



Annual Report 1980-1981

To the President of the University:

On my arrival at Harvard two and one-half years ago, my first priority was to define future policy for the Arnold Arboretum, and in particular for the curation and development of its collections. I had come as a fervent advocate of the Arboretum as an institution. This advocacy was, and still is, based on certain convictions that I espouse as a biologist, and one belief in particular: That all biological endeavor must spring from a solid base of description in systematics. Systematic biology is the study of patterns of variation between organisms. It entails far more than naming and tabulation. Systematics above the level of the breeding population, and most other rigorous descriptive and analytical biology, requires comprehensive and well curated collections and libraries, of which those of the Arnold Arboretum serve as a superb example. But I am also convinced that systematics is not an end in itself, and therefore is most creative when pursued in the broad biological milieu provided by a university.

Armed with these premises, I used my first annual report to set out a policy for our collections which seeks to reconcile what I consider to be their principal function, that is, research, with their role in education and public amenity. The present report should be read in the context, then, of this first statement. I did not attempt to explain why collections are essential for systematic and, indirectly, most other biological research, and this was just as well, for I would have grossly underestimated the complexity of the issue, particularly in the context of Harvard. But it is this question which I wish to address in the report that I present this year.

The Arnold Arboretum is a museum facility that has, besides its staff, three major resources: The libraries, the herbaria, and the living collections. Their resources are particularly strong in materials from tropical Asia and the Far East; indeed, the Arnold Arboretum is the leading American institution for research into the botany of this area. Our collections are primarily (but by no means exclusively) dedicated to woody plants, and in particular to trees, while our living collections are exclusively North temperate in origin. They thus complement those of the Gray Herbarium, the collections of which are primarily from the New World, the Farlow Herbarium of non-vascular plants, the Oakes Ames Orchid Herbarium, and the Herbarium of Economic Plants of the Botanical Museum.

What value do museum collections of long-lived plants now have in addressing the salient research issues of our time? We are now questioning the value of object based research in many fields. The implications are grave, for a museum collection cannot be maintained accessible to the scholar if it is merely locked away in an air-conditioned space. Facilities such as those possessed by the Arnold Arboretum take time to build, cannot easily be changed to accommodate new directions in science, and absorb significant funds for maintenance. Unlike, say, the equally or more expensive equipment required for molecular biology, they cannot be periodically written off and replaced. The collections of necessity require staff with a high level of scholarship who actively and continuously use them for research. Nowhere is this more essential than in living collections, which take up public space, need constant and expensive attention, and decline with surprising rapidity if they do not receive the constant care and interest of scholars.

Research in the arts depends, it is being claimed, less and less on the original, and in that sense, unique works stored in the Fogg, and archeological research seldom now needs direct access to the stelae of the Peabody. In these cases photographic reproduction has made the collections available to researchers without need for access to the originals, while there has been a shift in interest from artifacts to the people who created them.

However, biological museum specimens differ in important respects from cultural artifacts. They cannot be reproduced; only the originals are of value to research. They each represent a subjectively selected fragment, or a whole individual in the case of a living collection, usually of a unique genotype which was itself sampled from a population of living organisms. Nevertheless, biological specimens generally have no rarity value, although again, some of our plant collections are rapidly accruing it as the species they represent decline in the wild. Collections document biological variation and diversity, and are hence ultimately essential for all biological enquiry. They serve as partial records of living populations, as evidence for their distribution, and as material for the study of those aspects of the biology of an organism which are manifested in the collected specimen. They are the primary evidence for patterns of variation from which paths of evolution are deduced, and are hence ultimately the basis for all hypotheses in evolutionary biology. Research on fossil organisms adds a time dimension to evolutionary hypothesis, as well as disclosing organisms whose morphology must be reconciled with the morphology of extant organisms. This underlies the importance of Harvard's outstanding paleontological collections, and the need for continued research strength in this area.

Although living collections cannot be a substitute for a natural population, they allow examples of plants which in nature may be growing on different continents to grow together. Living specimens are amenable to a wide range of experimental manipulation. Living plants have the important additional advantage that most can be vegetatively propagated in perpetuity, and their genotypes can hence be replicated for experiment as well as for conservation.

Plants possess certain distinct advantages for research, and the history of plant science reflects these potentials, in part. Their sedentary nature facilitates long-term study of processes of adaptation and selection in relation to growth, development and mortality, while their modular construction, and relative ease of asexual propagation, permit replication of a single genotype. However, their lack of organization compared with higher animals, and absence of locomotory, nervous, or obvious sensory systems, impose restrictions and help to explain the traditional emphasis on classification in botany. Many plants are long-lived, and this restricts their potential for genetical and other experimentation. This is notably so in woody plants. But are we to ignore them on that account?

Systematics provides a framework, and thus the gateway, through which biologists can gain access to the diversity of the living world. The biological method will continue to be one of successive approximations. Systematic research cannot answer how biological processes take place, but through analysis of biological variation the systematist identifies patterns, and from them formulates hypotheses concerning these processes which then must be tested through experiment.

For example, the central integrating concept in whole-organism biology remains the theory of evolution. The processes of mutation and natural selection take place at the level of the individual organism, but influence evolution through changes in gene frequency in populations in nature. Research in population biology requires long-term observation in secure sites, of which the Harvard Forest, and the Concord Field Station of the Museum of Comparative Zoology, provide excellent examples. It is at these and lower levels of organizational scale therefore that mechanistic research into the processes of evolution will be concentrated. But which populations, and which organisms, will provide the most appropriate information from which to generalize?

Genius and technological adeptness alone cannot make a great biologist. Experience, arising from prolonged and meticulous observation of the natural world, is equally essential. Systematics, though inherently synthetic and non-experimental above the species level, should not be regarded as less rigorous than experimental, and especially mechanistic, branches of biology. The approach in systematic biology does not differ from that of, say, the late Professor Cecilia Payne-Gaposchkin's, in her astonishing systematic analyses of the variable stars. Though descriptive biology remains an essential precursor and adjunct to experimental branches of our science, the two approaches in certain respects require different philosophies and skills, and this has led to a mutually damaging lack of communication, and even respect, between their practitioners.

In many areas, the reopening of paths of communication must await future technological innovation, since application of the mechanistic approach to biological research is restricted by the refractory nature of much biological material. Current advances in molecular and cell biology are confined to a small group of organisms which, due to a peculiar combination of characteristics, are most amenable to experimentation. But to what extent can

our rapidly extending knowledge of *Escherichia coli*, *Drosophila melanogaster*, or even *Homo sapiens* be extrapolated to other organisms? There is no doubt that future research must be directed increasingly at developing the technology required to expand this dangerously slender base, and competently curated collections, particularly of living plants, will prove invaluable.

It is also true that systematics, except that based on population-level analyses, has been in the doldrums. This has been largely because systematists have been disinclined to discuss the theoretical basis of their scientific approach, and have considered classification as much an art as science. Hence, systematics has tended to be ignored by the rest of science. However, over the last 30 years techniques for analyzing new sets of characters, or simply for looking at the plant in new ways, have been developed and have given systematists vast amounts of new information. Advances in mathematical techniques, aided by the electronic computer, are permitting objective analysis of patterns of immense complexity. Perhaps more importantly, the recent revival of interest in the theoretical grounds of systematic biology enables systematists to utilize this information in critical studies of evolutionary relationships, and to explore anew the relationships between morphology (in the broad sense), classification, and evolution.

Our institution, as a member of the community of museums and other institutions that comprise the Department of Comparative Biology of Harvard University, has an excellent opportunity to make the diversity of the plant kingdom available to the experimental scientist. This must be done through broad yet rigorous monographic systematic research. There are many groups of animals and plants, notable among these are most arthropod orders, fungi, and flowering plants, particularly those of the tropics, still awaiting monographic study. These groups are literally inaccessible to scientific investigation until their systematics have been advanced. As an example which typifies the systematic research of our staff, Dr. Peter Stevens's current monographic research in the tropical tree family Clusiaceae, and notably the large and extraordinarily complex genera *Calophyllum* and *Mesua*, is revealing contrasting and unexpected patterns of variation and diversity which permit him to formulate hypotheses concerning the evolution of trees in tropical forests. In a rather different way, Dr. Carroll Wood's monographic *Generic Flora of the Southeastern United States* brings together a wealth of information on all aspects of the biology of a group of plants which include many whose phytogeography indicates a former vegetational connection between that region and temperate East Asia. Thus, it provides the essential background for research into this interesting stage in the evolution of the north temperate flora.

There is, therefore, still a critical need to expand the descriptive, and especially, the systematic base of knowledge, so that the most appropriate material for research into comparative and evolutionary plant biology can be identified. This requires rigorous scholarship and an aptitude for a particular kind of intellectual --though not necessarily technical-- innovation. It is a paradox that systematics, which people think encumbered with history, old books and Linnaeus, is more ahistorical than much research in physics and chemistry.

One of the marks of greatness in a biologist is his ability to appreciate, and foster links between, his own research and research at other organizational levels. In biology, this is as true of organismic biology as at other levels, and good systematists have always taken pride in their abilities as synthesizers. Fortunately, the boundary between systematics and other biological disciplines is becoming intellectually less clearly demarcated. The gulf that arose between the observational and the experimental sciences, and research at organismic, cellular and lower levels of biological organization, has been severely detrimental. The rise of ecology, as both an observational and an experimental discipline, has helped bridge the gap in some universities. At Harvard, bridges are being built through comparative, functional morphology and anatomy, and through ecological physiology.

Our living collections, which are probably the most completely documented of their kind in existence, are a superb tool for research and instruction in the comparative biology of the whole plant. They provide the practical means to link systematics with comparative, descriptive and experimental studies in morphology, anatomy, and ontogeny, with reproductive biology, embryology, cytology, and genetics, as well as physiological ecology.

Nowhere is the need for an integrated approach more urgent than in biological research in the tropics. The great majority of organisms on earth are tropical. It has been calculated that, of the 240,000 species of flowering plants 155,000, or some 65 percent, are tropical. Among woody plants, there are approximately 20 times more species in the tropics than the rest of the world. Many whole families of plants are confined to the tropics, as are many manifestations of plant form. In the favorable climate of the seasonal and humid tropics, plant species richness (and that of some animals, notably insects), reaches its zenith. In this exceptionally uniform environment the determinants of natural selection appear to be largely biotic, and frequently are extremely intricate. Many of the leading problems in comparative and evolutionary biology must, therefore, be addressed in the tropical rain forests. However, present rates of tropical deforestation, which are estimated to be 200,000-250,000 km annually, suggest that within 50 years these forests will be reduced to modified fragments, no longer suitable for answering many of these questions. Nor is this dilemma merely academic: As much as half the world's flora may be extinguished during this time, during a period when increasing energy costs will necessitate dramatic changes in industry and agriculture requiring new crops and more intensive use of renewable resources. Without expanded research in tropical botany many species of potential economic value in agriculture and forestry, and others which may yield new chemicals for the pharmaceutical and other industries, will be lost before their importance is realized.

The tree flora of the Far East is the richest on earth. The Arnold Arboretum, as repository for the most extensive herbarium collections and library for the study of the botany of tropical Asia in this country, must play a leading part in advancing this research while time remains. High priority must again be given by our institution, as custodian of the necessary resources, to monographic systematic research for, as mentioned, this will provide the critical

base from which hypotheses can be formulated, and assure a stable nomenclature. There is an immediate practical need though for local floras, of which Dr. Richard Howard's current *Flora of the Lesser Antilles* serves as a fine example. Increased collection of plant specimens, particularly from our area of specialization in Asia, is essential for our future research and a responsibility which, in view of our existing strengths, we owe to the biological community as a whole. Particular emphasis needs now to be placed on those several regions which remain little collected, yet where deforestation is now rapid, on novel collecting methods enabling preservation of anatomical, including embryological, material, and ideally, the creation of DNA or clone banks of species of particular interest, and on the total inventory of restricted areas of selected plant communities.

The reader may wonder why no mention has been made of horticultural research, for which the Arnold Arboretum has a distinguished reputation. Several of those aspects of basic scientific research, for which our living collections can provide such valuable material, are also basic to horticulture: Systematic and comparative morphology and anatomy provide the descriptive framework, and embryology, cytology, and genetics the groundwork for propagation and plant breeding. Horticultural needs provide an additional reason for the broad research policy outlined here.

In the past, our institution had on its staff botanists such as [Alfred Rehder](#), and horticulturalists such as [Donald Wyman](#), who prepared the encyclopedias of cultivated woody plants upon which we still rely. The need now, with so many plant species known, with nomenclature as well as taxonomic confusion in many major taxa, and with the almost limitless multiplication of cultivars is, once again, for thorough monographic treatment of the major woody plant taxa in cultivation. In temperate Asia there still remains a need for exploration in the quest for new taxa and, more particularly, for hardier genotypes than are currently in cultivation. It is to these ends that the research of Dr. Stephen Spongberg and [Dr. Richard Weaver](#) is dedicated.

At the same time, our living collections staff are encouraged, and indeed expected, to pursue research in propagation, in hardiness testing, and in assessment for horticultural display, thus continuing the traditions established by [Jackson Dawson](#), [Alfred Fordham](#), and others in the past. The results will continue to appear in the pages of our horticultural journal *Arnoldia*.

It is obvious that the endowment of the Arnold Arboretum is inadequate to support research in every aspect of whole plant biology or, indeed, in more than a few of the fields advocated in this report. Future appointments must take into consideration the need for continued strength in monographic systematic research, so that our collections may continue to be available to the wider scientific community. Future appointments must equally encourage as broad a use of our collections, and in particular our living collections, for research and instruction as they can sustain.

Systematic research proceeds through gradual, consistent accumulation of experience gained by continued use of biological collections. The collections, in turn, require constant, meticulous curation by scholars of the highest caliber. It is for these reasons that the Arnold Arboretum must continue to maintain a strong representation of systematic botanists on its staff. Furthermore, our obligations to the international scientific community, in the development of our collections and in systematic research, will be dependent on the grant support which our tenured staff alone can command.

Systematics requires, at one and the same time, abroad appreciation of the biology of the whole organism, meticulous care for detail, and an awareness of how to analyze the resulting data in a variety of ways, useful to scientists with differing requirements. Our most intractable dilemma is the current dearth of plant systematists who have the breadth necessary to build from plant taxonomy to general biological theory. Contemporary attitudes in education have militated against this approach to biological endeavor, as one may observe in the remarkable naivete of some of our new graduate students. Harvard is now possibly alone in providing the necessary combination of breadth and detail required of good systematists and, I would argue, in any whole biologist, and this is reflected in the continued demand for our graduates by the nation's colleges and museums.

Systematics cannot survive in isolation, but our future appointments policy can be a powerful integrating force. The living collections of the Arnold Arboretum make us particularly well-placed to foster the consolidation of whole plant science at Harvard, by ensuring that the collections are maintained and kept available to our scientific community as a whole, and through appointment of both descriptive and experimental scientists in fields which can benefit from the resources that our institution possesses. Our pending appointment in the field of root biology is being made in this spirit. It is to be hoped that our income will allow similar future appointments, though it is clear that they cannot be made to the detriment of our continued strength in systematics.

Harvard must seize the opportunity to continue the distinctive tradition in biology that its institutions have made possible. Our new Department of Comparative Biology, made up almost entirely by staff of the affiliated institutions, can thus advance biological knowledge, and instruct students, through as comprehensive an approach as that provided by any university. In the realm of tree biology, future staff of the Arnold Arboretum should be contributing to all levels, from the broad systematic monograph to the experimental investigation of individual phenomena.

ORGANIZATION

Mr. Franklyn Stevens was appointed Office Manager in September, 1980. Mr. Stevens has been responsible for some major improvements in the organizational infrastructure and financial systems of the Arnold Arboretum.

Our budget preparation and accounting systems have been reorganized in order to achieve closer fiscal control of operation. Rearrangement of our cost centers was undertaken, and lists of expense and income classes have been expanded to reflect this rearrangement. We can now begin to take advantage of the monthly reporting system provided by Harvard. The need to keep parallel records, or reconstruct months of activity to meet special needs, is now largely eliminated. Though our needs will continue to change, we now have the flexibility to change our reporting procedures accordingly. This represents the single, most important advance in our administrative systems this year.

The secretarial staff has been reorganized. The three full-time and two part-time secretarial staff in Jamaica Plain have been replaced by two secretaries and a clerk/receptionist. The accounts payable function in Jamaica Plain, which previously took up nearly all the time of one secretary, has been moved to Cambridge; only the petty cash and weekly payroll tasks remain. The bill-paying function is now integrated in one location and is handled by a half-time clerk. An increase in payment punctuality is leading to significant savings.

Office supplies have been inventoried, and ordering coordinated. Orders are now mainly placed with a vendor who has a special price arrangement with the University.

Upgrading of the telephone system in Jamaica Plain, and installation of postage machines in Cambridge and Jamaica Plain, are affording further cost and time savings. Steps are being taken to utilize automated billing, available through the Harvard Accounts Receivable Department, for subscriptions to our two journals.

Renovation and reorganization of the interior of the Hunnewell Administration Building in Jamaica Plain, which was coordinated by the Manager of Public Services, Ms. Wendy Marks, will receive mention in several parts of this report. A new energy-efficient heating system was installed. The former herbarium space at the back of the first floor was converted into office space for the secretarial staff, the Director, the Manager of Public Services, and living collections staff; a reception room was also provided, and booths for handling plant information inquiries. The first floor of the herbarium has been moved up to the fourth floor and air conditioned. The second floor remains in place, but the clerestory opening in its center has been cemented in, and a separate office provided for the herbarium preparators. The front of the building on the first floor is being converted to space for the public program. The former first-floor library has, therefore, been moved to the third floor at the back of the building, bringing it to the same level of, and allowing integration. With, the rest of the library in the building. Both library and herbarium are now taken out of direct public access, thereby improving conditions for conservation and security. The daunting tasks of moving the library and herbarium were coordinated by Horticultural Research Archivist Sheila Geary and Staff Assistant Ida Hay respectively.

Miss Dorothea Talbot, Staff Assistant to the Director, retired during the year; she was replaced by Ms. Susan Bryant.

RESEARCH AND INSTRUCTION

Highlights of the year's research included the publication of Dr. Peter Stevens's monograph of the Old-world species of the tropical, mainly Far Eastern, tree genus *Calophyllum* in the *Journal of the Arnold Arboretum*. This is one of the few truly comprehensive contemporary studies of any of the very large and taxonomically complex tropical flowering plant genera that are of such interest to the evolutionary biologist. Dr. Stevens's treatment lays a secure groundwork that should stand the test of time, and it describes in critical detail the patterns of variation from which hypotheses concerning speciation can be derived and tested, and at the same time it provides the forester with the tool by which he may identify the species in the field.

In addition, the year witnessed an upsurge of interest in the living collections for research. The work that has been undertaken is remarkable for its diversity: Systematic research has continued in *Rosaceae*, *Theaceae*, and *Viburnum*; an important publication of Dr. Howard's anatomical research appeared; there have been mathematical studies of variation in leaf shape in *Acer*, and research on the branching patterns and tree architecture in *Viburnum*, *Tsuga*, and *Asimina*; cytogenetical studies proceeded in *Hamamelidaceae* and *Platanaceae*; the breeding system of *Ulmus* was investigated; there were attempts to induce cone formation and flowering in selected gymnosperms and angiosperms by application of growth hormones; *Magnolia virginiana* was found to possess an unusual pattern of embryo development and seed germination; and a comparative study of *Alnus* species that fix nitrogen in the roots has been initiated, with the eventual aim of assessing them as a source of cattle forage. The imminent appointment of a professor in root biology, and the receipt of a gift towards the acquisition of equipment to set up a laboratory in chemosystematics in Jamaica Plain, will further strengthen research using the living collections.

The resurgence of interest in the botany of China continued this past year. Dr. Stephen Spongberg accompanied four botanical colleagues on the first Sino American expedition since the Chinese Revolution, and [Dr. Shiu-ying Hu](#) made an extensive lecture tour of China.

Professor Peter Ashton concentrated on studying and annotating the collections of *Dipterocarpaceae* at two major Far Eastern herbaria. The combined holdings in the National Botanic Gardens and Forest Research Institute in Bogor, Indonesia, comprise more than 40,000 numbers. Dr. Ashton visited these institutions in June and July, 1980, and, during the following winter, continued with the work, using materials sent on loan. Work on the Forest Research Institute collection is now completed. While in the Far East, Dr. Ashton attended the "Second Round-Table Symposium on Dipterocarp Research" in Kuala Lumpur, Malaysia, where he presented a paper and chaired a session. Thereafter he attended a symposium at Cambridge University on "Biological Aspects of Rare Plant Conservation," where he also presented a paper. He lectured at Yale University at the School of Forestry and Environmental Studies and again at the Department of Biological Sciences. He also lectured to biology students at Lehman College, New York, and to horticulture students as part of the University of Delaware's Longwood

Program. He served on a panel at planning conference organized by the President of the New York Botanical Garden, and on another convened at Tufts University to discuss the conservation of genetic resources. A chapter on the forests of tropical Asia, for a book on the current status of tropical forests, was submitted.

During the year Paul Cox, who was advised by Dr. Otto Solbrig and Dr. Ashton, submitted his thesis, entitled "Pollination and Unisexuality in Freycinetia." Mr. Steven Rogstad and Mr. Paul Rich are also advised by Dr. Ashton, the latter in collaboration with Dr. Thomas Givnish. Dr. Richard Primack continued his field work in East Malaysia, on a grant awarded Drs. Ashton and Stevens by the U.S. Department of Agriculture Forest Service. He is studying the wild breadfruits (*Artocarpus*) and tree figs (*Ficus*) of that region, which is the center of their species diversity. A field manual, for which illustrations are under preparation, has been otherwise completed, and Dr. Primack is now concentrating on growth and demographic studies of selected species.

Professor Richard Howard continues his work towards the treatment of the *Dicotyledoneae* for the next volume of the *Flora of the Lesser Antilles*, for which some illustrations have also been prepared. With permission from the Linnean Society of London, which owns the manuscript, he has completed a transcription of Alexander Anderson's early nineteenth-century accounts of the geography and history of the island of St. Vincent, and of the history of its botanical garden, which is the oldest in the New World. In collaboration with other specialists, he is attempting to interpret the plant description in Anderson's manuscript "Hortus." Dr. Howard also completed a paper on William Hamilton and his *Prodromus Plantarum Indiae Occidentalis*; two papers on *Opuntia* (*Cactaceae*) in the Lesser Antilles; one on the stay in Boston of Olaf Swartz, a student of Linnaeus who conducted plant explorations in the Lesser Antilles; one on Solander's *Florula Indiae Occidentalis*; another relating to Louise O'Farrells plant paintings from St. Croix; and also a manuscript, entitled "Additional Notes on *Coccoloba* in Jamaica," to be included in a more extensive revisionary paper by Dr. George Proctor. Treatments of *Icacinaeae* and *Polygonaceae* are currently under way for the floras of Venezuela and of Nicaragua. Dr. Howard, who holds a National Science Foundation grant for his research towards a Flora of the Lesser Antilles, was awarded a grant from the Stanley Smith Horticultural Trust for work on the Anderson manuscripts.

Dr. Howard received the Award of Merit of 1981 from the Monserrat, West Indies, National Trust. He attended the organizational meeting of Flora Neotropica in Quito, Ecuador, when he also visited herbaria there and in Lima and did some collecting; he serves on the Editorial Committee of the Flora. He chaired an ad hoc committee for the Dean of the Graduate School, University of Michigan, for evaluation of the Matthaei Botanical Garden and attended a meeting of the Plant Collections Committee of the Pacific Tropical Botanical Garden during its board meeting in Boston. Dr. Howard identified collections of cultivated plants of the Scientific and Industrial Research Organization of Pakistan and the Agriculture Department of New Caledonia, as well as the holdings of *Polygonaceae* and *Icacinaeae* for the French Organization

for Overseas Scientific and Technological Research (ORSTOM) at Cayenne. He lectured at the University of Connecticut and gave a botany seminar at Harvard, as well as a talk to the graduate students Society for Expeditionary Biology.

Dr. Shiu-ying Hu, who is retired, continued indefatigably in her studies of the botany of China. Between September, 1980, and February, 1981, she was in the East. After attending the Third International Ginseng Symposium in Seoul, Korea, where she presented an invited paper, she continued to Bangkok. There she presented papers on Chinese Materia Medica at the Fourth Asian Symposium on Medicinal Plants and Spices sponsored by the World Health Organization, and at a Thai-U.S. Cooperative Symposium on Underexploited Economic Plants. Thereafter she was in China, where she ran short courses in plant taxonomy at fourteen colleges and universities throughout the country, and spoke at branches of the Botanical Society of China and at horticultural clubs. As an invited participant, she also attended a review meeting of the Executive Board of the Botanical Society in Canton. For over a quarter century more senior Chinese botanists have been unable to communicate with colleagues in other countries. They are anxious to hear of the current issues in science outside of China and to train younger colleagues for senior positions. Dr. Hu, now in her seventies, covered 14,000 miles within her native country, daily giving courses and holding discussions between 8:30 in the morning and 5:30 in the evening. This remarkable effort was clearly much appreciated, and very much reflects the new spirit of cooperation which the Arnold Arboretum wishes to further develop with its Chinese colleagues.

Dr. Stephen Spongberg also concentrated this year on reestablishing both the Arboretum's cooperative program with Chinese botanists and its long-standing interest in the flora of China. These activities were facilitated through his participation as the Arnold Arboretum representative in the 1980 Sino-American Botanical Expedition to Western Hubei (Hupeh) Province. The expedition took place between August 10 and November 16, 1980. Sponsored under the joint auspices of the Academia Sinica and the Botanical Society of America, the expedition involved three months of field work in the Shennongjia Forest District and the Metasequoia region of Lichuan Xian (Hsien) in western Hubei Province, as well as travel to botanical institutions and gardens throughout China. Financial assistance was provided by a grant from the National Geographic Society and by a special fund established by the American Association of Botanical Gardens and Arboreta. While in China the American team was hosted by the Institute of Botany, Beijing (Peking) and the Wuhan Institute of Botany, Hubei, both of the Academia Sinica, and their field work was greatly assisted through the kindness of local provincial government officials in the Province. Professor Sun Siang-chung, Director of the Wuhan Institute of Botany and Chairman of the Department of Biology of Wuhan University, was the leader of the expedition, which was joined in the field by botanical colleagues from five botanical institutions elsewhere in China. The scientific results of the expedition, which are currently being prepared, will be published in a joint report in the *Journal of the Arnold Arboretum*. Dr. Spongberg will serve as general editor. Together with Dr. David Boufford, of the Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, he has also had the primary

responsibility for identifying the 2,085 herbarium collections gathered during the expedition. Dr. Boufford spent six weeks at the Arboretum during February and March to assist in this project. Altogether, these collections represent about 25,000 herbarium sheets, which were divided equally between the Chinese and American teams.

While in western Hubei, Dr. Spongberg was also able to observe and make herbarium and seed collections, as well as dried leaf collections for chromatographic analysis, of several taxa of *Sorbus*. Opportunities to work in several Chinese herbaria also allowed him to continue his study of *Sorbus*, *Hartia*, and *Stewartia*, and genera of the *Magnoliaceae*.

In addition, Dr. Spongberg has begun sorting through W.P. Fang's Mt. Omei and Szechuan collections that have been stored in Merrill boxes in Jamaica Plain for 30 years or more. These specimens are gradually being mounted.

Dr. Spongberg still found time to continue his responsibilities as Editor of the *Journal of the Arnold Arboretum*, and, with the valued collaboration of Dr. Howard, to add some 750 citations to the Rehder card index, the comprehensive bibliography for cultivated woody plants.

Professor Peter Stevens's monograph of Old World *Calophyllum* appeared in the *Journal* early this year. He has since made a start on *Mesua*, the second largest genus in the subfamily *Calophylloideae* of the important tropical family *Clusiaceae*. Initial studies are bringing to light a number of interesting characters from all parts of the plant, many of which have not been observed or have been ignored for a century, but the variation pattern promises to be yet more complex than in *Calophyllum*. Field work undoubtedly will be needed to further its comprehension. With students Mr. Paul Groff and Mr. Michael Donoghue, Dr. Stevens has been preparing a critique on the current uncritical use of morphological terminology, with a view to indicating its potential for misleading observation and theory. Arising from his new course on the history of botanical systematics, Dr. Stevens is preparing a paper on the interrelationship between the sciences of crystallography and botanical systematics between 1740-1840. A more general study of the metaphors used to describe the relationship in natural systems in immediately pre-Darwinian times is also under way. Dr. Stevens completed a critical evaluation of the criteria used to determine whether characters are advanced or primitive, concluding that most are highly suspect and lead to circularity in argument.

Dr. Stevens continues to supervise graduate students Ms. Elizabeth Taylor and, with Professor Richard Schultes, Mr. Jeffrey Hart, and also has become an advisor of Mr. Brent Mishler. He gave invited lectures at the University of Western Ontario, Guelph University, and Tufts University.

Dr. Stevens has continued his active curation of the herbaria and has identified material received from Thailand, India, and the Pacific. Also, with assistance from graduate students, he named a number of unidentified plants from Central and South America.

Professor Carroll Wood, in collaboration with Dr. Norton Miller, assembled a grant proposal for continuation of the Generic Flora of the Southeastern United States, in which they plan to work as co-principal investigators. The National Science Foundation has made a substantial three-year grant for this monumental project which, if continuously funded, is expected to be completed within the next decade. The account of *Amaranthaceae*, by former Arboretum Assistant Curator Dr. Kenneth Robertson, will start a treatment of the tribes of Gramineae in the Southeast.

Dr. Wood has received grants for each of his graduate students for field work, initially from the Atkins or Anderson Funds of the University, and subsequently from the National Science Foundation Program for Doctoral Dissertation Research in Systematic Botany. Ms. Elizabeth Coombs, who was thereby enabled to visit the western states last year, traveled to the Gaspé Peninsula in Quebec, and again to the Sierra Nevada of California in late summer, 1980, in order to pursue her studies in the *Poa sandbergii* complex of bluegrasses. Mr. Mishler, who is supervised by Drs. Miller, Wood, and Stevens, is enabled through one of these grants to pursue his systematic studies in the moss genus *Tortula* (Musci Pottiaceae) in the Southwestern United States and, later, in Mexico. He has meanwhile prepared a treatment of the genus for the forthcoming moss flora of Mexico. Dr. Wood has taken part in a Genetics Training Grant awarded to the Department of Biology that has assisted in the fieldwork of Ms. Coombs and Mr. Mishler, and of Mr. Donoghue whose thesis is now near completion, and also that of Dr. Campbell, who received his degree last year and is now teaching at Rutgers University. With its help, Ms. Coombs and Mr. Donoghue attended a workshop on the theory and application of cladistic methodology at the University of California in March, 1981.

Dr. Norton Miller, Botanist, meanwhile continued his research on Pleistocene macrofossils. He analyzed a stratigraphic suite of fossil mosses from sediments of Upper South Branch Pond, Maine, as part of a collaborative effort on the vegetational history of north-central Maine with Dr. Ronald Davis and Mr. R. Scott Anderson of the University of Maine. He also identified an assemblage of moss and other plant macrofossils from late glacial sediments from a kettle hole near Brampton, Ontario. These materials were provided by Dr. Alan Morgan of the University of Waterloo. Samples containing an assemblage of mosses were sent for study by Dr. James King of the Illinois State Museum in Springfield. The fossils are from a late Wisconsinian interstadial deposit in Illinois. The floristic composition of the assemblage, which was discovered during excavation associated with the installation of a nuclear power plant, is similar to an assemblage studied a few years ago from the Gardena locality in Illinois and also presumably the same age, although a C-14 age determination is pending. Both assemblages indicate the existence of rich fens. One contains fossils of the moss *Cinclidium latifolium*, currently a species of the North American High Arctic and thus potentially an important paleoecological indicator. Appear in the *Journal* in July, while a former student, Dr. Christopher Campbell, now of Rutgers University, is starting a treatment of the tribes of *Gramineae* in the Southeast.

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During the first two weeks of April Dr. Miller was joined by the late Dr. Monte Manuel of the University of Malaya. They finished the taxonomic part of a joint monograph of the Australasian-Oceanian moss *Trachyloma* (*Pterobryaceae*). The scanning electron microscope was extensively used for examination of calyptrae, peristomes, and spores. Plates illustrating most of the species and varieties have been assembled, and a manuscript is being assembled for publication. Two short floristic notes, "*Loeskypnum wickesiae* (Musci: Amblystegiaceae) in Alaska," prepared with Dr. Zenoske Iwatsuki of the Hattori Botanical Laboratory, Japan, and

"*Grimmia anodon* (Musci: Grimmiaceae) in North America north of Mexico" jointly with Dr. Robert Ireland of the National Museums of Canada have been submitted for publication. Lastly, work has begun on a chapter treating Cenozoic Bryophyta for a new edition of the *Manual of Bryology*. This book, which will update the current manual by Dr. Frans Verdoorn (1932) is being organized by Dr. Rudolph Schuster of the University of Massachusetts.

Dr. Miller gave invited lectures at the Department of Earth Sciences, University of Waterloo, Canada, and at the University of Alberta, Edmonton. He attended the Sixth Biennial Conference of the American Quaternary Association at the University of Maine, Orono, and the Annual Meeting of the American Bryological and Lichenological Society which was held at the Highland Biological Station, North Carolina. Dr. Miller was elected to the Council of the Society and has been appointed to a two-year term as Associate Editor of *The Bryologist*.

This year Dr. Bernice Schubert saw the publication of two papers on which she had been working for some time: A treatment of *Desmodium* (*Leguminosae*) for the Flora of Panama and, with Dr. Hiroyoshi Ohashi and Dr. Roger Polhill, a paper on the whole tribe *Desmodieae*, which includes twenty-seven genera in three subtribes. She is currently attempting to clarify the *Desmodium intortum*- *D. uncinatum* group of species, which are widespread in the New World tropics. The two species after which the group is named have recognized potential as agricultural forage crops. Botanical artist Ms. Margaret Van Montfrans, who joined the Arnold Arboretum in February, 1981, is preparing illustrations for this study. Scanning electron microscope studies of the pollen of another difficult group, *Desmodium* subgenus *Nephromeria*, which are mainly vines, has begun. Dr. Schubert is also committed to preparing a treatment of *Desmodium* for the Revised Flora of Ceylon, and another treatment of the genus for a new project on the *Leguminosae* of Oaxaca, Mexico.

Dioscorea, another long-standing interest of Dr. Schubert, is a large, diverse, and systematically very interesting genus still requiring much study. The organization of the *Dioscorea* material of Dr. Temple Clayton, alluded to in my last annual report, continued this year. A number of *Dioscorea* collections loaned for determination were identified. Dr. Schubert has agreed to prepare treatments of *Dioscoreaceae* for Dr. Wood's *Generic Flora of the Southeastern United States*, for the *Vascular Flora of the Southeastern United States* being published by the University of North Carolina, and for two Mexican regional floras.

In the large genus *Begonia*, Dr. Schubert has confined her attention to New World species. This year she has concentrated on *Begonia extensa*, for which complete material has recently become available for the first time. She will be preparing the treatment for the *Generic Flora of the Southeastern United States* and hopes also to prepare a revision of the Colombian species, on which she has published previously (with Dr. Lyman Smith, in *Contrib. Gray Herb.* 164, 1946). She gave a talk on sections of the genus *Begonia* to the Buxton branch of the American *Begonia* Society.

We have welcomed two long-term visitors to the herbarium this year. Dr. George Proctor of the Institute of Jamaica has been undertaking revisionary research on the flora of Jamaica with support from the Atkins Fund of Harvard University. Thus far, he has revised and completed an illustrated Flora of the Cayman Islands, and a paper, "Additions to the Flora of Jamaica," intended to be a supplement to C. D. Adams's *Flowering Plants of Jamaica* (1972). Work is in progress on a volume dealing with the ferns of Jamaica of which there are over 600 taxa. Two short papers have been published and appear in the bibliography. Dr. Benjamin Stone of the University of Malaya, who spent from March to July, 1981, with us as a Mercer Fellow, pursued two projects: He continued his monographic research into *Pandanaceae*, the screw pines. He was able to complete a revision of Pandanus subgenus *Rykia*, and to accumulate materials for revision of several other subgenera and for the genus *Freycinetia*. He prepared regional treatments of Pandanus for Indochina and, in brief, for Sumatra. He also completed a revision of the difficult genus *Glycosmis* (*Rutaceae*, *Aurantioideae*) and prepared materials for other genera in its group. In all, Dr. Stone completed six manuscripts for publication, fully curated our *Pandanaceae* holdings, and partially curated our Asiatic *Rutaceae*. The numerous type collections in our herbarium proved of crucial value to his research, as were our comprehensive holdings of botanical literature pertinent to the botany of Asia and the Pacific.

Among our living collections staff, Mr. Peter Del Tredici completed and published a study of the embryo development and germination characteristics of *Magnolia virginiana*; he continued his work on the growth and branching pattern of *Tsuga canadensis* and its cultivars. [Dr. Richard Weaver](#), who was fully committed to curatorial and restoration work in the living collections this year, provided taxonomic assistance to undergraduate, Mr. William Buike ma who was pursuing palynological and cytological investigation of *Corylopsis* (*Hamamelidaceae*) with advice from Dr. Alice Tryon.

I have summarized the range of research activities being undertaken through use of the living collections of the Arnold Arboretum in the introduction. Among these several have received mention in previous reports. Mercer Fellow Dr. Amar Hans completed his study of *Ulmus* breeding systems in July, 1980, and returned to Lusaka. Dr. Hans, who is Senior Forest Geneticist in the Forest Research Institute of the Government of Zambia, came to the Arnold Arboretum to gain experience in breeding work with hardwood trees prior to initiating a fruit tree improvement in his own country. Dr. Alan Longman of the United Kingdom Natural Environment Research Council Institute of Terrestrial Ecology Station at Penicuik, Midlothian, Scotland, visited the Arboretum with his technician Ms. Jan Dick in the spring of 1981. In collaboration with Mr. Del Tredici, branches of over twenty different recalcitrant-flowering tree species were either bark-ringed or injected with varying concentrations of gibberellic acid in an attempt to induce flowers or cones. The earliest results will not be known until 1982.

Mr. Geoffrey Nolin, a student at Hampshire College, was awarded a grant by the Percy Selden Fund to spend a year at the Arboretum. Mr. Nolin has been pursuing a project on nitrogen fixation in *Alnus* under the supervision of Dr. John Torrey of the Harvard Forest. He is

now extending this work to the collection, propagation, and evaluation of two genera, *Alnus* and *Ceanothus*. Both genera fix nitrogen in association with Actinomycetes in their roots. *Alnus* foliage is known to be rich in protein and has potential as a forage for cattle.

Research using the living collections of the Arnold Arboretum will be substantially strengthened thanks to a generous anonymous benefactor, who has provided us with the means to equip a chemosystematics laboratory in the greenhouse-headhouse in Jamaica Plain. Initially it is intended that research will be conducted in collaboration with Drs. Gillian Cooper-Driver and Tony Swain of Boston University. It is also likely that our root biologist, once appointed, whose laboratory will be in the same building, will share some of the facilities.

All professorial staff with graduate students under their supervision offered 300-level courses during the academic year. Dr. Stevens, with Professor William Fink, continued to run the Systematics and Biogeography Group, which had its fourth season. The discussion group, which provides an informal forum for systematics as a whole, meets fortnightly. The general standard of discussion this year was very high and meetings were well-attended. The Museum of Comparative Zoology funds the group jointly with the Arnold Arboretum.

All professorial staff of the Arboretum also contributed to undergraduate instruction this year. Professor Ashton collaborated with Professors Thomas Givnish and Kenneth Sebens in Biology 250, Tropical Ecology, in the fall term. This course provides an introduction to the ecology of tropical communities with particular emphasis on plant adaptations and their effect on species distributions and abundances. Following the course, a field trip was organized to Venezuela. Professor Ashton, with Professor Barry Tomlinson of Harvard Forest, taught for two weeks in Costa Rica in February, as part of the Organization of Tropical Studies graduate course program.

Professor Howard collaborated with Professor Tomlinson in the Summer Course in Tropical Botany, S-105, during June-July, 1981, at the Fairchild Tropical Garden, Miami. Dr. Howard was guest lecturer on poisonous plants in Dr. Schultes's course, Biology 104, Plants and Human Affairs, in the spring term. Dr. Howard also supervised Biology 91r, undergraduate research, for Ms. Mia Touw, who compiled a special report entitled "Asa Gray and the Wilkes Expedition - *Lobeliaceae*" and Biology 98r, undergraduate honors research, for the same student in this case involving study of a thesis on Tibetan materiamedica. In the fall Professor Stevens collaborated with Professor Fink in Biology 148, Systematic Biology. In the spring he offered a new course, Biology 164, History of Botanical Systematics. This course dealt with the development of systematics from pre-literate societies to the beginning of the twentieth century. The emphasis was on the comparison of practice and theory in systematics, with the aims both of being better able to understand the work of the early systematists, much of which is still being used, and also to appreciate the degree to which they were able to reach their avowed goals. It is important to understand this, since much current systematic practice was developed as long ago as the first part of the nineteenth century.

Professor Wood, with Professors Tomlinson and Pfister, taught Biology 18, Diversity in the Plant Kingdom, in the fall as usual. Graduate students Ms. Elizabeth Taylor and Mr. Calvin Sperling acted as teaching fellows. Dr. Wood's Biology 103, The Taxonomy of Seedbearing Plants, was taught in the spring. The ratings of the latter remain as high as ever; student teaching fellow Mr. Michael Donoghue received special commendation. In February Professor Wood was one of the panelists in the Professional Training Series of the Harvard Danforth Center for Teaching and Learning. This session was devoted to lecturing in the sciences, in this instance Biology.

Dr. Wood made extensive use of materials collected and preserved from the living collections for teaching Biology 103 during the winter months. Field classes were conducted in the living collections for Biology 18 and Biology 103. The following universities and colleges, besides Harvard, currently use the living collections for instruction: Bentley College, Boston College, Boston University, Fisher College, Northeastern University, Simmons College, Smith College, Springfield Technical Community College, State University of New York at Delhi, Stonehill College, Tufts University, University of Connecticut, University of Delaware, University of Maine, University of Massachusetts, University of New Hampshire, University of Vermont, Western Kentucky University, Wilkes Community College, and Worcester Polytechnic.

THE HERBARIA

Of the major research tools in the Arnold Arboretum, the living collections, libraries, and the herbaria are perhaps least visible. Even those of us who work in them sometimes take their efficient functioning for granted. However, the main herbarium of the Arnold Arboretum, some 1,112,633 specimens, along with the herbarium of the Botanical Museum, the Farlow Herbarium, and the Gray Herbarium, form one of the great herbaria of the world with more than 4,250,000 specimens. To ensure that all specimens can be readily consulted involves the investment of considerable time and money on each specimen after it arrives here, not to mention the effort involved in the actual collecting of the specimen, an effort which has not infrequently been attended by the loss of life or permanent injury, for the collector. We are fortunate in the Harvard herbaria in having a curatorial staff that maintains and develops the collections so that maximum use can be made of them by current research staff and other workers. Their work also ensures that the specimens will remain useful for future generations of scientists.

The basic needs for the herbaria are moderate and equable temperature and humidity and freedom from insect damage. If these conditions are met, specimens can remain useful for hundreds of years. For example, one of the first herbaria ever made, that of G. Cibo in 1532, is still in existence. This is why, in order to insure maximum longevity, all dried plant material coming into the herbaria is automatically fumigated; even specimens taken out of the building for use in a class are fumigated on their return. We have been using methyl bromide as the fumigant, but there have always been problems with the fumigation chamber, and methyl bromide itself is highly toxic. Thus, this year we are acquiring two large freezers, one for

Cambridge and one for Jamaica Plain. This will allow specimens to be deep frozen for two days, quite sufficient to kill insects and their larvae. However, despite all our precautions, specimens in the herbaria are sometimes found to have beetle larvae. Certain groups like the milkweeds (Asclepiadaceae), clubmosses (Lycopodiaceae), and composites (Compositae), and specimens which have been temporarily stored in the cardboard boxes designed for this purpose by Dr. E. D. Merrill (and appropriately named Merrill's perils!), are particularly vulnerable to such attack. Such infestations are immediately treated, since an unnoticed attack can make specimens almost worthless.

All specimens coming into the herbaria are fumigated, counted, and accessioned. Label data have to be typed for some collections, or the whole collection identified, or the specimens sorted into sets, one for the Arnold Arboretum (or Gray Herbarium) and the others for distribution. Even for collections coming in that have names and good labels, it is still wise to check through the whole collection to ensure that the identification is not wildly incorrect, and that the label does indeed belong to the specimen. Specimens are then ready for mounting by preparators Mrs. Edith Hollender and Ms. Zepur Elmayenat Cambridge, and Mrs. Helen Fleming and Mrs. Anne Sholes in Jamaica Plain. The sheet is stamped with the herbarium stamp, the label is affixed in the bottom right hand corner, and one side of the specimens sprayed with Nicoband-B glue and arranged carefully on the sheet. The specimen should not only look nice on the sheet, but should display all parts of the plant so that they can be seen without having to pull off leaves, etc. Finally, Archer's Medium is used to ensure that prominent parts of the plant are securely attached. Bulky fruits are labelled, cross-referenced with the sheet, and stored separately in the fruit collection. A Number of older specimens are also mended every year, since some of the glues used previously have turned out to be less than permanent, and the general wear and tear on a few specimens have caused them to be detached from the sheet.

After mounting, the specimens are sorted first to groups of families, then to family, genus, and geographical area so they are ready for insertion into the herbaria. This job, which, like others in curating, can be quite tedious, has been made more interesting by Senior Curatorial Assistant Mr. Walter Kittredge's expedient of writing the salient characters of the families on the family tags; this also allows another check to be made on the identification of the specimen. As in all stages of the curatorial process, great care must be taken. There is no list of specimens held in the herbaria, and specimens filed out of order may be effectively lost for a number of years; it is a tribute to the curatorial staff that specimens rarely are lost.

The herbaria are arranged following Engler's system, with genera and families following the index to his famous *Die Natirlichen Pflanzenfamilien*; species are nearly always filed alphabetically in each genus. This arrangement we find to be a nice compromise between ease of insertion and removal of specimens, and the use of the herbarium in identification and research. Assistant Ms. Martha Tack is doing much inserting now - no easy job, since it involves such problems as the decipherment of handwritings of varying degrees of atrocity and country names written in different languages and scripts, as well as catching misspellings. As folders of

specimens get especially bulky they are divided into two folders; this saves quite appreciable space. Type specimens, the important specimens by which plant names are validated, are filed separately at the end of each family. They are placed, a few together, in thin folders to ensure that they get maximum protection.

The herbaria exist not only for use by our staff but by scientists everywhere. Every year between 50,000 and 60,000 mounted specimens sent and received on loan are handled by the curatorial staff. This number includes at least 26,000 of our specimens requested on loan by researchers throughout the world, and specimens being returned after study, as well as specimens sent from other institutions for study by staff and students at the herbaria. A loan request varies in size from a single sheet to 2,000 sheets or more, and each one has to be processed with great care. The records system was essentially developed by Manager of the Systematic Collections Mr. Michael Canoso, who keeps tabs on all specimens coming into or being sent out of the building. Some loans are kept for an excessive period of time, and polite, but firm letters have to be sent requesting their return! The packing of loans is largely done by Mr. Howard Farkas; this is a job requiring considerable skill, since the weight of each package has to be kept to minimum at the same time ensuring that the specimens are protected.

Another very important continuing activity that keeps the herbaria maximally accessible and useful is the identification of specimens. There are still some hundreds of specimens, especially from South America and East Asia, that have been mounted, but which lack a name. At the end of many families are specimens with only a family name, and quite often these names are incorrect. Numerous other similarly poorly identified specimens turn up every year. Considerable effort is paid in the identification of such specimens, both because until they are reasonably identified they are useless in research, and also because, remarkably often, it is the rarer or more unusual species that are poorly identified. Recently, specimens of a tropical tree violet (*Violaceae*) with fleshy fruits turned up in both the tomato family (*Solanaceae*) and in the tropical *Flacourtiaceae*. Dr. Schubert not uncommonly finds interesting members of the spurge family (*Euphorbiaceae*), and the relatively little collected tropical *Menispermaceae*, mixed in with material of *Dioscorea*, the yam genus which, one might think, could never be confused with anything else. This last fall, a group of graduate students spent some time working on unidentified material from tropical America, dissecting the flowers and thus identifying the specimens at least to family. This was an educational process for them, and of great help to the herbaria. However, much remains to be done. In addition, Curatorial Assistant Ms. Laurie Feine-Dudley spends much of her time taking out specimens and identifying them following the identifications of duplicates in published monographs. This important activity often reveals unrecognized types that we hold, and makes our collections more valuable for identification and research. At the same time, she incorporates "Merrill rubbings" into the herbaria. These are rubbings of important specimens made by a former director, [Dr. E. D. Merrill](#), at various European herbaria, sometimes with fragments of these specimens added; many of these represent types, some of which are no longer in existence.

Heretofore the conditions in the herbaria at Cambridge have been overcrowded. If specimens are packed too tightly they get damaged when they are removed or inserted, and so considerable time has been spent over the last two years planning for the expansion of the collections in Cambridge into twelve new compactor rooms. Compactors are banks of herbarium cabinets on wheels, and they allow considerable saving in room space. This planning has been a matter of extreme complexity, since every specimen to be moved, and parts of families currently widely separated must be brought together, with the end result being an evenly-filled herbarium. It has given Mr. Canoso, ably assisted by Mr. Walter Kittredge and Ms. Laurie Feine-Dudley, numerous headaches, but the recent trouble-free move of 38 cases into a compactor unit suggests that this time spent on the planning was well-spent. In addition, [Ms. Ida Hay](#), Staff Assistant charged with the curation of the herbarium of cultivated plants housed in Jamaica Plain, recently planned and supervised the move of the part of that herbarium on the first floor to the fourth floor. Superintendent Henry Goodell and the grounds crew carried out the move with surprising rapidity during the winter.

By no means all the tasks involved in keeping the herbarium maximally useful for staff and visitors alike have been mentioned, but it is clear the unremitting careful work is the key to the whole operation. The highest compliment that can be paid to the curatorial staff, and indeed the only justification for the collections as a whole, is to ensure that they continue to be used as the basis of systematic work of the highest quality.

Dr. Peter Stevens supervises the combined herbaria of the Gray Herbarium and the Arnold Arboretum. Herbarium policy is formulated and overseen by the Herbarium Committee, of which he is the chairman. Other members are the Director (ex officio), Mr. Michael Canoso, and Drs. Donald Pfister (Farlow Herbarium), Otto Solbrig (ex officio, Gray Herbarium), Rolla Tryon (Gray Herbarium), and Carroll Wood; Ms. Ida Hay and Mr. Walter Kittredge are observers.

During the year Ms. Patricia Adakonis, Curatorial Assistant I, resigned and was replaced by Mr. Howard Farkas, who works part-time. Mr. Kittredge has been working two days a week helping to curate the Oakes Ames Orchid Herbaria under the National Science Foundation Curatorial Grant. Together, this has released a further full curatorial assistantship, which was filled for a time by Ms. Julie Zickefoose, and now by Ms. Martha Tack. Mr. Philip Cantino joined us as a temporary phanerogamic botanist to work on the type project under the NSF Grant; he resigned on May 31. He was assisted by Ms. Sandra Maclaren, Curatorial Assistant I, for part of this time.

Although the compactors were installed last year, owing to technical problems it is only recently that an order for gaskets, to make them airtight, has gone in, and there are still modifications to be made on the locking devices. However, one bank of compactors was made insect-proof after installations of gaskets, and a locking device that exerts enough pressure and allows plenty of space in the aisles when open, and alignment of individual compactor units. The Fagaceae and Ulmaceae were transferred to this bank, which seems to be working

satisfactorily and to have space for future accession. Further shifting of specimens in association with the move has been carried out and plans for moving finalized. Labels for the move are being made and, if experience with the Ulmaceae and Fagaceae is any guide, this should be carried out fairly smoothly.

The total number of sheets in the Arnold Arboretum holdings in Cambridge at the end of the fiscal year was 1,112,633; and 50 sheets were mounted, nine added directly and 41 removed. One hundred eighty-six further sheets were repaired. In Jamaica Plain the total number of sheets in the herbarium of cultivated plants stood at 168,893, with the addition of 845 specimens. Sixty sheets underwent repair. Six thousand twenty-nine accessions were received at the two herbaria, 2,977 of which were by exchange, 1,985 as gifts, 35 by subsidy, and 1,082 in exchange for identifications. The chief sources this year were eastern Asia (1,954), United States and Canada (1,045), Australia (1,009), western Malesia (557), India (423), and Papuasia (351). Five hundred seventy-three sheets were sent on exchange during the year, and 106 for identification. 2015 specimens were received on loan for study by staff and 2,842 by students; a further 790 were received for visiting scientists; 6,146 were returned on behalf of staff and 19,546 on behalf of students; 21,879 were forwarded in response to loan requests and 20,230 returned.

Curatorial staff annotated 1,800 further sheets in Anacardiaceae, a project started in the previous year following the revision of Ding Hou; 425 Malesian Labiatae after Keng; 250 Olacaceae after Sleumer; 100 Malesian Ulmaceae after Soepadmo; 175 Malesia Caesalpinia (Leguminosae) after Hattinck; 40 Guyanan Bonnetiaceae after Maguire, and 700 Malesian Araliaceae after Philipson; 30 Australian Chloanthaceae were also annotated. Material was annotated in Rubiaceae, and 13 new genera folders prepared following Ridsdale's recent publication; and *Meliosma* (Sabiaceae) was rearranged following van Beusekom. Collections of *Garrya* made by G. V. Dahling were divided for distribution. The recently acquired Schaeffer collection of West Indian plants is being prepared for incorporation. Altogether, 34 new genera have been added to the collections. One hundred and three specimens were photographed, including 50 types which were sent on loan.

In Jamaica Plain the relocation of nearly half the herbarium of cultivated plants was the major undertaking of the year. This was supervised by Ms. Ida Hay, Curatorial Assistant who is responsible for this herbarium. Although much was accomplished, there are still several tasks to be completed before the herbarium will be back to normal. In order to provide space for offices on the first floor, 86 cases, containing 70,000 specimens, were moved from the first to the fourth floor of the herbarium wing of the administration building. To prepare for this move work began in autumn, 1980, on the reorganization of materials stored on the fourth floor. The carpological collection occupied ten wooden cases and six tiers of library shelving. With the help of Ms. Emily Roberson, a volunteer and Harvard undergraduate, this collection was consolidated to occupy only five cases with room for future expansion. By mid-December, the fourth floor was cleared. In one week, the grounds staff, along with Superintendent Mr. Henry

Goodell, Assistant Superintendent Mr. Patrick Willoughby, and Ms. Hay, moved all 86 cases. Specimens were removed from the cases and lifted, half a case at a time, by means of the aerial bucket of the High Ranger truck. The cases were disassembled and moved by the same route. In this way, the order of specimens in the herbarium was maintained. The work of leveling, straightening, locking the cases back together, and replacing the doors was completed in early January.

On the second floor, mounting supplies that were stored in the central area, formerly the clerestory, were inventoried and moved elsewhere on that floor and to the attic. A new, reinforced floor was built by contractor and the railing around the area removed so that this space could be fully used. A large work counter was moved from the first floor and reassembled there. The Gray card index was also moved to the center of the second floor, and the Rehder index was relocated in the library corridor on the third floor. In order to accommodate the relocation of work space and offices of staff who use the herbarium on the second floor, and to use eight of the cases on the fourth floor to house the unmounted, boxed Yucca and Agave collections of [S.D. McKelvey](#), the herbarium there had to be further shifted once the main move was complete. Mr. Canoso, Ms. Hay, and Ms. Roberson worked on this. The work space for herbarium preparators was moved from an alcove in the herbarium to the office adjacent to the herbarium on the second floor. The cooperation, care, and effort of Superintendent Goodell, Assistant Superintendent Willoughby, and the grounds staff were invaluable throughout the herbarium move.

The processing of 600 Merrill cartons of unmounted material has begun. Some material collected by Fernandes has been identified, the Arboretum's set mounted with duplicates separated for exchange. Other material by the same collector is awaiting dispatch in the course of exchange. Checking of the large collection made by W.P. Fang has also begun; identifications are being checked, labels typed, and specimens mounted.

Our well-known Crataegus collection, which is housed in the Jamaica Plain herbarium, is being reorganized. Types have been removed to the end of the genus, and the whole genus is being alphabetized as a returned loan of almost 1,400 specimens is inserted.

The collections program in the living collections was reinitiated this spring with goals to obtain one flowering and one fruiting specimen of every accession for our use in verification and documentation, and to obtain duplicate material, when appropriate, to use for exchange. At the end of May, 1981, volunteer Ms. Annette Logan, a forest biology student at Colorado State University, arrived to spend the summer on this project. Using a copy of the computer printout and a set of the most recently revised maps of the collections to monitor the work, she made 235 collections by June 25, 1981. Volunteers Ms. Thais a Way and Ms. Roberson have assisted on this project. The collection of herbarium specimens from plants in the living collection with documented Asiatic origin also continued in 1980-1981. Volunteers Ms. Susan Davis, Mrs. Cora Warren, and Ms. Mary Wolcott made ten sets of 125 collections this year. The collection of our Crataegus accessions was continued by Ms. Hay, Mrs. Warren, and Ms. Davis,

who made 25 collections in fruit. In anticipation of removal and repropagation of much of the *Corylus* collection, specimens were made of all accessions in that genus.

The herbarium welcomed 179 visitors this year, of which 137 were from the United States, and a further 17 from elsewhere in the New World, and the remainder from the Old World.

THE LIBRARIES AND ARCHIVES

After almost seven years as Librarian of the Arnold Arboretum, Mrs. Lenore Dickinson retired on March 5, 1981. The current Librarian, Ms. Barbara Callahan, joined us on March 1.

The Librarian is chairman of the Library Committee. The other members, besides the Director (ex officio), are Dr. Alan Erickson (Harvard Libraries, ex officio), Ms. Sheila Geary, Dr. Richard Howard, Dr. Elizabeth Shaw (Gray Herbarium), Dr. Otto Solbrig (Gray Herbarium, ex officio), and Dr. Stephen Spongberg. The library support staff consists of Ms. Sheila Geary, Horticultural Research Archivist, responsible for the library in Jamaica Plain, Ms. Anne Thacher and Ms. Mary Thomas, Library Assistants. A third Library Assistant, Ms. Carol Rothstein, resigned March 20, 1981; her position will not be refilled.

During the year our total holdings of volumes and pamphlets reached 87,967; 185 titles had been added by cataloguing, and 122 titles by binding; 30 volumes were deaccessioned, including 10 duplicate volumes through sale; 187 reprints were catalogued, and 42 microfilms added. The wish to acknowledge the following donors of volumes to our library: Mrs. Forrest Davison, Mr. G. K. Fenderson, Dr. Shiu-ying Hu, Dr. Richard Howard, Mr. Ray Millman, Mrs. William Moore, Dr. Franklyn Ott, Dr. Richard Schultes, Dr. Elizabeth Shaw, Dr. Peter Stevens, Dr. Herman Sweet, and Dr. Barry Tomlinson.

Most of the Cambridge library had been shifted to the new space provided through the building extension in the previous year. The folio and monograph collections are still in the process of reshelving.

During the winter months the first phase of the projected library reorganization in Jamaica Plain was implemented. With assistance from Mr. Henry Goodell, Mr. Patrick Willoughby, and members of the grounds staff, Ms. Sheila Geary removed all library material, with exception of the staff reference section, from the first floor. The move included a complete rearrangement of the entire monograph section of the library. This rearrangement now places all library holdings on one floor in the Hunnewell Building shelved in the correct classification sequence, and with ample room for expansion. In addition the photograph collection was moved from the second to the third floor, and the archive collection was assembled in one location to facilitate its eventual move to new office space on the third floor. The reorganization and relocation of the library, photograph, and archive collections will ensure more control and improved management and conservation, yet will allow better access to the

collections. As a finding aid to the new arrangement, a revised guide to the library has been prepared.

The second phase of the library move, now in the planning stages, involves the journal collection. Although housed with the rest of the collection on the third floor, over half of the journals occupy space that serves the dual purpose of both library stacks and staff offices. These journals will be moved to new stacking, already on hand, to be assembled across from the newly relocated monograph collection.

The arrival of the new Librarian coincided with the phasing out of the Monograph Cataloguing Support System. As a new processing center, to be called the Harvard College Libraries Faculty of Arts and Sciences Cataloguing and Support Services, is due to begin on July 1, 1981, Ms. Callahan and Ms. Geary provided temporary cataloguing in the interim period. The new system will provide central cataloguing and terminal services for all new titles, including original cataloguing. Call numbers will continue to be provided, for the present, based on our libraries' unique classification system.

A backlog approaching 200 printed items each, in Cambridge and Jamaica Plain, as well as 42 microfilms in Cambridge, awaited cataloguing. Temporary cataloguing of some had been provided by Mrs. Dickinson; Ms. Callahan and Ms. Geary have been concentrating on the remainder. At the year's end altogether 44 monographs had received temporary and 48 original cataloguing; 129 titles had been found on the OCLC (Online Computer Library Center) database; 34 reference volumes received Library of Congress classification; and 16 titles were transliterated for cataloguing, either by the Department of Slavic Languages, or the Yenching Library.

After years of work the Distributable Union Catalogue, a computer-produced serial and monographic record of holdings drawn from almost all Harvard Libraries and units will be available during the month of July, 1981. Preceding the arrival of the DUC microfiche, both the Cambridge and Jamaica Plain libraries received, as a gift from the Harvard University Library, a Micron microfiche reader and fiche holders and panels. The receipt of this equipment and microfiche will facilitate access to other libraries' collections and aid in the coordination and improvement of collection development.

Due to lack of resources the Library Committee decided to discontinue publication of the Combined Accessions List: Selected Titles of the Arnold Arboretum and Gray Herbarium Libraries, 'with Number 25, October 1 -December 31, 1981

It is our policy to honor requests for loans only from those libraries with whom we have a long-standing, reciprocal, lending relationship. Only two loans were made to non-Harvard libraries during the fiscal year. In place of a loan we have been providing photocopies in response to requests from other institutions for a minimal charge. Two thousand three hundred thirty-one photocopies were supplied on a fee basis in lieu of interlibrary loan. In some cases the request for material resulted in the microfilming of several items, after which the request

could be filled by the sale of a copy of the film master. The Librarian prepared a study of the time and costs involved in fulfilling these requests and, based on these findings, recommended a fee revision.

The Librarian has judged several further areas of operation to require new planning in order to attain the goals and objectives both of the library and the Arnold Arboretum. Needed in particular are a library policy and procedure manual; a completion of reshelving, cleaning, oiling, dusting, and acid-free relabeling of the collection; an annotated list of the uncatalogued, unlisted, uncontrolled items scattered throughout the library with the intent of securing grant monies to help gain control of these collections; and a complete inventory of holdings. Meanwhile, the Librarian has requested that each library staff member keep a daily activity log. The use of these logs as planning tools should assist in increasing efficiency and thus provide time to develop the new programs.

During this year Ms. Anne Thacher has been principally responsible for reorganizing our government documents collection and reviewing our acquisitions procedures. She has also helped transfer the public services area in Cambridge into a remarkably congenial and satisfying environment. Ms. Mary Thomas acted as Serials Assistant and has undertaken minor restoration projects.

In Jamaica Plain, Ms. Sheila Geary has been fortunate in receiving help from volunteers. Each year their contribution is measured in hours spent filing, shelving, and sorting. The immeasurable contribution comes in the dedication, care, and interest they bring to the library. During the past year Muriel Bergdorf worked on the journal records, filed catalogue cards, and accomplished a great deal on a long-term project that will integrate the index of our archival letter file with the indexes in the bound archival letterbooks. Mrs. Jane Morss prepared material for binding, tracking down missing pieces. She organized the oversize book collection, annotated their cards, and labeled each book. Mrs. Cora Warren spent each morning on the photograph collection. Her extensive work included the organization on the lantern slide collection. Gathered from all recesses of the building, this collection of over 4,000 slides is now sorted and labeled by subject. In the photographic print collection two filing systems have been merged. Mrs. Warren's work now enabled the user to locate all historic prints of a specific genus in the collection regardless of geographical location. This new system is being expanded to also include the current photograph collection.

One hundred six monographic volumes were bound altogether, either by repair or prior to addition. A further 190 journal volumes were bound. As part of the library's on-going preservation and restoration of the collection, a number of items were sent out again this year to be hand-repaired or fitted for acid-free fallback boxes. Some of this work fell under the category of retrospective binding and was supported by part of the grant from the National Science Foundation for curation of the collections. Forty-three volumes received special binding attention. Through the support of the Harvard University Library's grant for preservation microfilming under the Strengthening Research Library Resources Program provided by Title II-

C of the Higher Education Act, the Library was able to have microfilm copies made from 18 volumes. Items were nominated for microfilming on the basis of their physical condition, research value and/or inaccessibility in other research libraries.

An inventory of the combined archives of the Arnold Arboretum and the Gray Herbarium has been started through the NSF grant. Ms. Lynn McWood has been appointed to undertake this task directed by Dr. Shaw.

Since May 1, 1981, the library in Cambridge has been closed for public service between 9 and 10 A.M. and between 12 noon and 1 P.M. to free staff for administrative and technical services. Responsibility for the photocopier was transferred to the Herbarium Secretary. These changes have greatly increased staff efficiency at no apparent disadvantage to users. The number of registered visitors to the Cambridge library was 224. Access to the stacks is limited to members of the Institute of Plant Sciences and their graduate students; due to this it is necessary to provide paging service for 4,276 items for users without stack privileges.

The primary users of our library are self-sufficient in their research pursuits, but a large number of our secondary and tertiary users require reference services. The current Librarian has begun a reference log in order to document the variables in our reference service. Thanks are due to the graduate students, faculty, and staff who volunteered their assistance in searching answers to the many obscure questions posed by occasional users of the library.

In addition to the staff, summer students, and volunteers who regularly use the Jamaica Plain library, 96 visitors consulted that collection during the past year.

Ms. Callahan reported on development of the combined library collections with the Subcommittee on Undergraduate Libraries of the Board of Overseers Committee to visit the Harvard University Library. Throughout the year both libraries have enjoyed the helpful cooperation of Dr. Alan Erickson, who is responsible for liaison between the Harvard science libraries.

Ms. Sheila Geary attended two seminars concerned with archival conservation during the past year. The first, entitled "Institute on Archival Management," was held at Simmons College and explored the various methods of organization and conservation of an archival collection. The second, one in a series sponsored by the M.I.T. Museum and Historical Collections, dealt specifically with conservation and restoration of photographs. Both seminars addressed and offered solutions to problems we have within our own collection.

On April 23, 1981, the second meeting of the National Association of Olmsted Parks convened for a four-day program in Boston. Ms. Sheila Geary, volunteer Mrs. June Hutchinson, and Supervisor of the Living Collections Mr. Gary Koller participated in the workshops and led tours through the "emerald necklace" highlighting the Arnold Arboretum.

Ms. Anne Thacher has been working towards her Master of Science degree in library and information science from Simmons College. Ms. Mary Thomas attended a two-day

workshop on Preservation and Restoration of Library Materials given by the Harvard University Book Conservator, Mrs. Doris Freitag.

PUBLICATIONS

Our policy for publications is defined and monitored through a joint committee, with the Gray Herbarium, under the chairmanship of Dr. Bernice G. Schubert. The members are Ms. Elizabeth Schmidt, Dr. Peter Ashton (ex officio), Dr. Otto Solbrig (ex officio), Mr. Carl Lobig, Dr. Stephen Spongberg, Dr. Peter Stevens, Dr. Donald Pfister, Dr. Richard Weaver, and Dr. Carroll Wood.

Mr. Carl Lobig assumed the position of Publication Officer for the Arnold Arboretum on September 1, 1980, taking over from Mr. Norton Batkin, who had resigned to pursue his Ph.D. in philosophy at Harvard University. At the time he assumed responsibilities, *Arnoldia*, the bimonthly horticultural publication of the Arnold Arboretum, was six months behind schedule. Most of his first nine months were therefore directed to rectifying *Arnoldia's* schedule difficulties, while at the same time undertaking design and layout changes that will help to make *Arnoldia* a more marketable publication. Since September, 1980, six issues of *Arnoldia* have been published, including the first two numbers of Volume 41. *Arnoldia* will be up-to-date as of the July-August, 1981 issue, Volume 41, Number 4. Accelerating *Arnoldia's* production schedule necessitated a change of printers, a move long under consideration for financial reasons. Heffernan Press of Worcester, Massachusetts, has been chosen. Although still on a trial basis, Heffernan's work seems to be more than satisfactory and offers significant improvements.

As the primary benefit of membership to the Arnold Arboretum, and as the Arboretum's major publications link to the general public, it is important to maintain and develop *Arnoldia's* standards while at the same time increasing its popular appeal so that it may become self-supporting. In the initial stage this means improving its graphic appeal. A number of major steps have already been taken over the past year. They include special attention to photographic presentations; a new, more striking logo design combined with a move to a four-color cover which began with Volume 41, Number 1; a better quality cover paper; and a more varied photographic treatment. These initial changes, combined with the return to a regular publishing schedule, have brought *Arnoldia* considerably greater attention and pave the way for future promotional efforts. This year we also began program of distribution to horticultural bookstores on a trial basis. Further changes are under consideration.

In attempting to bring a wider readership to *Arnoldia* we have begun soliciting articles from within and outside the Arboretum on a diversity of subjects. This year saw the publication of Dr. Richard Howard's two-part historical profile of E. H. Wilson as a botanist (Vol. 40, Nos. 3, 3) and a special issue devoted to *Magnolia*, timed to appear at the American Magnolia Society's Annual Convention held at the Arnold Arboretum in April. *Arnoldia* continues to provide a place for publishing horticultural research associated with the Arboretum: Mr. Peter Del Tredici's

prolific contributions included research on *Tsuga canadensis* f. *pendula*, and *Magnolia virginiana*, while graduate student Mr. Michael Donogaue contributed a study of growth patterns with examples from his research on the genus *Viburnum*. Meanwhile plans are being developed for further thematic issues aimed at particular horticultural interest groups as potential subscribers. A major promotional mailing is planned for fall, 1981.

With *Arnoldia* coming back on schedule, Dr. Richard Weaver became Associate Editor and took over as Technical Advisor from Dr. Bernice Schubert beginning January, 1981. Mrs. Barbara Epstein continues to act as Circulation Manager.

The Editor of the *Journal of the Arnold Arboretum* is Dr. Stephen Spongberg; Ms. Elizabeth Schmidt managing Editor. The Editorial Committee remains the same as last year. Four numbers of the *Journal* appeared during the year. Despite this, the *Journal* was one issue behind schedule at the end of the year. It is intended that all numbers of Volume 62 will appear during calendar year 1981.

Volume 61, Nos. 2 and 3, were devoted entirely to Dr. Stevens's "Revision of the Old World Species of *Calophyllum*," and were issued simultaneously on December 19, 1980. These two issues, the largest in the history of the *Journal*, numbered 582 pages and included a special index. A total of 792 pages were devoted to the eight articles by ten authors published in the past fiscal year. Dr. Richard Howard, former staff member Ms. Kristin Clausen, and Dr. Peter Stevens were Arboretum staff who published in the *Journal* during this period, while Dr. Walter Judd published the first installment of his Monograph of *Lyonia* (*Ericaceae*), which is based on the thesis he prepared while a graduate student under Professor Carroll Wood's Guidance. Three of the ten authors were associated with foreign institutions. Manuscripts are presently on hand for issues into Volume 63. Twenty-four manuscripts were received during the past fiscal year; of these three were rejected, two are currently being reviewed, and the remainder have been accepted for publication.

A new cover design, which is embossed on off-white cover stock, utilizes the logo drawn by Mrs. Karen Stoutsenberger Ku, and the same design reduced in size is being used as the device on the reprint covers. It is intended that this logo be associated with the *Journal* for many years to come. As a result new cover designs will not have to be prepared on an annual basis.

Special recognition should be given to Ms. Schmidt for her unflagging efforts to cope with the work load in the editorial office during Dr. Spongberg's absence in China and, after his return, in her efforts to put the *Journal* back on schedule. Mrs. Mary Ashton, Mr. Mellard Ashton, Ms. Margaret Campbell, Mr. William Curtis, and Dr. George Proctor are also thanked for assisting in the thankless job of reading galley proofs.

Other areas of activity in the publication department were recently limited by the overriding needs of *Arnoldia*. Some progress is now being made. In conjunction with Ms. Eugenia Frey, Mrs. Barbara Epstein, Ms. Hope Wise, and the Director, plans were made to integrate the publishing of the Arboretum into our overall development plan for public services,

covering the next four years. This includes development and marketing of *Arnoldia*, production of new brochures and promotional pieces, and the development of educational programs and displays. In order to supervise scientific accuracy, Dr. Bernice Schubert, representing the Publications Committee, has volunteered to review materials before publication. Our latest publishing venture, our newsletter, *plant Sciences*, is reported on in the section on Public Programs.

An inventory of publications in Jamaica Plain has been undertaken with the help of volunteers, subsequent to moving back stock from newly allocated library shelves to a publications storage area. A procedure for billing and tracking stock flow has been put into effect which will, in addition to keeping more accurate records, generate a mailing list of interested horticulturalists. Over 500 names and addresses have already been compiled. Negotiations are under way for a new mailing house, and plans are being made to computerize all our mailing lists for the first time.

The photographic collections continued to receive careful attention from volunteer Mrs. Cora Warren, while volunteer Mrs. Dodie Loomis diligently supervised the curation of the slide collection. As our resources have become better known, requests for their use have increased, making comprehensive cataloguing and curation increasingly urgent. This year we provided photographs on a fee-for use basis to major publishing houses including Beacon Press, Houghton Mifflin, *Horticulture* magazine, and *New England Outdoors* magazine. A proposal to provide over 1,000 photographs for a book on landscape architecture is currently under consideration.

LIVING COLLECTIONS

The Living Collections Committee consists of Plant Propagator Mr. John Alexander, Assistant Supervisor of the Living Collections Mr. James Burrows, Superintendent of Buildings and Grounds Mr. Henry Goodell, Records Coordinator Ms. Jennifer Hicks, Drs. Stephen Sponberg, Peter Stevens, and Richard Weaver, the Director (ex officio), with Mr. Jonathan Shaw, Director of the New England Wildflower Society, as outside member; the Supervisor of the Living Collections, Mr. Gary Koller, is Chairman.

Substantial progress has been made in the curation of the collections in Jamaica Plain again this year, including major acquisition of new material in the preparation of the accessions records prior to their entry into computer storage, and in general restoration and maintenance of the grounds. Plans are being made for the more intensive utilization of the Case Estates.

Detailed planning of accessions had been the responsibility of Dr. Richard Weaver and Supervisor Mr. Gary Koller. Due to the very dry summer and fall of 1980, the fall planting was kept at a minimum. Essentially the only planting done was a large number of rhododendrons sited near the South Street Gate. Eighty-two accessions of 77 taxa and cultivars, a total of 150 plants, were set out. The species material, a total of only nine plants, were planted at various locations on the grounds. By far the largest percentage of the plants, consisting entirely

of Rhododendron cultivar material, was planted at the base of Hemlock Hill near the South Street Gate. This area has been the Arboretum's traditional collection of evergreen Rhododendron and consists almost entirely of cultivars owing to the paucity of species that are hardy in our climate. By far the largest and most conspicuous component of the collection has been the series *R. catawbiense* hybrids and cultivars known as "ironclads". The collection, particularly that part nearest the road, has declined over the years and has not presented a particularly good appearance to the numerous visitors entering through the South Street Gate as well as general visitors coming to see the rhododendrons when they are in bloom. During this planting, gaps in the borders were filled with both deciduous and evergreen Rhododendron with an attempt to select cultivars that would increase diversity and harmony in color, height, and flowering time; unsightly plants were relocated or moved; and a new series of beds was established across Bussey Brook along the southeast edge of Hemlock Hill. All planting areas were well-prepared under the supervision of Mr. Patrick Willoughby and Mr. James Burrows.

The spring planting lasted from the beginning of April until the middle of June. Four hundred ninety-four plants were set out, representing 172 accessions of 158 taxa and cultivars. Included were 85 plants of 30 different cultivars. In addition 15 accessions of 14 taxa were moved from the shrub collection; most of these plants were divided before they were replanted in their new locations. Ten of these are cultivars of *Paeonias uffructicosa*, and 11 are cultivars of *Rhododendron nakaharai* developed by Mrs. Julian Hill of Martha's Vineyard, a recently retired member of our Visiting Committee. One hundred thirty-one plants, of 31 accessions of 27 taxa, represented the first major planting resulting from the Spongberg-Weaver expedition to Japan and Korea of 1977. The plantings were done according to the Bentham and Hooker sequence, and a number of new plantings begun last year were strengthened. The only new family replaced in taxonomic sequence is the Calycanthaceae. Several taxa of Calycanthus were planted in the Azalea Border and in the Liriodendron collection. Fifty-four plants of Cytisus as well as 13 plants of other shrubby legumes were planted among the Colutea and Caragana along the Arborway wall behind the Vine Trellis. This area will be the primary collection of shrubby legumes. For cultural and esthetic reasons these plants are unsuitable among the arborescent legumes. The Hydrangea collection was relocated from the shrub collection to the edge of the Acer collection along the Meadow Road. The Chinese Path area on Bussey Hill received a number of accessions. Several species of Chinese trees were added to the azalea and Enkianthus beds for shade. Several Chinese plants, which were first exhibited in the Flower Show, including *Rhododendron schlippenbachii*, *Dicentra spectabilis*, and *Liriope spicata* were planted among the Stewartia collection. Also, several bamboo species and tree peonies were planted in the old Cytisus bed. The grass strip between the sidewalk and the roadway, in the vicinity of the Forest Hills Gate was formerly occupied by hedges of roses. We hope to replace these eventually, and an experimental planting of two polyantha rose cultivars was begun near the Forest Hills Gate.

The phased replacement of the shrub and vine collection was begun. Approximately 225 existing plants on the three-acre site were evaluated. Plants will be relocated, repropagated,

and in a few cases disposed of. The first sections of the existing shrub garden were closed down by grassing in. With assistance from the New England Rose Society the rose collection was reviewed and names verified. Dr. Weaver then went through the collection to remove unnamed or overgrown accessions and separated those to be retained. Vines of various genera were planted on the Arborway and Adams-Nervine fences.

Most of the *Alnus* planted along Willow Path last fall did not survive, primarily because they could not be dug properly because they were too close together in the nursery. The dead plants were replaced this spring. The torch azaleas (*Rhododendron obtusum* var. *kaempferi*) were killed back badly last winter. The planting beneath the oaks, just before the ponds, was largely reworked this spring. Unsightly plants were pruned back and consolidated into tighter groups, and the poorest plants were removed entirely. Fifty plants were purchased and were used to reconstitute the original groups. The groupings were mulched with shredded leaves rather than the customary wood chips, to reinforce the naturalness of the plantings. Major pruning of the willow collection and associated plantings was undertaken, mainly by Pruner Mr. Mark Walkama. Eight large specimens, which had been repropagated, were removed. Review of the *Malus* collection continued to determine which trees flower and fruit poorly as well as being susceptible to foliage and fruit diseases. After being evaluated, and in some instances repropagated, approximately 40 mature specimens were removed. During the summer, 1980, there was a major removal of thin, weak, or declining plants in the *Syringa* collection. The *Ulmus* collection continues to be affected by Dutch elm disease. It was necessary to remove 16 more mature trees which had died or were affected by the disease. While it is not often noticed, a great many poor and declining specimens have been removed from various collections. These plants had previously been repropagated or replaced.

From August 3 to September 20, 1980, Dr. Weaver participated in the fifth of a series of joint plant collecting expeditions coordinated by the Cary Arboretum of the New York Botanical Garden and the Academy of Sciences of the U.S.S.R. The other American participants were Mr. Robert Hebb and Dr. Frederick Seaman, both of the New York Botanical Garden. The objective was to collect seeds or living plants, documented with herbarium specimens, from the wild for cultivation in the United States. They concentrated on the steppe flora of European Russia and the forest and alpine flora of the northern Caucasus Mountains. Just over 300 collections were made. Germination of the seeds has been quite good. Due to the poor woody flora in the areas visited, only about 70 of the collections were of woody plants, but many of the herbaceous collections will be used in educational exhibits or offered to other institutions for exchange.

Dr. Stephen Spongberg's participation in a joint Sino-American expedition to Hubei Province, China, has been reported under Research. In addition to the herbarium collections, nearly 600 seed collections were obtained on the China expedition, all vouchered by herbarium specimens as well. In addition, 42 miscellaneous collections of seed were made during the course of travels in China once the expedition itself had been concluded. A share of all but a small percentage of these living collections have been received at the Arnold Arboretum and

are currently being processed at the Dana Greenhouses. It seems likely that several new introductions to cultivation in the West are among these acquisitions.

Altogether 171 shipments, consisting of 1,536 taxa, were raised this year for propagation in response to requests from 21 countries. In addition, 336 taxa were propagated to prepare replacement for existing specimens in decline. Notable donations of plant materials, which have been used as understock, were received from Hess Nurseries, Cedarville, New Jersey, and Princeton Nurseries, Princeton, New Jersey; Lawyer Nurseries, Plains, Montana; Weston Nurseries, Hopkinton, Massachusetts; and White Flower Farm, Litchfield, Connecticut.

Much progress has been made in the verification of the plant records and the mapping and labeling of the collections in the past year.

Information and assistance provided by Mr. Burrows has made possible an intensive records update and relabeling of the plantings at the Case Estates. In Jamaica Plain volunteers and horticultural trainees have assisted in extensive field checking, the replacement of labels on more than 1,000 plants, and the preparation of labels for placement on an additional 700 plants during the summer of 1981. Mr. Charles Mackey of the grounds staff devoted the winter to the preparation of display labels for placement during the spring and summer. Horticultural Trainee Mr. Timothy Byrne, a student at the University of Massachusetts in Amherst, completed replacement labeling and remapping of the plantings surrounding the Hunnewell Building and a section of the Azalea border on Meadow Road during the spring of 1981.

Field checking has this year identified nearly 500 existing plants which had not previously been included in the plant records. New plantings, and the relocation of existing plants have been recorded and mapped as completed. Because special effort has been taken to deal with areas in which mapping and labeling are known to be problematical, portions of many grounds maps have been field checked and updated. Six maps have been fully updated and will be redrawn; three maps have been updated but will not be redrawn due to scheduled redesign or collection development; six maps have been redrawn.

Implementation of the plant records documentation and computerization project, funded by the National Science Foundation, began with the appointment of Ms. Patricia Dalton as Research Assistant for Records Documentation. Although she joined us in late April, she has already made significant progress in the verification of the records and their transcription into the format designed for computerization. Special mention should be made of the exhaustive library research in conifer nomenclature by volunteer Dr. Richard Warren. His work is being closely coordinated with Ms. Dalton's, and will prove valuable- to her since nearly 1,000 of the taxa represented in our collections are conifers. It is Dr. Warren's ultimate aim to verify the entire conifer collection. In June he was joined by volunteer Ms. Ann Carlsmith, who is making a comprehensive herbarium collection' of the conifer holdings.

An ONYX C8002 computer and a Visual Technology V-400 terminal have been purchased and will be operational during July, 1981. Although entry to the plant records will not begin

immediately, the use of the computer for 1981 nursery inventories, in the format designed for the living collection records, will provide an opportunity to test its programming in operation prior to beginning entry of full records for an estimated 20,000 accessions now in permanent display positions at Jamaica Plain and the Case Estates.

Numerous inquiries have been received from individuals, organizations, and institutions for information concerning our plant records system and our maps and labels.

The Arnold Arboretum continues to contribute to the Plant Sciences Data Center of the Horticultural Society of America. Mr. Koller participated at a meeting, held at Longwood Gardens in October, 1980, to develop plans for its future.

Satisfactory advances have been made in general maintenance and in the restoration of the path system.

Improved planting techniques resulted in much higher survival rates in the reestablishment and vigorous growth of new plantings. Nevertheless, late summer drought in 1980 severely weakened many plantings which were old and declining or, in some cases, new plantings which were not yet reestablished. An extremely cold winter followed, with prolonged sub-freezing conditions. In addition, the winter was somewhat dry and, with long periods of exceptionally cold temperatures, proved to be one of the worst in recent memory. These conditions combined to cause much dieback in many taxa, including *Lindera praecox*, *Corylopsis* spp., *Idesia polycarpa*, *Deutzia* spp., *Weigelia* spp., *Elaeagnus umbellatus*, *Sasa japonica*, and *Cytisus* spp. Much additional fine pruning was therefore needed this spring, which was effectively undertaken by Head Pruner Mr. James Nickerson with Mr. Mark Walkama.

A grass fire in Kent Field in late summer led to damage and loss of a number of plants at the edge of the conifer collection.

The bittersweet, which had smothered the rock outcropping next to the conifer path for many years, was cleared and, we hope, eradicated. This has exposed the lovely rock ridge. While no plans exist at present for replanting, this represents a preparatory step for future development.

Work on the Oak Path is proceeding according to schedule. The mown path is well-established, although it is still not satisfactorily delimited where it begins on Meadow Road. Several wild flower masses were established in the summer of 1980. Two areas were planted with 1,000 each of *Cimicifuga racemosa* and *Trillium grandiflorum*. *Tiarella cordifolia* and the fern *Thelypteris phegopteris* were planted on the rather steep bank on the top side of the graded upper path. With the possible exception of *Trillium* these appear to be well established and should rapidly form a ground cover. Major regrading was undertaken along Willow Path to improve its definition and upgrade the roadbed to accommodate service and maintenance vehicles.

At the greenhouses the insulation reported last year proved highly effective, and the two remaining houses were covered. Mr. Alexander and his staff have processed 102 taxa to acquire propagation data. The inventory of lilacs (*Syringa*) for susceptibility of mildew and leaf roll necrosis continues, as do hybridization experiments among resistant taxa. This program is an important adjunct to the planned restoration of our celebrated lilac collection.

Mr. Robert Nicholson extended his studies of maples. He examined rooting responses of Manchurian maples and attempted induction of somatic mutation in *Acer palmatum* by colchicine injection. Mr. Nicholson also carried out experiments in hormonal injection of cuttings of recalcitrant conifer species in an attempt to induce rooting.

At the Case Estates drought affected the fall 1980 operations too, but 500 *Syringa* species and cultivars were transplanted to the 950 section of the nursery. These plants are to be used in the restoration of the lilac collection. Rows 1-40 and 120-160 were prepared and planted with 1,400 plants from the Saran houses. These represent replacement propagation, and plants from the Spongberg-Weaver [expedition](#) to Japan and Korea. The established nurseries are now almost full. Consequently, a water main has been installed on the opposite side of Wellesley Street, entering the old pruning demonstration plot which is to be removed. This will provide an irrigation source for the whole of this section of the Estates. Initial steps have been taken to open a new nursery, sufficient for 2,640 plants, which will open in spring, 1982. A quarter of the area has been plowed and prepared, and a cash crop planted to offset the cost of the operation.

The inventory of the permanent nursery was completed in 1980 and checked against records. Much has been lost, but much also remains. Detailed accession information, including living collections map locations of the same accession or the same taxon with its accession data where such exist, has been collected in order to determine which plants should be repropagated for return to the living collections. The process of repropagation will be delayed except in the case of declining specimens, owing to the current pressure on nursery space.

The Massachusetts Chapter of the American Rhododendron Society commissioned a landscape architect, Mr. John Gwynne, to draw up a schematic plan of the proposed garden which they intend to install, with the collaboration of the Arnold Arboretum, in the woods at the Case Estates. In order to implement the design, Arboretum staff have continued tree thinning and cleaning; Mr. Burrows laid out the route of the primary path system. The first batch of rhododendrons, presented by the society, have arrived at the Case Estates for planting in their final positions next spring.

The street tree plot was surveyed in 1980. The trees were overcrowded, many were damaged or diseased, and few were labeled. Poor trees were removed and repropagated, some new trees were planted in the spring, and all were labeled. Further renovation also occurred in the groundcover plots and some new covers added. This display is now in excellent condition and, once the new ground covers have grown, should need minimum maintenance.

Assistant Supervisor Mr. James Burrows and Horticultural Taxonomist Dr. Richard Weaver, with help from a group of volunteers, have made major changes in the old Low Maintenance Perennial Garden, which is to become the American Garden, an interpretive display of selected American native herbaceous species and the cultivars that have been derived from them. Beds were redesigned, and perennials propagated in the fall. Some of these were planted out in the spring, but the garden will not be completed for another year.

A one-year, renewable agreement has been signed between the Arnold Arboretum and Land's Sake, Inc., of Weston, to use land in the forty-acre field at the Case Estates to grow vegetables and small fruit for sale to local markets. The work is sub-contracted to Land's Sake, Inc.; any losses or gains made will be the Arnold Arboretum's responsibility. This year, work was started on a trial basis. A quarter-acre each of raspberry and strawberry were planted, and one acre of squash. A further five acres were plowed and planted to a cover crop. Land's Sake, Inc. is a nonprofit corporation open to any Weston resident. It is dedicated to the education of farm and forest management practices and to aiding the small home gardener. For the Arboretum this represents an attempt to offset the increasing costs of running the Case Estates by generating revenue from unused land. This new venture initially attracted some adverse comment from our neighbors, but a public meeting was held, and our endeavor has subsequently received interest and support.

Our staff, as usual, provided a variety of horticultural service to our colleagues and the public. During the year, 189 shipments of plant material, comprising 1,094 taxa, were distributed to cooperating institutions, nurseries, and individuals in 12 countries. We are particularly happy to have been able to assist Professor Bruce Tiffney of Yale University by providing unusual and interesting plant materials which will be used to reestablish the Marsh Botanical Garden. Mr. Nicholson mounted expeditions to localities throughout New England on his own initiative, to collect *Acer saccharum* from selected provenances for the Chinese Academy of Forestry, Peking. Three species of *Magnolia* were given to members of the American Magnolia Society during their annual convention which was held at the Arnold Arboretum in April, 1981, and was organized by Drs. Howard and Spongberg, and Mr. Koller. Seeds of *Sorbus alnifolia* and *Schizophragma hydrangioides* were also distributed to members of the International Plant Propagators Society at their Eastern Region Convention held in Boston in December, 1980. Mr. Alexander and Mr. Koller moderated the New Plants session at the Convention. Dr. Spongberg continued to serve as registrar for cultivar name registration, but from January 1, our responsibilities became limited to the 11 genera for which the Arboretum acts as International Registration Authority. Miscellaneous registrations are now being handled by the U.S. National Arboretum.

Living collections staff members acted as consultants to several public and private properties, responded to numerous inquiries by letter and telephone, contributed to lectures and tours, and guided visiting colleagues about the living collections, including the Magnolia Society, the International Plant Propagators Society, and the National Association of Olmsted

Parks. Dr. Ashton serves on the Board of Trustees of the Massachusetts Horticultural Society and the Corporation of the Museum of Science; Mr. Koller serves on the Board of Trustees of the New England Wild Flower Society, where he is chairman of the Garden in the Woods Committee, and on the Board of Directors of the Jamaica Hills Association, Jamaica Plain. Drs. Ashton, Howard, and Spongberg judged at the New England Flower Show. Mr. Koller organized the Judging Panel for the 1981 Arnold Arboretum Award, presented at the Show, which was won by Mr. Alan C. Haskell of New Bedford, for exceptional landscape use of the American Native *Pachistima canbyi*. Mr. Koller also judged at the New England Camellia Show, the New England Flower and Garden Show, and the Philadelphia Spring Flower Show. Staff gave numerous talks to garden clubs and other private organizations during the year.

No new living collections staff appointments were made during the year. Grounds staff member Mr. Ralph Benotti has been out of work, due to illness, since January. Several staff have attended courses: Mr. Henry Goodell and Mr. Maurice Sheehan participated in a course on insects and disease, and Mr. James Papargiris in a course of landscape design at Massachusetts Bay Community College; grounds staff member Mr. Bruce Munch was sent to Wakehurst Place, a substation of the Royal Botanical Gardens, Kew for four months to obtain experience in practical horticulture. Assistant Superintendent Mr. Patrick Willoughby has been awarded a one-year scholarship by the National Federation of Garden Clubs, Northeastern Region, to study horticulture at the University of Reading, England, in association with the Royal Botanical Gardens, Kew.

Mr. Tom Park, a longtime resident and Superintendent of the Hillcrest Gardens and Case Estates, died in February. Tom will be remembered with affection by all our staff. Dr. Howard contributed an obituary in our summer, 1981, plant Sciences newsletter.

PUBLIC PROGRAMS

Our public programs policy is formulated through the Public Relations and Education Committee. The Manager for Public Services, Ms. Wendy Marks, is currently interim chairman. Members are Mrs. Barbara Epstein, Friends' Coordinator; Ms. Eugenia Frey, Plant Information and Education Coordinator; Mr. Gary Koller, Supervisor of the Living Collections; Mr. Carl Lobig, Publications Officer; Ms. Kate Nixon, Public Relations Office; Ms. Cornelia McMurtrie, Volunteers Coordinator; Dr. Carroll Wood; the Director (ex officio); Mr. Timothy Anderson, former Director of the Franklin Park Zoo, acted as the outside member.

Our programs are still at an early stage of expansion. In this light, the year's achievements are considerable.

It is our policy that the public programs of the Arnold Arboretum should be entirely funded on the revenue they produce. As part of the reorganization of our budget and financial systems, cost centers were established for the public programs and subordinate centers for each of the sections including publication, education, membership, exhibits, volunteers, and public information. It is now feasible to compare costs against revenue for each section

quarterly and thereby to identify promising sources of revenue as well as unnecessary drains on resources. In the process cost analyses of various operations became necessary. Analyses were undertaken of our fledgling internal transportation system and the unit cost of growing plants in the greenhouses. The latter aided efficiency in other parts of our program.

PUBLIC FACILITIES

The Arnold Arboretum in Jamaica Plain has lacked such basic public facilities as toilets, an information and sales room, and meeting rooms. Our single exhibition and lecture room was clearly inadequate to meet all needs. An architectural firm, Douglas Okun & Associates, was therefore commissioned to convert the front wings of the Hunnewell Administration Building on the first floor to public use. Work started June 1, 1981. The renovation will provide a lecture room, seminar room, exhibition area, receptionist space, kitchenette, sales shop, workspace for volunteers, a lift for the handicapped, and men's and women's rooms designed for handicapped access, as well as offices for the Friends' Coordinator, Plant Information Coordinator, and Public Relations Officer. This project has been made possible in part thanks to grants from the Charles B. Hayden Foundation, the William E. and Bertha E. Schrafft Charitable Trust, the Neal Rantoul Foundation Trust, the Edwin S. Webster Foundation, and the Cabot Family Charitable Trust.

The five electric [trams](#) which were donated last year went into operation on July 7, 1980, when a Family Day was organized to give publicity. A tape was prepared for interpreted tours of the grounds. The trams were well-received by the public, and tours continued on weekends through the summer, and charter tours were organized on weekdays. The trams were plagued with breakdowns, however. The electric motors proved insufficiently strong to pull full loads up our hills. Further, the trams carried too few passengers to be economical. Regrettably, four had, therefore, to be sold, one being kept as a mobile sales booth. A generous donation from Mrs. Barry Bingham has enabled us to acquire a new, gasoline-driven vehicle that can carry 25 passengers in comfort.

Much further thought has gone into future development of our public programs and services in the spirit of the policies defined in the previous two annual reports. A five-year program for all sections of our public services has been set up with a provisional time schedule to aid planning. Weekly meetings of the Public Relations and Education Committee have led to improved coordination. Integrated time-schedules were initiated in the current year and proved effective.

On January 8, 1981, a meeting was convened of representatives from the city of Boston, the Metropolitan District Commission, the Massachusetts Bay Transportation Authority, the Harvard Administration, and the Arboretum to discuss the need for improved public facilities in Jamaica Plain. Our aim is to attract more visitors, who are themselves a safeguard against serious vandalism, and to generate revenue for the improvement of security and maintenance. Following this meeting, Environmental Planning and Design of Pittsburgh was commissioned to

undertake a feasibility study to assess whether such a development would be financially viable. The conclusions of this study, completed at the end of March were positive. The study recommended that revenue could be developed from internal transportation, parking facilities, and a visitor reception center with an exhibition space and interpretive garden to which there could be an admission charge, a restaurant, and a sales area. Following further meetings, preparations are now being made to commission a detailed economic and market analysis of the alternatives open to us, on the basis of which a master plan will be prepared. Negotiations meanwhile continue with the MBTA, MDC, and the city of Boston for a new access to the Arboretum from the proposed new subway station, across MBTA and city land into our South Street tract. All parties have agreed in principle to this proposal, and the engineers for the Southwest Corridor Project are designing the station surrounds in a manner which will accommodate a turning circle and road head for our internal transportation system. It has also been agreed that there will be an exhibit space within the station for the Arboretum. Our horticulture staff are assisting in the landscaping of the station precinct.

Horticultural Taxonomist Dr. Richard Weaver has been awarded a grant by the National Endowment of the Humanities for an interpretive guide to the Arnold Arboretum which will research our plant collection as a human endeavor. Horticultural Research Archivist Ms. Sheila Geary, Staff Assistant Ms. Ida Hay, and a volunteer, Mrs. June Hutchinson, worked with Dr. Weaver in the preparation of the proposal.

Meanwhile, part of Mrs. Bingham's gift is to be used to design and install interpretive signs at key points of the Arboretum.

PUBLIC RELATIONS

Ms. Hope Wise, Public Relations Officer, who joined us July 1, 1980, resigned at the end of April. Her place has been taken by Ms. Kate Nixon. During her brief stay Hope was responsible for planning and implementing our first newsletter, *Plant Sciences*, which was published in October; a second issue appeared in the spring, and a third will do so in July. It is intended that three will appear annually, to complement the annual report which is published in December. The newsletter communicates news of Harvard botany in general; it has been well received by both Friends and the general public.

Several other public relations projects were undertaken. A shuttle bus was organized to run from Harvard Square to the Arboretum on Sunday afternoons in May and proved extremely popular. With the collaboration of the propagation staff a plant sale was held at the Case Estates in October following the Annual Plant Distribution to Friends. It drew an unexpectedly large crowd and 41 new Friends. This is to become a regular event. Local community activities included a tree planting ceremony on the grounds of the Little City Hall in Jamaica Plain, when three Japanese wingnut trees (*Pterocarya rhoifolia*), grown from seed collected by Drs. Spongberg and Weaver, were planted to commemorate Arbor Day; and a litter cleanup on

Peter's Hill in the Arboretum, which was undertaken by the Corporation for a Cleaner Commonwealth.

Wedding ceremonies have become increasingly popular in both Jamaica Plain and the Case Estates. The administration of requests for weddings and other receptions has been reorganized; they are providing a useful minor source of income.

Publicity for the Arboretum and its programs was increased considerably during the year. A public service announcement was produced with Channel 7. Slides of plants in bloom were sent to WGBH Television (Channel 2) and appeared periodically. A Boston Globe series on plants in bloom at the Arboretum was revitalized. There was increased publicity for all events, classes, courses, and tours, which undoubtedly contributed to their success. The course brochures, the work of Plant Information and Education Coordinator Ms. Eugenia Frey, were particularly admired, as was a four-page supplement in the Gazette which highlighted the Arboretum's spring program.

Internal communication has been much improved through inauguration of The Sheet, a news bulletin which provides staff in Weston, Cambridge, and Jamaica Plain with news of current activities.

PUBLIC EDUCATION AND INFORMATION

Thanks in part to increased experience with the interests of our public, and in part to much improved publicity, there was greatly increased participation in our course program, especially from the Cambridge community. The series in Weston was moved this year to the Harvard University Herbaria Building in Cambridge, and from weekday to weekend and evening programming. Owing to renovation work in the the Hunnewell Building, spring programs in Jamaica Plain took place in the Dana Greenhouse classroom. Besides publicity from Plant Sciences, news releases, fliers, and the *Harvard Gazette*, the spring program brochure was designed in a poster format. This led to increased distribution, and extra runs of the poster were sold in the Harvard Coop.

Attendance increased from averages of 25 last year to 60 at the end of this year. Twenty-four programs, of which five were cancelled owing to inadequate registration, were organized for fall, 1980: thirty-three programs of which 8 were cancelled were organized for the spring, 1981. Total attendance jumped to 219 in the fall, and to 576 in the spring, representing increases over the previous year of 28 percent and 56 percent respectively.

Altogether, 17 staff from all sections of the Arboretum and the Department of Comparative Biology, 10 graduate students, and 11 outside speakers contributed to the programs. The interest and enthusiasm shown by staff and students alike is very encouraging.

This year pilot programs were run for elementary school children. The Park School and Milton School, grades 4 and 5, participated. These sessions are beginning to give us information for curriculum and program development for a future schools program. An improved

educational program was offered to our Summer Horticultural Trainees, with Tuesday lunchtime talks, Thursday after-work walks, and weekend trips with staff. We received 72 applications this year, of which 19 were accepted from 10 states, including 10 from Massachusetts.

Owing to building renovation only three exhibits were mounted this year in the Hunnewell Building. The first, the Herbarium, prepared by Ms. Ida Hay, ran between July and September and explained the purpose and methods of herbaria. Between September and November the work of a young watercolor painter, Ellen Tikkanen was exhibited in a show entitled "Arnold Arboretum Landscapes." "Conifers," an exhibit assembled after considerable careful research by volunteer Dr. Richard Warren, was on view from November to February. Our exhibit at the Massachusetts Horticultural Society Spring Flower Show was entitled "Oriental Temple Garden." An enormous amount of staff time went into its preparation, and this was rewarded with a Gold Medal, the First Prize for the horticultural merit of the plants, and the prestigious Trustees Emeritus Award for an innovative exhibit which most exemplifies and expands the traditions of the show. A major effort was put into distributing 10,000 Arnold Arboretum pamphlets, yet only 200 were returned. Clearly, we must review the benefits of the considerable effort involved. Thanks to the excellent coordination of Volunteers' Coordinator, Ms. Cornelia McMurtrie, we were able to increase the number of guided tours of the Arboretum substantially in 1981, and they have become a significant source of revenue. Altogether, 55 guided tours, led by staff and 17 volunteer guides, took place at the Arboretum and the Case states in the spring, 1981. A week-long orientation and training session for new tour guides was held in April, 1981.

The heaviest attendance of visitors on tours was during the week of May 18, following "Lilac Sunday," with 10 scheduled and approximately 30 unscheduled tours. An exact count of groups visiting the Arboretum proved impossible, but a typical busy day, May 21, witnessed 8 unscheduled tour buses and walks in addition to the 5 scheduled guided tours. In a typical week in early June, 38 driving permits were issued to residents of 12 states, including Idaho, California, Texas, Georgia, and Kansas. Although the number of cars has been kept under control, an even greater effort should be made to reduce the number of cars driving within the Arboretum.

The Plant Information service has been increased in efficiency by implementation of a one-hour daily "hotline" service. This has proved convenient for staff and users alike and will improve further with the completion of the new telephone system in Jamaica Plain. Ms. Frey, Ms. Hay, Mr. Koller, Mr. Alexander, and Dr. Weaver are the principal contributors. In the fall, 1980, Ms. Linda Bowman volunteered to man the service which proved very helpful. There were 1,086 recorded inquiries between July, 1980 and May, 1981, of which about 350 were poison calls, and a similar number addressed cultural questions. Many inquiries are of a specialized nature, and it has been found necessary to build up a reference book collection for rapid access to answers.

The community gardens project continued to be plagued by vandalism, and the drought in 1980 proved a further detraction. In the spring, 1981, registrations for plots had dropped to half that of the previous year. It was decided that more people were needed to effectively carryout all jobs required for adequate garden maintenance, though committees were established and workdays organized.

VOLUNTEERS

Ms. Cornelia McMurtrie became part-time Volunteer Coordinator on a trial basis in January, taking over responsibility for the program from Ms. Hope Wise. She proved extremely successful.

New volunteers were attracted to the Arboretum by the offer of membership benefits and expanded publicity. Contacts were also made with local volunteer organizations.

The contribution of the volunteers to the activities of the Arboretum has been considerable. Throughout the year 67 volunteers have donated their time, 42 of them on a regular basis for an average of 120 volunteer hours a week. Since the 1981 training session, 13 new volunteers have joined the staff. Many projects would not have been accomplished without the help of our volunteers. Highlights of the year's achievements include the following: Over a six-week period 17 volunteers, 10 of them new, led 65 tours, generating \$1,300 in revenue; volunteer landscape designers completed the research, map, and graphics for a guide to the Case Estates, and an extensive nursery index; a landscape architect has volunteered to help produce a slide show for use in community programs; one volunteer is organizing our large photograph collection.

A team, which includes conifer and rhododendron authorities and a plant ecologist is assisting in the verification of the living collections; one volunteer, working full-time, aided by a team of three others part time, is making reference vouchers from the living collections which will be housed in our herbarium of cultivated plants; duplicates are being collected for exchange. Altogether, seven volunteers have contributed to this collecting program.

Supervisor Mr. Gary Koller has had the assistance of two volunteers in the assessment of our shrub collections; volunteers have assisted Assistant Supervisor Mr. James Burrows in the renovation of the rock garden and the development of the American Garden at the Case Estates; one volunteer assisted in preparation of a grant proposal for curatorial assistance for the slide collection, another in the grant proposal for the guidebook to the Arboretum; bilingual volunteers have translated publicity material for the Arnold Arboretum into French and Spanish.

Volunteers prepared the spring Plant Sciences mailing and collated 10,000 handouts for the Massachusetts Horticultural Society New England Spring Flower Show. Fifty volunteers took turns in manning our exhibit for the ten-day show; volunteers staffed the Fall Plant Distribution and Sale at the Case Estates.

The ranks of the greenhouse volunteers have expanded to 12, who transplanted many thousands of seedlings from the 1982 plant mailing to Friends, compiled inventories, and processed seeds.

In all, this is a remarkable contribution, deserving our deepest thanks. Special recognition must go to [Mr. Al Bussewitz](#), who taught classes, has assisted almost every staff member in Jamaica Plain, and who also led innumerable tours, including one which was unique, for the Newton Center for the Blind.

MEMBERSHIP

Our total membership at the end of the year was 2,366, representing a net increase of 118. This is considerably less than we had planned, but plans for a membership drive were delayed until *Arnoldia*, which had been behind schedule, was up to date.

Nevertheless, staff, with the help of volunteers, have been working hard to reach new sources through mailings. We are proud of the results from mailings to past deleted members: A figure of 6.8 percent of these former Friends were welcomed back. Since we know that mailings have been successful it is obvious that some computerized means must be utilized for membership acquisition in the future. With *Arnoldia* back on schedule a major campaign to increase membership will be undertaken in the coming year.

The Friends' benefits have increased this year with the introduction of the Arboretum's new newsletter, *Plant Sciences*, which will enable Friends to keep in touch with current Arboretum activities and accomplishments.

In accordance with past policy course and workshop participation was offered to Friends at reduced rates. Special invitations were sent to Friends for openings of two of our exhibits, "Arnold Arboretum Landscapes" by Ellen Tikkanen, and "Conifers" by Dr. Richard Warren.

All Friends received invitations to Family Day, which was held on July 7 at the Arboretum. Included in the invitation were tickets for a free tram tour of the Arboretum.

The Friends Plant Distribution was held on Sunday, September 28, at the Case Estates in Weston. Surplus plant material was distributed to over 200 attending members.

Friends responded enthusiastically to the lecture series "Oriental Connection." In conjunction with this a special offer was made to Friends who brought in new members. Both the sponsor Friend and the new Friend were given a choice of a gift plant of oriental origin, or free tickets to a lecture in this series.

Spring walks for new members were held on both May 28 and May 30. New members were welcomed by Dr. Ashton, and seasoned volunteer guides Mrs. Cora Warren and Mr. Al Bussewitz gave special tours.

In order to show our appreciation to our sponsors, donors, and patrons, a reception was held in their honor in the Hunnewell Building Lecture Hall on October 16.

Peter Shaw Ashton, Director