lec/lab):4 sh
--Introductory Botany	Botany 192 (2 lec/3 lab):3 sh biological manifestations as evidenced in the plant kingdom (text: Keeton) (prerequisites - none)
Course Philosophy	1) Learn structure/function/diversity of plants 2) Learn the scientific method. 3) Develop skills in observation/analysis/expression
Non-core Botany Courses in Major	Mycology 321 each(lec/lab):3 sh Systematic Botany 325 Comparative Plant Morphology 327
Who Takes Botany	All biology majors
Trends in Enrollment	Enrollment holding steady. Botany required of all biology majors
Faculty Contact	Dr. Gary Emberger, Assistant Professor of Biology

School	FRANKLIN AND MARSHALL COLLEGE (Lancaster, PA)
Size	1,900 undergraduate
Biology Major	Biology
Core Courses in Biology Major low.div. courses # 1-19	Biology 13 - Cellular and Molecular Biology Biology 14 - Organismic Biology Biology 15 - Genetics /Biology 16 - Developmental Biology and/Biology 17 - General Physiology or /Biology 18 - Plant Development and/Biology 19 - Plant Physiology each is one course *
Introductory Biology	Biology 13 - Cellular/Molecular Biology 1 course* biological molecules, cells/organelles, bioenergetics/metabolism Biology 14 - Organismic Biology 1 course* structural and functional approach to organ systems, diversity of animals and plants (text: Curtis) (prerequisite - none) (*) graduation requirements calculated in courses rather than semester or credit hours
Course Philosophy	1) Integration of principles of botany and zoology 2) Critical approach to observing, analyzing, and expression of conclusions 3) Learning structural and functional diversity of plants and animals
-- Introductory Botany	None (no survey botany)
Botany Courses in Major	Biology 18 - Plant Development Biology 19 - Plant Physiology (one course each, no prerequisites)
Who Takes Botany 18 and 19	Biology majors have option of taking Biology 16 and 17 (animal) or Biology 18 and 19 (plant)
Trends in Botany Enrollment	Although small numbers of students opt for botany courses, number holding steady
Faculty Contact	Dr. Carl S. Pike, Associate Professor of Biology

School	LEBANON VALLEY COLLEGE (Annville, PA)
Size	900 undergraduate
Biology Major	Biology
Core Courses in Biology Major low.div. courses # 100-299	General Biology I - 111 (lec/lab):4 sh General Biology II - 112 (lec/lab):4 sh Special Topics 191 1-6 sh Genetics 201 (lec/lab):4 sh Biology Seminar 499 1-2 sh
Introductory Biology	Gen. Biology I - 111 (3 lec/3 lab):4 sh cell biology, genetics, taxonomy, evolution Gen. Biology II - 112 (3 lec/3 lab):4 sh physiology, embryology, botany, ecology (prerequisites - none)
Course Philosophy	1) Basic introduction to botany/zoology courses 2) Integrated approach 3) Cover anatomy of plants/animals as it relates to physiological function
--Introductory Botany	None (no survey, no core, no low. div. botany)
Botany Courses in Major	Survey of Plant Kingdom 302 (lec/lab):4 sh (text: Raven) (prerequisite - Biology 112) Plant Physiology 307 (lec/lab):4 sh (prerequsite - chemistry)
Who Takes Botany Courses	All biology majors take at least one botany course
Trends in Enrollment	Enrollment holding steady
Faculty Contact	Dr. Susan E. Verhoek, Assistant Professor of Biology

School	HARRISBURG AREA COMMUNITY COLLEGE (Harrisburg, PA)
Size	6,866 (4047 FTE)
Required Biology Courses	General Biology 101 (3 lec/3 lab):4 sh biochemistry, higher organisms, ecology, plant groups and classification General Biology 102 (3 lec/3 lab):4 sh plant/animal metabolism, heredity, reproduction, evolution, animal groups and classification
--Introductory Botany	Botany 212 (3 lec/3 lab):4 sh (prerequisites - none)
Course Philosophy	1) Cultivate knowledge and appreciation of plant world 2) Learn local flora 3) Learn basic botanical concepts 4) Learn lab/green house skills
Who Takes Botany 212	Interested students, majors; no supporting majors feeding into course (agriculture/horticulture/landscaping)
Trends in Enrollment	Down. Course last taught several years ago. 15 students minimum per class
Related Biology Courses	Field Biology 130 (lec/lab):4 sh collecting/identifying/studying local flora and fauna (prerequisites - none)
Faculty Contact	B. Michael Hollick, Professor of Biology

BIOLOGICAL SCIENCES DATA SUMMARY SHEET

	MULTIPLE MAJORS (concentr, option, special.)	BOTANY MAJOR	BIO MAJ CORE bot/zool integrated	BIO MAJ CORE intro botany included	INTRO BOTANY not in core	PREREQ-UISITES intro biology	PREREQ-UISITES intro botany	SEMESTERS OF INTRO BOTANY 1 or 2	#UNITS OF INTRO BOTANY [Cred. hr. / sem. hr.]	WHO TAKES INTRO BOTANY	ENROLL-MENT TRENDS IN INTRO BOTANY	FEED INTO BOTANY FROM OTHER MAJORS	LECT TEXT / LABS
PENN STATE	yes	yes	–	yes	–	no	yes	1	4	all biology maj.	UP	yes	RAVEN / DEAN (wcl
RUTGERS	yes	yes	yes	–	yes	no	yes	1	4	all botany maj.	UP	no	RAVEN / own
CORNELL	yes	yes	yes	–	yes	no	yes	2	3	all botany maj.	UP	yes	RAVEN / own
FAIRLEIGH DICKINSON	yes	no	–	yes	–	–	no	1	4	all biology maj.	SAME	no	RAVEN / EVERT (wcl
SUNY	yes	no	yes	–	yes	no	no	1	one COURSE	optional	DOWN	no	RAVEN
MILLERS-VILLE	yes	no	yes	–	no	no	–	–	–	–	UP	no	CURTIS / own
SHIPPENS-BURG	yes	yes	–	yes	–	–	no	1	4	all bio/med tech maj.	SAME	yes	RAVEN / own
DREW	yes	yes	–	yes	–	no	yes	1	4	all bot/biol maj.	DOWN	no	ESAU / own
DICKINSON	no	no	–	yes	–	–	no	1	one COURSE	all biology maj.	SAME	no	JOHNSON / own
MESSIAH	no	no	–	yes	–	1	no	1	3	all biology maj.	SAME	no	KEETON / own
FRANKLIN MARSHALL	no	no	yes	–	–	–	–	–	one COURSE	–	DOWN	no	CURTIS / own
LEBANON VALLEY	no	no	yes	–	yes	no	yes	1	4	all biology maj.	DOWN	no	RAVEN / own
HARRISBURG	no	no	–	–	–	no	no	1	4	–	DOWN	no	–

OBSERVATIONS

The diversity between the colleges and universities visited was quite apparent. Aside from size and whether public or private, they varied in number of biology majors offered and in concept on how to best teach introductory biology courses. Due to the inherent statutory limitation upon Mt. San Antonio College as a public two-year community college serving as a feed-in to upper division schools with differing graduation requirements for biology majors, complete application of the data to our botany courses is not possible. Yet, a number of things can be said.

Integrated or separate introductory courses

As to be expected, the large multi-college universities had impressive botany programs. All had a single Biological Science major with a number of concentrations (options, specializations) in the major. Aside from the basic introductory principles - biochemistry, metabolism, reproduction, cell structure/function, they all felt it is difficult to teach a truly integrated general biology so as to satisfactorily cover both botany and zoology. Comments made included: "unless the course is taught by a botanist the examples tend to be zoological" (Cornell); "aside from basic concepts, how do you explain plant and animal reproduction together, or plant translocation and human circulation together" (Penn State); "an integrated approach requires an instructor who is equally prepared or adept in all inter-disciplinary aspects of the course, and such an instructor is difficult to find" (Penn State); "integrated texts, such as Keeton, contain too little botany" (Cornell).

Ways of accomplishing a modified integration of approach were to: have a botanist/zoologist team teach the course together (Millersville); teaching one semester of introductory biology from a botanical point of view by a botanist, and a second semester from a zoological point of view by a zoologist (Dickinson); having a botanist teach the introductory biology course so he would use plant examples (Cornell); or following up a basic introductory biology course with an introductory botany one (Drew).

One university using a botanist/zoologist team for teaching an integrated introductory course, admitted that botany students coming directly from this course into advanced botany courses had a poorer introductory background (Millersville); another felt an integrated introductory course weakens the botany program (Penn State). One school (SUNY - Binghamton) in which botany has been entirely eliminated as a requirement for biology majors, felt that a major step backward had been taken.

An integrated basic principles course seemed to work best where there were multiple biology majors and students moved quickly into a botany concentration (option, specialization).

Yet, one school (Millersville) was quite enthusiastic about their integrated introductory courses for another reason. After completing the introductory courses, majors select courses from three advanced cores - botany, zoology, and cellular/microbiology. All majors must select a minimum of two courses from each such core. While students coming into advanced botany courses do not have as thorough an understanding of basic botanical principles

as they did when the department used to require introductory botany, the trade-off is that now the advanced botany courses are full every semester. Before, when students took introductory botany and introductory zoology, fewer students took advanced botany courses and those classes did not fill up.

One school (Shippensburg) still teaching introductory botany and advanced traditional botany courses, found that the upper division advanced botany enrollments were in trouble. Even one large university (Rutgers) found that some of the advanced botany enrollments were down.

Lest the reading of this seems confusing, it is. Millersville (part of the Pennsylvania State College system) recently surveyed biology departments of public and private colleges and universities across Pennsylvania and found no uniformity in programs; rather much diversity. Even among the Pennsylvania state colleges there was no uniformity.

Feed-in of botany students from other majors

Schools that fared best in retaining strong botany programs were not only the larger schools, but ones with a strong feed-in of students from other departments. Penn State (43,000 undergraduates) gets ½ of its botany students from its colleges of agriculture, agronomy, and horticulture; Cornell (12,000+ undergraduates - and a national reputation in botany) gets many students in botany from Plant Sciences (pomology, plant breeding, etc.). In one school (Shippensburg), 2/3 of the introductory botany students are medical technologists - they are required to take the course. Other schools are planning to develop new sources of students for their introductory botany courses.

Millersville and Messiah, both of whom have no agriculture programs, are developing horticultural courses or programs.

Other schools, particularly smaller ones with single biology majors, require introductory botany of all biology majors (Drew, Messiah, and Dickinson).

One of the brightest stories of innovation in developing new sources of students in botany was encountered at Rutgers. The biological sciences there are now developing a new major, Biotechnology for Agriculture. The word agriculture is included in the title in order to gain access to public funding. This new major will be a specialization in cellular, molecular, and genetic botany. (Incidently, Rutgers has noticed that the enrollments in cellular and molecular botany courses has been higher than those in other courses.) Much of the newer research in DNA is being done with plants (fewer problems with ethics, material more available, ease of working with materials). The major is being called for by biotechnical industries (pharmaceuticals - Johnson/Johnson, Schering, Squibb; foods - Campbells; agrochemicals - Monsanto, Cyanimide; seed companies; genetic engineering). Tomato growing (Campbells) was one of the first industrial ventures into DNA research. The industry needs many researchers/technicians with more biological training than gained from reading newsmagazines or newspapers. Heretofore the industry has relied on chemists. Rutgers is liaisoning with industry as a source for new funding (grants - faculty, students; scholarships; laboratory refurbishing) and is more favorable to those industries putting up front money before expecting services. Rutgers says this new major is bringing new perspective to their

botany program. Similar new biotechnical majors are being initiated or considered in Minnesota, Texas, and California.

Schools in the most trouble in their botany courses were either small in size or had no reliable feed-in of students from other courses (Lebanon Valley, Franklin and Marshall, Harrisburg Area Community College). Harrisburg, in fact, last offered a low-level introductory botany course several summers ago. They have not been able to enroll 15 students to make the course go since. The only botany-like course taught at Harrisburg each year is a field biology course for nonmajors.

At Mt. San Antonio, the botany courses survive on the feed-in of students from the Agriculture Department. Without that relationship there would be too few students to qualify enrollment.

One or two semesters of introductory botany

Most of the schools visited taught a one-semester introductory botany course rather than a two-semester sequence. An examination of the content of their botany courses, however, revealed that often the content of the traditional second semester of the two-course sequence was contained in some other non-introductory botany course.

Most commonly the introductory botany courses dealt with the structure and function of angiosperms (similar to the first semester Plant Structure and Function (Botany 1) course taught at Mt. San Antonio). Two schools (Shippensburg, Rutgers) combined Mt. San Antonio's two-semester sequence (Botany 1, Botany 2 - Plant Morphology) into a single semester course.

Commonly, when schools taught an integrated biology course, it included those topics (biochemistry, cell structure/function, metabolism, cell division) that are included in the first sem-

ester course at Mt. San Antonio.

Texts

Over half of the schools used Biology of Plants, 3e, Raven, et.al, (Worth) for their introductory botany courses. Second most commonly used was Biology, 4e, Curtis (Worth).

Laboratory manuals

Virtually all of the schools visited produced their own laboratory materials. Two of them used published manuals.

CONCLUSIONS AND APPLICATIONS

There were a number of observations from these visits that might have application in the teaching of botany at Mt. San Antonio.

Presence of a botany course

There seems to be little doubt as to the need for botany in a bona fide lower division biological sciences curriculum. Everywhere, a background in plants was viewed as essential in the education of a biological sciences major.

Integrated or non-integrated

From speaking to the leaders in botany education, particularly those in the name universities with graduate botany programs, there is evidence that teaching an integrated botany/zoology course for students contemplating a transfer to a four-year school would be unwise. Karl Niklas (Cornell) and Carl Keener (Penn State) were both very assertive on the continued need for a strong program in traditional botany. Since such universities set the pace in botany education/research, have reputations in

graduate training, and serve as models for schools to which our students transfer, we may take reassurance in our attempts to maintain our program in botany.

One semester versus two semester

We may continue to follow developments here rather carefully. While it is true we teach a two-semester introductory botany sequence, this is the only majors botany we teach in lower division. Some of the schools observed taught the contents of our second course in the second year of their lower division. To say we do or do not teach a two-semester sequence in introductory botany demands examination of course content.

Aside from our own personal wishes regarding one or two semesters of introductory botany, we want to be in step with the schools to which our botany students transfer.

Feed-in of students

In my observations, one thing became most apparent. Those schools with reliable associated majors in plant sciences (agriculture, horticulture, etc.) helped guarantee successful programs in introductory botany. Virtually every school with troubled enrollments or dropped botany requirements had no plant science program to which they could relate or rely on.

Among community colleges, Mt. San Antonio is most fortunate in having a reputable Agriculture Department with majors in plant sciences. Our introductory botany course exists both to provide for those biological science students needing or wanting botany and, very importantly, for those agriculture students needing it for their programs. Our botany course must meet

their needs in course content and scheduling.

Text

In the botany courses at Mt. San Antonio we have been using the text Botany, 6e, Wier, et.al (Wiley). A mainline text of long reputation, I encountered various objections to its adoption and none of the schools visited were using it. A careful look at Biology of Plants, 3e, Raven et. al (Worth) merits attention. This we are doing.

Laboratory manuals

Lab materials are always a nemesis. Not totally satisfied with the labs we use, particularly first semester, I am looking at some of the manuals, campus-developed and published, whose use we encountered.

Number of units

By a considerable margin, schools visited taught botany as a 4 credit hour (ch) or semester hour (sh) course. This is what we do. We would be hard put to reduce it to a 3 ch course. Again, we must keep contact with our upper division transfer schools and stay in step with them.

Prerequisites

Most of the time the introductory botany courses were taught without prerequisites. In all cases the introductory biology courses were taught with no prerequisites. Only when first botany courses were sophomore or junior year courses were there any course prerequisites. Since our course in Botany 1 at Mt. San Antonio covers basic metabolic, cellular, and biochemical concepts, no prerequisites should be required.

VALUE OF SABBATICAL

All in all, both parts of my sabbatical were well worth the effort and cost, and fulfilled my expectations.

As for the study of the arboreta of northern Europe, the survey was fascinating even though tiring. It gave me the opportunity to renew my graduate taxonomy training and to place such information in practical context. While the array of taxa worldwide is myriad and difficult for laypersons to grasp, the notes and many slides of new and unusual plants and flowers is of certain value to me, my botany classes, and my department colleagues. Seeing firsthand the botanical institutions of northern Europe, a historical locale that has contributed so richly to foundations of modern botany, was personally enriching. Even since my return, I am able to build into my lectures signficant data from my travels.

Regarding the study of introductory botany in selected colleges and universities, I have found usable basis for evaluating what we are doing at Mt. San Antonio in introductory botany and have been introduced to instructional developments we need to investigate and be sensitive to. Conversations with other professionals and investigations of reputed botany programs give added direction to my botany instruction and course development at the college.

I express appreciation to the Sabbatical Leaves Committee, to the administration, and to the Board of Trustees of Mt. San Antonio College for allowing me to do these studies.

APPENDICES

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The Pennsylvania State University Bulletin, Baccalaureate Degree Programs, 1983-1985
University Center at Binghamton State University of New York, Undergraduate Bulletin, 1983-1985

Henderson, D. M., International Directory of Botanical Gardens, IV, 4th edition, Koeltz Scientific Books, Koenigstein, West Germany, 1983.

MT. SAN ANTONIO COLLEGE
Salary and Leaves Committee

PM 4:26
PERSONNEL OFFICE

APPLICATION FOR SABBATICAL LEAVE

Name of Applicant Curtis O. Byer

Address 559 Clark St., Upland, CA 91786

Employed at Mt. San Antonio College beginning September 1964

Dates of last sabbatical leave:

From _____ To _____

Department Biological Sciences Division Natural Sciences

Length of sabbatical leave requested:

One semester X
Fall X Spring _____

Two semesters _____

Administrative _____

Purpose of sabbatical leave:

Study _____ Independent Study and Research X

Travel X Combination (specify) X

NOTE: Sabbatical periods are limited to contractual dates of the academic year.

Effective dates for proposed sabbatical leave:

From September 1984 To January 1985

and (if taken over a two school year period)

From _____ To _____

Attach a comprehensive, written statement of the proposed sabbatical activity(ies) including a description of the nature of the activity(ies), a timeline of the activity(ies), an itinerary, if applicable, the proposed research design and method(s) of investigation, if applicable.

Attach a statement of the anticipated value and benefit of the proposed sabbatical activity(ies) to the applicant, his/her department or service area, and the College.

Any change or modification of the proposed sabbatical activity(ies) as evaluated and approved by the Salary and Leaves Committee must be submitted to the Committee for reconsideration.

Curtis O. Byer
Signature of Applicant

November 30, 1983
Date

Applicant's Name Curtis O. Byer

The acknowledgment signatures reflect awareness of the sabbatical plan for the purpose of personnel replacement. Comments requested allow for recommendations pertaining to the value of the sabbatical leave plan to the College. Applicants must obtain the signatures of acknowledgment prior to submitting application to the Salary and Leaves Committee.

ACKNOWLEDGMENT BY THE DEPARTMENT/DIVISION

Signature of Department Chairperson [signature] Date 11-30-83

Comments:

Signature of Division Chairperson [signature] Date 11/30/83

Comments:

ACKNOWLEDGEMENT BY THE OFFICE OF INSTRUCTION

Signature of Asst. Superintendent/Vice President, Instructional & Student Services [signature] Date 12-1-83

Comments:

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FINAL ACTION BY THE SALARY AND LEAVES COMMITTEE:

_____ Recommend approval to the Board of Trustees

_____ Not recommend approval to the Board of Trustees

_____ _____
Signature - Chairperson, Salary and Leaves Committee Date

_____ _____
Signature - Authorized Agent for the Board Date

myw
10/13/83

SABBATICAL LEAVE APPLICATION PROPOSAL

I am applying for a sabbatical leave for the purpose of research and travel relating to my teaching areas of botany, plant and animal biology, and human sexuality.

I want to use the opportunity to observe plant geography, in a region that has interested me since graduate training in botany, and to visit some historical botanical gardens and libraries, to which I make reference in my courses in Botany (1 and 2), and Plant and Animal Biology (Biology 2). I want to visit several well-known centers of research in human sexuality, a course I have coordinated and helped teach since its inception on this campus. Further, I want to investigate the teaching of undergraduate botany in the mid-Atlantic states, find what is being done to enhance its teaching, and learn what we might do to further reestablish botany as a significant course in our Biological Science offerings.

My plan is to:
(A) Starting in early September, 1984, and extending for six to eight weeks, to visit the countries of Sweden, Norway, Denmark, and the Netherlands (in approximately this sequence). Upon recommendation of Dr. Robert Thorne (Rancho Santa Ana Botanic Garden) and Dr. Sherwin Carlquist (Pomona College/ Claremont Graduate School), I would visit gardens, museums, and universities from the following list:

(September) Sweden: Stockholm - National Museum
Swedish Institute for Sexual Research
Uppsala - - University of Uppsala (home of Linnaeus, father of Botanical nomenclature)
Gothenburg - Botanic Garden (one of world's largest)
Maritime Museum

(September) Norway: Oslo - - - -Botanic Gardens
Ekeburg Nature Park
Maritime Museum
Bergen - - -Maritime Museum (center of Norwegian fishing industry)
Aquarium

(September/ October) Denmark: Copenhagen - Botanic Garden
Zoological Museum

National Museum
University of Copenhagen
North Sealand - National Historical Museum
Fredericksborg - National Museum

(October) Netherlands: Amsterdam - Aalsmeer Flower Market
Rijkmuseum
Bennebrock - Linnaeshof Garden (extensive flower display)
Leiden- - - University of Leiden
Lunde - - - Botanic Garden
Lisse - - - Keukenhof Gardens
Rotterdam - Boymans-van-Beuningen Museum

(B) Returning to the United States by the middle of October, and for the next two months, I plan to visit colleges and universities in the mid-Atlantic states that have gained reputations in the teaching of Botany and the Biological Sciences. Upon recommendation of Dr. Kenneth Hoover, past president of the Pennsylvania Academy of Sciences, I would plan to visit schools from the following list:

(October) Delaware: Marine Biological Station (Lews)

Maryland: St. Mary's University (Baltimore)
Salisbury State College (Salisbury)
University of Maryland (College Park)

(November) New Jersey:
Rutger's University-The State University of New Jersey (New Brunswick)
Rutger's University-The State University of New Jersey, Rutgers College (New Brunswick)
Rutger's University-The State University of New Jersey, Cook College (New Brunswick)
Fairleigh Dickinson University, Madison Campus (Madison)
Drew University (Madison)

(November) New York: Cornell University (Ithaca)
State University at Binghamton (Binghamton)
Corning Community College (Corning)
State University of New York at Stony Brook (Stony Brook)
Broome Community College (Binghamton)

(November/ December) Pennsylvania:
Dickinson College (Carlisle)
Pennsylvania State University (State Colleg
Shippensburg State College (Shippensburg)
Bucknell University (Lewistown)
Franklin and Marshall College (Lancaster)
Lackawanna Junior College (Scranton)
Millersville State College (Millersville)

In my college visitations I expect to make contact with the following people or their replacements:

Dickinson College - Dr. Paul Beibel
Shippensburg State College - Dr. Larry Klotz
Bucknell University - Dr. Manning
Rutgers University - Prof. William Roberts

My investigation at each of these schools will include:

1) The philosophy of the course
2) How the course fits into the natural sciences curriculum
3) The content of the course
4) Materials being used (texts, lab manuals, ancillary materials
5) How is the course made attractive to students
6) Who is taking the course
7) Trends in enrollments
8) New innovations and technologies in teaching the course

With the information gained from this research, I would plan to review the Botany 1 and 2 programs which I teach in terms of course description, lecture and lab content and sequence, and appeal to students both in the 4-year bachelors and the 2-year vocational programs.

This proposed sabbatical would be of value both to myself and to Mt. San Antonio College in the exposure I would have to places and people I teach about but have never had the opportunity of seeing first-hand. My teaching of Biology 2 and of Botany, for example, includes significant reference to plant and animal geography. These courses have benefitted directly from the various types of field work I have heretofore engaged in. I would anticipate returning from this refresher leave as a more enthusiastic person, with lectures of greater relevancy, and as an instructor of greater value to the college.

ADDENDUM

Amplification on questions raised regarding my application:

1) Expand on what would be accomplished on visits to gardens and museums.

As stated in my application, I teach two courses (Botany, Biology 2), both of which involve extended reference to plant geography. To aid my own background I, several years ago, completed a graduate course in Plant Geography at Rancho Santa Ana Botanic Garden (Claremont Graduate School). Any botanic garden can include only a small portion of the vast array of plants worldwide. All gardens I have seen have representations of regional flora which is generally not seen too widely. I have visited and photographed gardens throughout California, the Hawaiian Islands, the Pacific Northwest, the eastern U.S., and many of the national parks. With specific interest in plant classification, it is my intent to visit some European gardens to observe examples of plants I would possibly never otherwise see.

I would hope to visit some European museums for exactly the same reasons, that of seeing new biological entities. My Biology 2 course has a major segment devoted to animal species worldwide. Those museums I have visited each has content of regional significance usually seen in few other museums.

2) Specify a minimum number of schools to be visited.

I would plan to visit at least six universities/colleges in New Jersey, New York, and Pennsylvania. If, and as I had more time it would be my intent to expand the number of visits I would make.

3) Clarify paragraph "...with the information gained..."

Upon evaluation of the information I gather from my visits regarding the teaching of Botany, it is my intention to modify the course program, where I can, to attract more students into the Botany course and to more effectively prepare them for either terminal programs at Mt. San Antonio or for transfer.

4) Clarify that you will make contact with more than the four (4) persons listed on the last page.

I have already made contact with Dr. Kenneth Hoover (Pennsylvania) and Dr. William Roberts (New Jersey). They are contact people who have identified main college/university people who will either be the person I plan to visit or will direct me to that person. The person I visit must be available (on campus) the semester I visit and be immediately involved with the course I wish to observe. This primary person could very will change between now and nine months from now, especially in larger schools. I have recently faced this very problem in contacts of similar nature with Fullerton State and Cal Poly, Pomona regarding our Botany course. In both cases I have gotten the necessary information from persons I was not originally aware of.

SABBATICAL SCHEDULE FALL SEMESTER 1984-85

MONTH	WEEK	
September	1	Travel and visits to arboreta in Belgium: Brussels
	2	West Germany: Munich, Frankfurt, Hamburg
	3	Finland: Turku, Helsinki
	4	Sweden: Stockholm, Uppsala
October	5	Norway: Oslo
	6	Norway: Bergen Sweden: Gothenburg
	7	Denmark: Copenhagen, Aarhus
	8	Netherlands: Utrecht, Leiden Belgium: Ghent, Meise
November	9	College/University visits: Dickenson College, Shippensburg University
	10	Harrisburg Area Community College, Lebanon Valley College, Millersville University, Franklin and Marshall College
	11	Pennsylvania State University
	12	Drew University, Fairleigh Dickinson University, Rutgers University
December	13	Cornell University, SUNY @ Binghamton, Messiah College
	14/16	Curriculum research: Pennsylvania
January	17/18	Curriculum research: Pennsylvania

FISHERIES, FLOWER CENTERS, AND MUSEUMS VISITED

FINLAND

- Turku
  - Biological Museum
- Helsinki
  - Zoological Museum

SWEDEN

- Stockholm
  - Biological Museum
  - Wasa Museum
  - National Museum
  - Gustavsberg Museum
- Uppsala
  - Geological Museum
  - Biological Museum
  - Zoological Museum

NORWAY

- Oslo
  - Munch Museum
  - Kon Tiki Museum
  - Norwegian Folk Museum
  - Fram Museum
  - Norwegian Maritime Museum
  - Gustav Vigeland Museum
- Bergen
  - Maritime Museum
  - Aquarium

DENMARK

- Copenhagen
  - Zoological Museum
  - National Museum
- Esbjerg
  - Fisheries and Maritime Museum
  - Aquarium and Sealarium
  - Fish Auction Hall

NETHERLANDS

- Aalsmeer
  - Aalsmeer Flower Auction
- Amsterdam
  - National Museum
  - Linnaeshof Gardens
  - Keukenhof Gardens

SYLLABI OF SELECTED INTRODUCTORY BOTANY PROGRAMS

BIOLOGY 102 Syllabus - Penn State University

SPRING SEMESTER 1984
M,W,F 8:00-8:50 A.M., Schwab Auditorium

INSTRUCTORS: C. S. Keener, 306 Buckhout Lab (865-6201)
Office Hours: M,T,W (9:00-11:00)

R. A. Pursell, 307 Buckhout Lab (865-9651)
Office Hours: M (1:00-2:00), T (9:00-10:00), W (11:00-12:00)

LABORATORY COORDINATOR: Debbie Eberts, 352 N. Frear

TEACHING ASSISTANTS: To be announced later.
NOTE: Be sure you know the office hours of your teaching assistant. These will be posted at the entrance to Rooms 201 and 207 Buckhout Laboratory, in addition to the teaching assistants' office doors.

TEXT: Raven, Evert & Curtis. 1981. BIOLOGY OF PLANTS, 3rd Ed., Worth Publishers, Inc., N.Y.
OPTIONAL TEXT: Curtis. 1983. BIOLOGY, 4th Ed., Worth Publishers, Inc., N.Y.

LABORATORY MANUAL: Dean, H. L. 1982. BIOLOGY OF PLANTS. 5th Ed., Wm. C. Brown Publishers, Dubuque, Iowa.

LECTURES: Three/week. Regular attendance is strongly recommended. Mastery of both text and lecture material is assumed. Regardless of attendance, each student will be held responsible for all materials and announcements presented.

LABORATORY: One two-period session/week. Attendance to your assigned laboratory section is obligatory.

EXAMINATIONS: Examination schedule is as follows:

A. Three 1-hour exams held on the following Wednesday evenings from 9-10 in the FORUM (room assignments to be assigned): February 15, March 28, April 25.

B. Comprehensive Final (Consult Final Exam Schedule).

C. NOTE: Material from Lecture, Texts, and Laboratory Exercises will be included in each exam.

EXAMINATION MAKE-UP: Any examination or quiz missed may be made up only if an authorized medical excuse is presented to the instructor no later than one week after the exam or quiz was given. Those to whom this privilege is extended will make up the missed exam given during a common time following the 3rd hour exam.

COURSE GRADE: The final grade for this course will be determined from the following:

Exams 1, 2, 3 (100 points each)	300 points
Comprehensive Final Exam.....	150 points
Laboratory Practical Exam and Reports.....	150 points
	600 points

Neither the exams nor the final average will be curved. Grades will be calculated by strict percentage (90-100 = A; 80-89 = B; 70-79 = C; 60-69 = D; 59- and below = F). Exams will be returned to you in the laboratory. If there is any question concerning the grading, the exam is to be returned to the laboratory assistant immediately. No adjustment in a grade will be considered once the exam is removed from the laboratory.

Three unexcused absences from laboratory will be permitted, but each additional unexcused absence will result in a decrease of the final grade by one letter.

There is no way that a course grade can be imporved by term papers, etc. Requests to do such work will not be honored.

GRADE-REPORT POLICY: Grades will neither be posted nor issued via telephone. The final grade will be mailed only if the instructor is presented with astamped self-addressed envelope (no postcards).

DEFERRED GRADES: Requests for deferred grades will be approved only if all laboratory exercises and examinations have been completed satisfactorily up to the FINAL EXAM.

COURSE OUTLINE, BIOLOGY 102, SPRING SEMESTER, 1984

Jan.	16	(K)	Introduction (Introduction, pp. 1-12)
	18	(K)	Plant Tissues (ch. 21; review ch. 1: 15-35)
	20	(K)	" "
	23	(P)	Vascular Plant Structure: Seed and Root (chs. 20, 22)
	25	(P)	Root
	27	(P)	Stem (ch. 23: 445-453)
	30	(P)	Stem (ch. 24)
Feb.	1	(P)	Stem
	3	(P)	Leaf (ch. 23: 453-467; 471-475)
	6	(K)	Flowers, Fruit, Pollination (ch. 23: 467-471)
	8	(K)	" " " (ch. 18: 359-363)
	10	(K)	" " " (ch. 19: 377-401)
	13		EXAM I
	15	(K)	Vascular Plant Transportation (ch. 28; review Ch. 3)
	17	(K)	" " "
	20	(K)	Photosynthesis (ch. 6; review chs. 2, 4)
	22	(P)	Respiration (ch. 5)
	24	(P)	Metabolism (ch. 27)
	27	(P)	Growth and Development (chs. 25, 26)
	29	(P)	" " "
Mar.	2	(P)	" " "
	12	(K)	Reproduction (mitosis, meiosis) (ch. 1: 36-44; Ch. 8: 132-138)
	14	(K)	Genetics (ch. 8: 139-146)
	16	(K)	" (Curtis, ch. 18)
	19	(K)	"
	21	(P)	Reproduction (life cycles) (ch. 10: 180-181)

	23		EXAM II
	26	(K)	Classification (ch. 10)
	28	(K)	" (Kingdoms)
	30	(P)	Algae (ch. 11: 184-192; 202-204)
Apr.	2	(P)	" (ch. 14)
	4	(P)	Fungi (ch. 12)
	6	(P)	" (ch. 13)
	9	(P)	Bryophytes, LVPs (ch. 15)
	11	(P)	" " (chs. 16, 17)
	13	(K)	Gymnosperms (ch. 18: 338-356)
	16	(K)	Angiosperms (Ch. 18: 336-358; 363-371)
	18		EXAM III
	20	(K)	Population Biology: Genetics (ch. 9; Curtis, Section 7: 880-948)
	23	(K)	Population Biology: Genetics
	25	(K)	" " "
	27	(P)	Community Structure (Ch. 29)
	30	(P)	Community Interaction
May	2	(P)	Biogeography (ch. 13)
	4	(K)	Humans and Environment

BIOLOGY 102 LABORATORY SCHEDULE
SPRING SEMESTER 1984

WEEK OF:	LAB TOPIC	EXERCISE #, or H	DROSOPHILA
Jan. 16	Root	15	
23	Primary Stem	9, 13, 14	
30	Secondary Stem	10, 11, 12	
Feb. 6	Leaf, Flower Students Plant for Hormone Experiment	2, 5, 19 (part)	
13	Fruit, Pollination	20, H	Study in Lab, Review Experiment
20	Photosynthesis	H	
27	Photosynthesis Treat Hormone Plants	H	353 N. Frear* Mon. - Clarify F_1 Set Up F_2
Mar. 5	NO LABS, NO CLASSES MON.-SAT.		Friday - Dump
12	Hormones, Growth Movements Transpiration	H, 18, 8	Classify F_2 Start F_3
19	Algae	22, 23	
26	Algae, Fungi	24, 25, 26, 27	Classify F_3 Start F_4
Apr. 2	Fungi, Lichen	28, 29, 30	
9	Bryophytes, Ferns	31, 32	Classify F_4
16	Horsetail, Clubmoss, Gymnosperm	33, 34, H	
23	Angiosperm	19 (part)	
30	Genetics - Human & Plant	H, 36	

*Hours this room will be open to be announced.

BOTANY BI-201

Catalog Description- A study of the plant kingdom with major emphasis on the primary producers of the ecosystem; the morphology, anatomy, physiology, ecological significance and evolutionary position of members of the plant kingdom.

Purpose of the Course- To present a foundation in the area of plant sciences.
- To increase awareness of our dependence upon plants, especially in times when natural resources are being threatened and depleted.
- To develop an attitude which will exhibit:
  a. logical and orderly thinking.
  b. the ability to correlate information.
  c. the ability to be a discriminating reader.
  d. open mindedness.
  e. formation of better study habits.
  f. an active and intelligent curiosity.

Time- Lecture-	Monday, Thursday	9:00-9:50	Room S-11
Lab 1 -	Monday, Thursday	1:15-2:55	Room S-3
Lab 2 -	Monday, Thursday	3:05-4:45	Room S-3

Grading- Lecture- constitutes 50% of final grade - determined by 3 or 4 theory examinations each covering a portion of the course.

Lab - constitutes 50% of final grade - determined by practical-type examinations and other requirements to be announced.

Text- Biology of Plants, 3rd ed.
Raven, Evert, Curtis
Worth Publishers

Lab Manual- Laboratory Topics in Botany
Evert & Eichhorn
Worth Publishers

4 126

BOTANY BI201- Course Outline

syllabus - Fairleigh Dickinson University

Topic		Text References
1. Introduction:	nutrition types	introduction 1-12
	plant classification	10:169-178;182-183
	essential nutrients	27:537-541;545-557
	levels of integration	
	trophic levels in the ecosystem	29:579-594
	succession	12:225-227;29:579-
	plant distribution	30:595-612
	role of vegetation in the ecosystem	
2. Seed Structure, Seedling Development		20:403-415
3. The Flowering Plant:	general features	
	flower structure	18:356-363
	flower development	23:467-471
	fruit formation, types	19:393-395
	regulation of plant growth & development	25:501-517
	external factors and plant growth	26:518-533
	evolution of flowering plant	19:372-400
4. Vegetative Reproduction:	types	9:154-155
	specialized plant structures	
5. The Cell:	structure and function	1:15-44
	reproduction	
6. Plant Tissues		21:416-431
7. The Root System:	structure and function	12:237-239;22:432-4
	soils and soil relations	27:541-545
	nutrients and recycling	27:545-557
8. The Shoot System:		23:445,453,466
	Leaf- structure and function	23:454-466
	water movement	28:559-569
	Stem- structure and function	23:446-452;471-475
	tree growth	24:476-496
	wood structure	
9. Prokaryotes:	Kingdom Monera- bacteria	11:184-204
	cyanobacteria	
10. The Life Cycle:	alternation of generations	8:132-139
	meiosis	10:178-181
11. Eukaryotes:	Kingdom Protista- algae	14:251-285
	Kingdom Fungi	12:212-240
	Kingdom Plantae- nonvascular plants	15:287-303
	vascular plants	16:304-314
	nonseed producers	17:317-337
	seed producers-	
	gymnosperms	18:338-356
	angiosperms	18:363-371

GENERAL BOTANY
BIO 120 (4 credits)
Fall, 1984

Instructor: Dr. Larry Klotz
Office: FSC 153, ext. 1402
Office hours: M, W: 10-12; F: 10-11

This course deals with the structure, function, diversity, and significance of plants. Morphology, anatomy, physiology, ecology, and taxonomy are considered. Three periods of lecture and two periods of lab are scheduled per week, and many of the labs require additional time. The course has no prerequisites, but it is designed for biology majors. Some background in chemistry is helpful.

Text: Raven, P. H., R. F. Evert, and H. Curtis. 1981. Biology of Plants. Third ed. Worth, New York.
Required for labs: textbook; looseleaf notebook; 15-cm ruler; plain, white paper; pencil and eraser.
Required for exams: #2 pencils, eraser, clear mind, thorough knowledge.
Other requirements: ruled, white paper; stapler; paper punch; gummed reinforcements; colored pencils.

Objectives:
1. to acquire a foundation of knowledge about the structure, function, diversity, and significance of plants;
2. to make comparisons between plants and other kinds of organisms, such as animals and bacteria;
3. to develop skill in scientific methods of observation, inquiry, and expression.

These objectives will be attained by means of the five interrelated components of the course: lectures, laboratories, reading assignments, written assignments, and examinations.

Evaluation:
three one-hour exams----------120 points (40each)
final exam (partly comprehensive)--------80 points
four quizzes and four reports----------40 points (5 each)
240 points.

Quizzes and exams will contain questions from both lectures and labs.
Dates of the quizzes are indicated on the syllabus with an asterisk (*).
Correct spelling is required for full credit on quizzes and reports.
Reports must be typewritten and stapled.
Students must avoid plagiarism from the textbook and from each other.
Makeups will not be given except for absences excused by the dean.
Each unexcused absence from laboratory will result in a deduction of seven points from the final total.
Notebooks will be examined by the instructor. Lecture and laboratory materials must be integrated and arranged according to topic. Points will be deducted for poorly organized notebooks.

DATE	LECTURE TOPIC	LABORATORY EXERCISE	TEXT CHAPTER
Sept.5	Introduction	(no laboratory)	Introduction
7	Membrane Structure		1

	10	Membrane Function	Plant Cells	1
	12	Organelles		2
	14	Cell Wall		2
	17	Mitosis	Mitosis	3
(*)	19	Stems: Primary Growth		23
	21	Cell Types		21
	24	Stems: Secondary Growth	Stems: Growth in Length	24
	26	Plant Hormones		25
	28	Photoperiodism		26
Oct.	1	Temperature and Growth	Stems: Growth in Girth	26
	3	Translocation in Phloem		28
	5	Translocation in Xylem		28
	8	EXAM I	Roots and Transpiration	22
	10	Photosynthetic Pigments		6
	12	Light Reactions		6
	15	Dark Reactions	Leaves and Photosynthesis	6, 23
(*)	17	Photosynthesis: Summary		6
	19	Respiration		4, 5
	22	Plant Nutrition	Photosynthesis and Respiration	27
	24	Meiosis		7, 8
	26	Flowers: Gametogenesis		18
	29	EXAM II	Flowers and Fruits	
	31	Flowers: Fertilization		18
Nov.	2	Fruits		18, 19
	5	Seeds and Seedlings	Seeds and Seedlings	20
	7	Pollination		19
(*)	9	Fungi: Lower Groups		13
	12	Fungi: Life Cycles	Fungi	12
	14	Fungi: Ecological Roles		12
	16	Algae: Classification		11, 14
	19	EXAM III	Algae	
	21	Algae: Life Cycles		14
	26	Algae: Seaweeds	Bryophytes	14
	28	Bryophytes		15
(*)	30	Lower Vascular Plants		16, 17
Dec.	3	Gymnosperms	Lower Vascular Plants	18
	5	Paleobotany		17, 18
	7	Plant Species		9
	10	Plant Classification	Trees on Campus	10
	12	Plant Ecology		29, 30
	14	Plant Conservation		Introduction

BOTANY

Dr. Gary Emberger
211 Kline Hall

Biology 192
Spring, 1983

COURSE OBJECTIVES

1) To introduce the biology major to the study of plant anatomy, morphology, physiology, reproduction, classification, and ecology.
2) To study representatives of the plant kingdom both in the lab and in natural habitats.
3) To promote an awareness of the relationship of plants to mankind.
4) To develop an understanding of the promises and limitations of agricultural ecosystems.

COURSE TEXT

Rost, Thomas L., et al. 1979. Botany, A Brief Introduction to Plant Biology. John Wiley & Sons, Inc., New York.

LECTURE SCHEDULE

DATE		TOPIC	CHAPTER
February	1	Introduction / What are plants?	1
	3	Plant structure-cells and stems	3,4
	8	Plant structure-leaves	4
	10	Plant structure-roots and flowers	4,7
	15	Photosynthesis	6
	17	Photosynthesis / Respiration	6,2
	22	Respiration / Fungi	2,12
	24	Fungi	12
March	1	Lecture Exam # 1	
	3	Algae	11
	8	Algae	11
	10	Bryophytes	13
	22	Absorption and transport	5
	24	Lower vascular plants	14
	29	Control of growth and development	8
	31	Gymnosperms	15
April	5	Lecture Exam # 2	
	7	Angiosperms	16
	12	Fruit and seed development	7
	14	Plant ecology	9
	19	Plant taxonomy	10
	21	Our uses of plants	
	26	Selected topics	
	28	Selected topics	

LABORATORY SCHEDULE

DATE (week of)		TOPIC
February	7	Use of microscope / plant cells / stem anatomy / mitosis
	14	Flower structure
	21	Photosynthesis
	28	Fungi / Lab quiz # 1
March	7	Algae
	14	Semester break
	21	Bryophytes / Lab quiz # 2
	28	Lower vascular plants / tree & shrub identification
April	4	Gymnosperm life cycle / tree & shrub identification
	11	Angiosperm life cycle / tree & shrub identification/ Lab quiz # 3
	18	Field trip / tree and shrub identification exam
	25	Field trip

GRADING

1) Lecture			
a) Lecture exams	2 @ 100 points each	200	42%
b) Final		100	21%
c) Reading reports*	2 @ 25 points each	50	10%
2) Laboratory			
a) Quizzes	3 @ 25 points each	75	26%
b) Identification exam		50	
		475	

*During the semester you will be expected to read two botany-related articles and prepare a 1-2 page report for each. The report may be written or typed and must include the article title, author, date of article, and the publication the article was taken from. Publications should be of a scientific nature. The report should include not only a summary of the article but also your reaction to it. Find something to read that stirs up a response or makes you think about something in a different way.

The first report is due during the week of March 7 and the second during the week of April 11. Reports will be collected during lab.