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All photographs in this issue are by Peter Chvany unless otherwise noted.

Cover: Light dusting of snow highlights Rhododendron buds.
The nation's Bicentennial celebration continued through the spring of 1976, although the expected large number of visitors to Boston, and possibly the Arnold Arboretum, did not appear. In cooperation with the official "Boston 200" program the Arboretum staff supplied new publicity material for many brochures and pamphlets distributed to visitors by the committee. A plant press revealing old newspapers from China was exhibited at the display area of the multimedia exhibit "Where's Boston," and elicited many comments and inquiries. The artifact was associated with the role of the Arnold Arboretum in introducing to the Boston area plants new to cultivation through expeditions to China. The Arnold Arboretum was awarded a special certificate indicating its primary position as an arboretum created for the purpose, another Boston "first."

For our own contribution to the Bicentennial, the staff propagated 300 plants of *Liriodendron tulipifera*, the tulip tree, for distribution to New England organizations for commemorative planting. The trees averaged 6 feet in height and were available in containers. All 300 were accepted and we received much publicity as these were planted. Staff members took part in the dedication plantings in Concord and in Lexington.

From the standpoint of horticultural interest, the year will be regarded as anomalous in its weather conditions and the effects they had on the flowering of the living collections. We experienced a dry summer and fall when we were plagued with vandal-set fires that caused considerable damage. Moderate and above-average temperatures occurred early in the spring, climaxed by one week in April with subfreezing temperatures on a Monday followed by a weekend with temperatures in the nineties, and then cooler weather. For the first year on record a great many lilac inflorescences were aborted; and the flowers were destroyed in several species of plants including all specimens of the dove tree. The inevitable contrast occurred in spectacular flowering of dogwoods, rhododendrons (but not azaleas) and mountain laurels. The situation was so unusual and severe that a committee of the American Association of Botanical Gardens and Arboreta is assembling comparative data from gardens in the northeastern United States for future reference.
Paul Mazerall (left), Lexington Superintendent of Parks and Trees, and Dr. Richard A. Howard break ground for planting of the town's commemorative tulip tree.

The following notes will indicate that the Arnold Arboretum remains an active organization nationally and internationally, in participation in, and contribution to, botanical sciences and to horticulture.

Staff

Dr. Shiu-Ying Hu reached retirement age during the year and retired officially on June 30, 1976. Dr. Hu came to Radcliffe College for graduate work in 1946, and in 1949 joined the Arnold Arboretum staff to become a specialist in such groups of horticulturally important plants as *Philadelphus*, *Hemerocallis*, *Ilex* and *Paulownia*. In recent years she has spent considerable time in Hong Kong on work directed toward a modern flora of Hong Kong and the New Territories.

Resignations were received from Dr. Gordon DeWolf as horticulturist, Edward Flaherty as record keeper, and Mrs. Thomas Walsh as horticultural secretary. Dr. Eric Lee, a Mercer Research Fellow, completed his appointment and returned to Hong Kong.

New appointments to the staff included John Alexander III as plant propagator, Gary Koller as supervisor of the living collections,
Dr. Shiu-Ying Hu.
Robin Lefberg as botanical artist, Donna Lynch as record keeper, Margo Reynolds as a staff assistant, and Jackie Smith as senior curatorial assistant.

Dr. Bernice Schubert was appointed a senior lecturer on Biology within the University during her term as curator of the Arnold Arboretum.

Mr. Alfred Fordham, who has served as plant propagator for the past 18 years, was given a new assignment as research horticulturist. Mr. Fordham received a professional citation from the American Horticultural Society during the annual meeting in Hawaii. He was recognized as "one of the world's foremost propagators and . . . particularly noted for work in the woody plant seed germination and the development of dwarf conifers."

In commemoration of the United States Bicentennial, the Royal Horticultural Society selected 200 American horticulturists as complimentary fellows for the year. Dr. Howard was among those selected. He was also appointed to the ISHS commission for horticultural nomenclature and registration. Stephen Spongberg was appointed chairman of the American Horticultural Society committee on nomenclature and plant registration, and a member of the comparable committee of the American Association of Botanical Gardens and Arboreta. Norton Miller joined Drs. Weaver and Spongberg as an associate editor of the journal *Rhodora* issued by the New England Botanical Club. He also has joined the editorial boards of *Systematic Botany* and the *Journal of the Hattori Botanical Laboratories*.

Dr. Carroll E. Wood, Jr., was honored by Harvard University for 25 years of service to the University. This honor includes the gift of a Harvard chair with a suitable name plate.

Members of the staff traveled widely during the year, specifically for field work or to attend meetings which offered also the opportunity of collecting or of study at other herbaria and libraries. The major meeting of the year was the International Botanical Congress held every four years — the 1975 meeting having been scheduled for July in Leningrad in the Soviet Union. It was preceded by a meeting of the Nomenclature Section in Leningrad and a meeting of the International Association of Botanical Gardens in Moscow. A number of field trips were scheduled following the Congress. Dr. Spongberg represented the Arboretum and cast the institutional ballots at the nomenclature sessions. He visited gardens in England and studied at herbaria preceding and following the nomenclature meetings. Dr. Miller attended the Botanical Congress and presented a paper on Quaternary Fossil Bryophyte Assemblages in North America in a symposium on Aspects of Geography and Ecology of Bryophytes. Following the Congress he participated in a field trip to the north Caucasus region. Dr. Howard, as past president of the International Association of Botanical Gardens, was a member of the presidium
at the Moscow meeting. He also spoke on the use of computers in registration and analysis of plant introductions. As an Honorary Vice-President of the International Botanical Congress, Dr. Howard was a guest of the Academy of Sciences of the USSR and was presented a Congress medal. Following the Congress he was a member of the group that visited the Crimea, where he had a chance to spend extra time in Yalta at the Nikita Botanical Garden. The trip also included a visit to the botanical garden in Kiev in the Soviet Union, and stops were made in Vienna and London for herbarium study on the return route.

The Council of Botanical and Horticultural Libraries arranged a special trip to England preceding their regular annual meeting at Longwood Gardens. Mrs. Dickinson traveled to England for the joint meeting with the Biological Group of the Association of Special Libraries and Information Bureaus which met at the British Museum (Natural History). Visits to other libraries, including that of the Royal Botanical Gardens, Kew, were part of the program.

The annual meetings of the American Association of Botanical Gardens and Arboreta were held on Kauai in Hawaii, followed by the annual meeting of the American Horticultural Society on Oahu. Dr. Howard and Mr. Fordham attended the former meeting where...
Dr. Howard presided and completed his term as president of the organization. Mr. Fordham stayed on for the American Horticultural Society meetings.

The Northeast Regional Meeting of the American Association of Botanical Gardens and Arboreta was held at Skylands in New Jersey. Drs. Spongberg and Weaver represented the Arboretum and had the opportunity of special collecting for the herbarium, the living collections, and their own research programs.

Dr. Miller was the sole staff member to attend the meetings of the American Institute of Biological Sciences where he presented a paper on "The Viability of Windblown Bryophyte Fragments in Arctic Canada."

Dr. Hu continued her association as a professor at Chung Chi College in Hong Kong while proceeding with her work toward a flora of the area. She was fortunate to join a group from the college in a visit to the People's Republic of China during the summer. An account of her trip, including observations on botanical gardens, herbaria, botanists and publications, was published last November in Arnoldia. In late January Dr. Hu participated in a task force on Indigenous Plants for Fertility Regulations sponsored by the World Health Organization (WHO) in Mexico City.

Dr. Schubert was a participant in the 5th Mexican Botanical Congress at Xalapa, Veracruz, Mexico, and continued field work in her search for material of her specialty, Dioscorea.

The Arnold Arboretum was represented by Mr. Pride at meetings of the Hemerocallis Society at Raleigh, North Carolina, and by Mr. Pride and Dr. Weaver at the meetings of the American Rock Garden Society in Boston.

Mr. Fordham has attended meetings of the Plant Propagators' Society regularly; the recent meeting was in Tallahassee, Florida.

Staff members are asked to speak at botanical and horticultural meetings at the Arboretum and elsewhere. Our films on the Arnold Arboretum and on Poisonous Plants are often the basis of lectures to garden clubs and schools. College lectures usually involve a topic representing the individual's research or specialty. Many such requests were filled during the year. Dr. Howard chaired a section of a symposium on Better Trees for Urban Environments held at the U. S. National Arboretum; was the featured speaker at the dedication of the Callaway Building at the University of Georgia Botanical Garden; and spoke also at the annual meeting of the Dallas Arboretum Society. All three occasions were accompanied by invitations to speak at nearby colleges.

The Arnold Arboretum was asked by the National Science Foundation to be the collaborating institution for two projects in Pakistan supported by the foreign currency program. In October Dr. Howard traveled to Islamabad to consult with Dr. Mohammad N. Chaudhri of the National Herbarium, and to Peshawar to meet with Dr. S. M.
A. Kazmi of the PCSIR. Both men are collecting plants of Pakistan and the first set of duplicates will be deposited with the Arnold Arboretum. Drs. Chaudhri and Kazmi, as well as Dr. E. Nasir of the Stewart Herbarium, arranged field trips for Dr. Howard. The fall season also permitted the collection of seeds at higher elevations which may produce useful plants for cultivation in the United States.

An extended field trip completed by Dr. Stevens permitted him to make field observations and collections of the genus Calophyllum. One month was spent in herbaria at Edinburgh, London, Paris and Geneva en route to Malesia. Bases for field work were established in Malaya, Sarawak, Sabah, and Papua New Guinea. Fifty species were encountered and studied in the field and 900 numbers collected. Shorter visits were made in Singapore, Java and Australia. The trip was sponsored in part by a grant from the Atkins Fund.

Horticulture

By terms of agreements with the City of Boston, dated 1882 and amended in 1896, the Department of Parks and Recreation assumed responsibility for the roads, paths, benches, fences and police protection of the Arnold Arboretum. In return the collections were to be open to the public “at reasonable hours,” with maintenance of the living collections, by the staff, financed solely by unrestricted and restricted funds of the Arnold Arboretum and by special gifts to the Arboretum. The protection of the collections and the visitors is the responsibility of the City of Boston. We receive excellent cooperation from the Captain and staff of Station 13 of the Boston Police Department in Jamaica Plain. The station supplies occasional patrols of the grounds during the day and at night, and responds effectively to emergency calls. The control of unauthorized cars and motorcycles, of occasional theft, of damages to plants by vandal-set fires and malicious breakage, the accumulation of litter and the thefts from cars, is extremely difficult due to the faulty maintenance of fences and gates at the periphery of the property. Pedestrian gates do not close, driving gates are broken and damaged fences have remained unrepaired for over two years. Several meetings were held during the year with local legislators and with representatives of the Mayor's office in an attempt to obtain some action. There has been no response and the problem remains. Vandals have set fires in the vine collection and in the Leitneria and Hamamelis plantings, and deliberate breakage was extensive in young Magnolia and Cercidiphyllum holdings. The director has been refused permission to make the necessary repairs with Arboretum funds. Until the periphery is secured, any admission charges or patrols are not reasonable. The low priority the Arnold Arboretum has in the budget of this city is perhaps understandable, but it is regrettable.

The resignations of two members of the horticultural staff and the appointment of replacements permitted the reexamination of the
Superintendent Robert G. Williams (center) and Arboretum grounds crew members join forces to extinguish brush fire.
current work, the goals, and the work to be done on the living collections. A complete inventory of the nursery and the permanent plantings in Weston has been completed, and the identification of the plants is being verified. A detailed survey of the living collections in Jamaica Plain is under way to reaffirm the location of each plant, to check its physical condition, to verify its identification and to determine the need for labels. The loss of labels over the last few years has been disturbing, and their replacement time consuming and expensive. A major effort will be required during the winter months to revise many of the maps of the collections, to prepare new record labels and to redesign the display labels for the major part of the collection. Utilization of a new computer printout of the inventory by geographic areas will make this work feasible. The close cooperation of the Plant Sciences Data Center of the American Horticultural Society is appreciated. Our printouts now give complete data on the origin of each plant within the collection.

In response to requests for material from our collections, 95 shipments of plant material in the form of seeds, cuttings or plants, comprising 272 taxa, were sent to cooperating institutions, nurseries or scientists in the United States and 14 foreign countries. A total of 114 shipments, representing 411 taxa, were received during the year from 22 countries. These ranged from potential taxa for the hardy collections, such as the 40 and 35 kinds of seeds selected from seed lists distributed by the Lu Shan and the Yunnan Botanical Gardens in the People's Republic of China, to materials requested by the staff for individual research projects. During their travels many of the staff members collect plant materials which are accessioned into our records. Some, such as those from Pakistan, may prove hardy in Boston, or will be shipped, after study, to gardens in warmer climates. Some material will be consumed in the course of research efforts, and of course many of the seeds requested do not germinate or survive. Drs. Weaver and Spongberg, in the course of their horticultural studies, acquired new material from the wild in both North Carolina and Pennsylvania. Additional material may be acquired from plants cultivated elsewhere, but an effort is made to have as many plants as possible from wild sources.

Not included in the records of material shared with other arboreta is that obtained by responsible visitors to whom collecting permits are granted. As an example, cuttings of over 300 taxa were obtained by representatives of the Cary Arboretum during one visit. The practice is reciprocal and reduces the demands on the Arboretum staff when such permission can be granted.

As staff members work on the living collections, any plants that are in poor condition or otherwise need attention are noted and called to the attention of the propagator, the superintendent and the record keeper. During the year 222 taxa were propagated to prepare replacements for such specimens. Ninety taxa were processed
Liriodendron tulipifera trees are labeled by James A. Burrows preparatory to Bicentennial giveaway.
to acquire or verify propagation data, and 54 were propagated in larger numbers to be tested for hardiness in appropriate areas.

The program to distribute a plant of special interest to contributing Friends of the Arnold Arboretum was implemented this year with the distribution, in mailing tubes, of over 2,000 rooted cuttings of *Syringa* 'Rutilant'. This is a custom in alternate years, with surplus plants from the nursery being distributed to local Friends as the supply lasts. The surplus plants are offered first to the Department of Buildings and Grounds of Harvard for the campus, and to the Business School, and then to other arboreta or universities. Such plants are dug and transported by other than the Arboretum staff. The remaining surplus materials are dug and balled by our staff, and are available on a selected day on a first-come first-served basis. The distribution of 300 *Liriodendron* plants, already mentioned, was completed with the help of Volunteers of the Arnold Arboretum. The Volunteers also were responsible for the mechanics of packaging and shipping the mail distribution.

*Volunteers Allen Brailey, Leslie Oliver, Lucy Richardson, and Louis Segel pack rooted cuttings of Syringa 'Rutilant' for distribution to Friends of the Arnold Arboretum.*
Volunteers also are continuing a program of systematic collecting of herbarium specimens from plants on the grounds and in the nurseries. A set is mounted for addition to the herbarium of cultivated plants, and duplicates are available for distribution, in exchange, to other institutions. We are indeed grateful for this regular help.

The bonsai collection is under the supervision of our honorary curator of the bonsai collection, who obtains staff or Volunteer help as needed. Most of the smaller plants were reported during the year. One old and valuable pot was repaired and essentially restored to its original condition. A special gift made possible the production of copies of two of the older pots. Regrettably, the bonsai collection was the object of two episodes of vandalism. After plants from the outdoor collection were stolen, an alarm system was acquired. The second theft involved subtropical bonsai taken when the greenhouse was entered through a soil bin.

The staff continues to function as registration authority for cultivars of woody taxa not otherwise represented by societies. A request is made for a plant of each registration for testing in the Boston area. Drs. Spongberg and Howard serve on national and international committees associated with this activity. Dr. Howard was a participant in the symposium on computer processing of cultivar registration held at the American Horticultural Society headquarters in Virginia through the auspices of the Plant Sciences Data Center.

The Arnold Arboretum Achievement Award for Botanical and Horticultural Excellence has been offered in the past to outstanding students in high schools or private schools in Massachusetts who receive a certificate accompanied by a gift of books and plants from the Arboretum surplus. Nominations are received from school administrators. The 1976 award was made to Frederick S. Creager, a graduating senior of Jamaica Plain High School.

Assistance was given to Walter Judd, a graduate student, in support of field studies of the genus *Lyonia* in the United States and the Dominican Republic.

**The Case Estates**

The Case Estates in Weston comprises approximately 110 acres, and serves several important functions in the work of the Arnold Arboretum. Plants from the greenhouses or the small nursery area in Jamaica Plain are grown to larger size in Weston. Plants we wish to preserve, but for which space is unavailable in Jamaica Plain, are maintained in low-maintenance areas. Some display collections have been developed. The area is ample for staff research projects, and the buildings are used for classes and public lectures.

Renovation work continued on an irrigation system for the nursery area. The ground cover display section has been consolidated for more effective display and maintenance. A new inventory and

*Jo Umber, Jackie Smith, Eric Lee, and Ray Umber (right to left) at work in sorting room of Harvard University herbaria in Cambridge.*
evaluation has been completed for all temporary and permanent nursery collections.

The Weston location is maintained by a small permanent staff, which is increased by several student horticultural trainees during the spring and summer months. We also are grateful to the Arboretum Volunteers who take the responsibility for guided tours of the Case Estates during the year.

The Arboretum donated 75 trees to the Town of Weston during the year for roadside plantings in the town.

The work to widen Wellesley Street along the Case Estates property, which will create sidewalks and reduce some curvature and visual obstacles, is under way. The Arboretum lost approximately one acre of land to this renovation, but has preserved the historic “hen’s tooth” stone wall and the row of Malus ‘Henrietta Crosby’. The area should be safer for pedestrians and visitors to the Case Estates. New plantings will be established where some vegetative screens were removed.

*Herbarium*

The crowded conditions of the herbarium in Cambridge, mentioned in previous reports, remain a major problem in day-to-day operations, and relief remains several years ahead. The architects hired by the University to consider the problem concluded that the logical ex-
pansion area would involve an addition to the front of the Harvard University Herbaria building. Preliminary floor plans have been submitted for staff and University consideration. The use of compactors to house herbarium specimens in the new structure appears to be a necessity. An architect’s drawing of the facade of the building is under study by the University Planning Office. If all aspects of appearance, floor design and costs are approved, such plans, along with a brochure describing the work carried on in the building, will be used in a campaign to raise money for the construction.

In the meantime, heroic measures are being taken by the herbarium staff to accommodate the specimens added to the collections annually. The use of cardboard storage cartons on top of the regular cases is both an inconvenient and an inadequate storage method. The boxes now total 2,708 with the addition of 312 units during the year, and such additions will increase. The purchase of steel herbarium cases, to be placed in space created by the move of the fern collection, has become a necessity. Some additional space has been provided in the regular herbarium sequence by the removal to a basement storage area of specimens identified only to family. Unfortunately, this reduces the occasions when such material will be consulted by staff and visitors.

The overcrowded storage units have impeded the proper care of the type specimens which have been located at the end of each taxonomic and geographic unit. To offer these specimens better curatorial care, all type specimens are now being placed in an alphabetical generic sequence at the end of each family of plants, and the collection is shifted as required. A program is also under way to examine every folder in the herbarium, divide those that contain an excessive number of specimens and replace worn or outdated folders. This will involve several years of work. Seventy new genus and family boards have been prepared. Procedures have been adopted to photograph routinely all type and authentic specimens on loan to staff members, as well as those belonging to our herbarium. Documentation against possible loss or damage to specimens sent on loan is thus assured. The special collections of fruits and seeds have been receiving care and all collections, excepting the Cactaceae, are now completely protected in plastic bags and catalogued. As a result of all this curatorial work, shifts of specimens have altered locations and require the relabeling of cases and editorial changes on indices.

The curatorial work has been supported in part by a grant from the National Science Foundation to the Harvard University herbarium collections considered of national scientific significance. The staff is grateful for this grant which has been extended for another year, at which time a new long-term application must be submitted. To justify the grant, the organization agrees to make its specimens available on loan to qualified investigators, and to maintain the
financial level of curatorial assistance contributed previously by the recipient. Some record keeping which seemed onerous at the time has revealed interesting figures. All visitors using the herbarium are asked to register, and during the present fiscal year 146 individuals from 87 institutions used the herbarium for periods ranging from a few hours to several months. Records must be kept of requests for information requiring the use of the herbarium or the library, and these numbered over 300 from the office of the director alone. When the information is compiled for all library and herbarium staff members, the service aspect of the work of the Arnold Arboretum is clear.

Volunteers under the supervision of Ida Burch have been hard at work in the herbarium of cultivated plants in Jamaica Plain. Activities include putting the cone collection in order, replacing the labels on the herbarium cabinets and checking the geographic sequence of specimens.

Specimens added to the herbarium during the year totaled 28,365, bringing the total herbarium holdings to 1,054,824 sheets of which 161,661 comprise the herbarium of cultivated plants housed in Jamaica Plain. The Arboretum received 11,292 specimens during the year: 8,473 by exchange with other institutions; 1,838 by gifts from individuals, 916 by subsidy; and 65 sent for identification that were worthy of retention. The largest lots came respectively from Western Malaysia, Papuasia, India, Australia, and the United States, with smaller numbers from other areas. Due to staff involvement in curatorial work, only 3,064 specimens were distributed as exchange.

Requests for our specimens on loan for study came from 50 domestic and 29 foreign institutions, representing 185 and 83 loans respectively, totaling 21,647 sheets. Although it is professional procedure to loan specimens for an indefinite period of time, excluding only types, each institution expects that specimens will be studied and returned as soon as possible. A review of our records during the year indicated that some specimens have been on loan to institutions since September of 1938, and that at present a total of 93,909 specimens are out on loan. Fortunately not all of these will be returned simultaneously, or our crowded conditions would become critical.

The development of federal legislation on threatened and endangered species has involved both staff knowledge and the resources of the herbarium. Congress assigned to the botanists at the Smithsonian Institution the responsibility of assembling a list of plants, and an original list was circulated to botanists at other institutions for comments and additions. Puerto Rico and the Virgin Islands, as well as Hawaii, were included in the area to be covered domestically, but the list also contained many plants of scientific interest in other countries. Some plants listed are used in staff research or teaching programs, and so the wording of the proposed legislation and
the involved cooperation with similar foreign agencies is pertinent to our work. The New York Botanical Garden sponsored a symposium on Threatened and Endangered Species in the Americas, at which Dr. Howard presented a survey and discussion of the plants and problems of the Caribbean area.

The research of the staff is varied, and includes floristic studies, manual preparation, monographs and investigations of single species of plants. The bibliography of published papers indicates the type of projects completed and published during the past fiscal year. Such studies may require initial or continued field work and/or be laboratory or herbarium oriented. The basic resources of the Arnold Arboretum are a living collection, an herbarium and a library, and appropriately equipped offices and laboratories. The use of these facilities is excellent.

Library

The curatorial grant from the National Science Foundation permits the use of some money for retrospective work including cataloguing and binding of older material. One library assistant was assigned to this work during the past year, and in four months 72 titles of the backlog were catalogued and 94 titles completely recatalogued or revised in classification. Current cataloguing by other staff members is done with the assistance of the publication, Cataloguing in Publication (CIP), for the majority of books in the English language, as well as through a systematic search of the National Union Catalog when orders for Library of Congress cards are not filled. CIP is rapidly replacing the Library of Congress card orders as a cataloguing source. The remainder, including specialized volumes and those of foreign languages, require original cataloguing.

A net increase in volumes and pamphlets during the fiscal year was 748 items, bringing the total holdings to 85,094. A total of 723 periodicals is received.

The entire library staff was closely involved in the reclassification of the reference collection in the Herbaria building. The project could be brought to completion due, in large part, to the excellent searching, organizing and collating of editions by Bernita Anderson and, upon her resignation, by Becky Rohr. Books were catalogued and Library of Congress classification numbers were assigned, replacing the former shelf location numbers for each volume. Then in one day the library staff, assisted by the library committee and a graduate student volunteer, shifted 950 volumes to sequence demonstrating the application of the Library of Congress classification to a botanical reference collection.

The use of the library in Cambridge increased 8%, based on the number of volumes returned to the stacks, as compared with the previous year. Interlibrary loan requests numbered 478, an increase of 12% over the previous year. Although the majority of these are
filled by supplying photocopies of the desired pages, a number of requests were refused due to a "no loan" policy or the inability to photocopy because of age or condition of the volume.

Beginning July 1, 1976, the Harvard College Library is instituting a basic fee of $8.00 for interlibrary loans, and has indicated a willingness to pay a comparable amount if billed. Although there are exceptions made to cooperating libraries of the Research Library Group, there is the possibility of charges to the staff for interlibrary loan requests. Fortunately our needs for such requests have been few. Photocopying charges are also increased to a minimum charge of $6.00. This is the method through which most requests made to our library or from our staff are filled. For the present the Arboretum Library will charge a lesser amount.

Binding of current items as well as older items continues on a regular schedule. Volumes that cannot withstand rebinding are placed in boxes lined with acid-free paper. In the case of the first
numbered copy of E. H. Wilson's *America's Greatest Garden, The Arnold Arboretum*, we wished to preserve the original binding; hence, the volume was boxed in its present condition.

A book treatment program recommended by the conservator of the Harvard University Library has begun on the collections in Jamaica Plain. Volunteers were the original helpers during the winter months, and the program has continued as experience for the summer horticultural trainees. Books are removed from the shelves, which are then thoroughly cleaned. The volumes are dusted and the leather bindings treated with a special preservative dressing. Call number labels are being replaced by Identastrips of acid-free paper. A new shelving guide and shelf labels improve the ease of use of the library.

Volunteers under the direction of Margo Reynolds have brought up to date the scrapbooks of clippings pertaining to the Arnold Arboretum, and have prepared an alphabetical list of genera as an index to the collections of Wilson photographs.

**Education**

The Arnold Arboretum functions as an educational organization at many levels and in many ways. The nearly 400 acres of organized collections, nursery areas and greenhouses of labeled plants offer the greatest educational exposure to botanical and horticultural subjects. The grounds are open to the public for casual visits or for organized tours. The majority of visitors respect the plants and appreciate the opportunity to visit and to learn from the material. Regular classes are offered as tours of the grounds or in the form of lecture series in Jamaica Plain and in Weston. Staff members generally conduct the tours for professional groups, but we are fortunate to have the help of talented and well-trained Volunteers to conduct tours and offer some classes for other visitors.

Questions are received and answered by telephone and by mail, and the staff shares this responsibility. During the year the staff prepared two exhibitions for the display area of the Administration Building. One exhibit focused on the herbarium, explaining the preparation, housing and use of herbarium specimens. While this exhibit was on display the American Begonia Society met in Boston and scheduled some of its meetings at the Arnold Arboretum. A special section of herbarium specimens of *Begonia* species was prepared by Dr. Schubert who has worked on this family for many years; and Dr. Spongberg was a speaker for the participants.

A second exhibit related to the living collections and displayed the methods by which plant material is received, processed and then planted in the collections. The nature of the care and maintenance of the collections was easily documented in the display, as were the records and record keeping, the labeling and finally the use of the collections in staff research or in supplying material for other scien-
tists. The Arboretum staff earlier had prepared an exhibit on the seed propagation of woody plants for display at the New Hampshire Spring Flower Show. When this show concluded the exhibit was added to the horticultural display. The technique of embedding plant material in plastic was used by Volunteer Sheila Magullion to enrich this special display.

The photographic files of the Arnold Arboretum also are used in educational efforts of the staff. The historic collection of the photographs taken by E. H. Wilson, primarily in China, has had much use in recent years. The photographs not only show the life and buildings of China in the early part of the 20th century, but represent the plants that were sources of seed introduced into cultivation.

An attempt is made to have every plant species that flowers or fruits in the Arboretum represented in the photographic collection. During the past year Peter Chvany has added hundreds of pictures to this collection. Prints of specific plants are requested regularly by staff and by others for use in articles. Prints also are supplied regularly to University publications to publicize the collections of the Arnold Arboretum.
The two films developed by the staff are now distributed in sales and rentals by a commercial firm, with royalties returning to the Arnold Arboretum. The film on Poisonous Plants continues to be a popular one. Staff members use the film regularly in speaking to local groups, which have included the Harvard Community Health Center, the New England Medical Center and several universities, among others. The Poisonous Plant film was awarded a Red Ribbon as the second best educational film entered in the American Film Festival in New York City. Using the royalties, special gifts from the Friends of the Arnold Arboretum and a matching fund grant from the Massachusetts Society for Promoting Agriculture, work has been started on a film on plant propagation. This type of educational effort may well become self-supporting and permit the development of less popular but important educational films on such subjects as collection management and herbarium procedures.

The Arnold Arboretum cooperates with the Boston Poison Information Center by handling referral of calls concerning the ingestion of plant material. Calls received at the Center in the Boston Floating Hospital (Tufts-New England Medical Center) are referred to the Arboretum office during the daytime and to various staff members in the evening hours. Although most calls involve nontoxic plants, a sufficient number of potentially toxic plants have been identified to make the service offered worthwhile.

During the year the staff has collaborated with the Massachusetts Horticultural Society in two new programs. One involved joint sponsorship of a distinguished visiting horticulturist who spoke to the Arnold Arboretum audience in Weston and the Massachusetts Horticultural Society members in Boston. Another new program involved tours to distant areas of horticultural interest. Dr. Howard led a plant study tour to Florida, centering in the Miami area. Mr. Pride led a tour to Monaco. In each case the Massachusetts Horticultural Society staff handled the solicitation of participants and the arrangements before and during the trip. Each participant made a financial contribution which was shared by the two organizations. Although many other botanical gardens have sponsored or led such trips, these were the first ventures of the Arboretum and the Massachusetts Horticultural Society into this type of educational program.

The care of the living collections and maintenance of the grounds are the responsibility of a few individuals who supervise a small but skilled crew of employees. This group is supplemented during the growing season with selected students of botany or horticulture who have applied for summer employment. The students are designated horticulture trainees, selected for their abilities and the usefulness of the practical experience to their academic programs. They have represented an average of 14 colleges, universities and high schools. Participants receive student rate wages as approved by the Harvard Personnel Office. Tours and special lectures by the staff
are offered every week so that the students not only receive on-the-job training in caring for the living collections, but have the opportunity to see other aspects of the work of the Arboretum staff, as well as other gardens, businesses and horticultural practices in the Boston area. A few other students are accommodated during the year in cooperation with other colleges in student intern programs. These may be oriented in favor of the library, herbarium or horticulture. Such students are either volunteers or are paid by their own colleges.

Formal courses are taught at Harvard by several staff members. During the year Dr. Wood offered Biology 103, an elementary course in plant taxonomy, and shared the teaching of Biology 18, Diversity in the Plant Kingdom, as well as the Summer School course, Plants of the Tropics, offered in Florida. Dr. Miller offered Biology 138, the Biology of Mosses, Liverworts and Hornworts, and participated as well in Biology 18. Drs. Howard, Miller, Schubert and Wood supervised the work of graduate or undergraduate students in numbered research courses.

Publications

The two regular publications of the Arnold Arboretum are the Journal of the Arnold Arboretum, issued quarterly, and Arnoldia, issued six times a year. The four issues of the Journal published during the fiscal year comprised 429 pages and 20 articles by 22 authors. The technical editor, Miss Kathleen Clagett, is assisted by an editorial committee. Other members of the staff review manuscripts.

Mrs. Jeanne Wadleigh edited six issues of Arnoldia comprising 259 pages and 17 articles by 11 authors. Again staff members may review manuscripts and, in addition, assist with proofreading. Of interest to the staff was a complimentary article in Russian, by T. G. Chubarian and P. I. Lapin, entitled "Through the Pages of Arnoldia," which appeared during the year in the Bulletin of the Main Botanical Garden, Moscow. The demand for reprints of the Arnoldia issue, "Poisonous Plants," remains high, and a recent article on subtropical bonsai also had an enthusiastic audience. The issue on low maintenance perennials was republished as a paperback volume by Quadrangle/The New York Times Book Company, and is income-producing through royalties.

The copyrights have expired on several early publications of the Arnold Arboretum, and commercial publishers have issued facsimiles. In the United States a Dover reprint of the 1930 edition of Aristocrats of the Trees, by E. H. Wilson, is now available. The Koeltz science publishers in Germany have reproduced The Bradley Bibliography and The Catalogue of the Arnold Arboretum. Such reprints do not require permission, nor do we derive royalties from them.

The considerable stock of back issues of various publications was recatalogued during the year, and the prices reconsidered in terms of filling and mailing orders. A booklet on the available publications
of the Arnold Arboretum was prepared and distributed to libraries and departments that might be interested.

Gifts and Grants

The Arboretum and its staff have been fortunate in the support offered in the form of gifts, grants and materials from many individuals and sources. The Friends of the Arnold Arboretum respond regularly to requests that they renew their membership contributions, and the staff is grateful for this continuing support. Such funds are without restrictions, although most are used in the work associated with the living collections. A bequest was received from the Estate of Miss Harriet Rantoul, and memorial gifts were accepted in memory of Mrs. John E. Thayer and Ms. Virginia S. Coen.

As mentioned previously, a matching fund grant was obtained from the Massachusetts Society for Promoting Agriculture for the production of a film on plant propagation. The generosity of the Society was matched promptly by gifts from interested Friends. A similar grant from The Stanley Smith Horticultural Trust provided for the preparation of illustrations for a new manual of cultivated woody plants, and again matching funds were received from interested Friends. One gift was specified for support of work in plant propagation under the direction of Mr. Fordham, and two gifts were received to be applied to the care of the bonsai collection. A most welcome grant was received from The Charles E. Merrill Trust following our request for funds to support publication of three items of staff research nearing completion.

Gifts in kind included many books, some for review in Arnoldia, pots for the bonsai collection, and artifacts, including letters and photographs, relating to the history of the Arnold Arboretum. Many nurseries have donated the plants we ordered for our living collections, and these were accepted with gratitude.

The grant from the National Science Foundation, shared with other botanical collections at Harvard, is truly significant in the curatorial work in the herbarium and the retrospective work in the library. Support of field work for Dr. Stevens' trip to Malesia was obtained from the Atkins Fund. The Tozier Fund of Harvard granted a request by Drs. Miller and Wood for photographic equipment, and one by Dr. Howard for the development of visual material useful in teaching the families of flowering plants.

RICHARD A. HOWARD
Staff of the Arnold Arboretum 1975–1976

Richard Alden Howard, Ph.D., Arnold Professor of Botany, Professor of Dendrology and Director

Donald Wyman, Ph.D., Horticulturist, Emeritus

Ida Hay Burch, B.A., Curatorial Assistant
James Alvah Burrows, B.S., Assistant Plant Propagator (Appointed August 11, 1975)
Michael Anthony Canoso, M.S., Manager of the Systematic Collections*
Kathleen Ann Clagett, M.A., Technical Editor of the Journal of the Arnold Arboretum
Constance Tortorici Derderian, A.B., Honorary Curator of the Bonsai Collection
Gordon Parker DeWolf, Jr., Ph.D., Horticulturist (Resigned January 24, 1976)
Lenore Mikalauskas Dickinson, M.S., Librarian*
Edward Herbert Flaherty III, Curatorial Assistant (Resigned March 5, 1976)
Alfred James Fordham, Propagator
Sheila Connor Geary, B.F.A., Assistant Librarian
Arturo Gomez-Pompa, Dr. Sc., Honorary Research Associate*
Henry Stanton Goodell, Assistant Superintendent
Shiu-Ying Hu, Ph.D., Research Fellow in Temperate Asiatic Botany
Thomas Matthew Kinahan, Superintendent, Case Estates
Gary Lee Koller, M.S., Supervisor of the Living Collections (Appointed June 16, 1976)
Donna Anne Lynch, Curatorial Assistant (Appointed May 16, 1976)
Norton George Miller, Ph.D., Associate Curator and Associate Professor of Biology*
George Howard Pride, M.A., Associate Horticulturist
Margo Wittland Reynolds, B.A., Staff Assistant (Appointed August 4, 1975)
Kenneth Ray Robertson, Ph.D., Assistant Curator
Bernice Giduz Schubert, Ph.D., Curator and Senior Lecturer on Biology
Jackie Marie Smith, M.A., Curatorial Assistant* (Appointed July 16, 1975)
Stephen Alan Spongberg, Ph.D., Assistant Curator
Peter Francis Stevens, Ph.D., Assistant Curator
Karen Stoutsenberger Velmure, B.A., Botanical Illustrator
Jeanne Stockbarger Wadleigh, B.S., Editor of Arnoldia
Richard Edwin Weaver, Jr., Ph.D., Assistant Curator
Robert Gerow Williams, B.S., Superintendent
Carroll Emory Wood, Jr., Ph.D., Curator and Professor of Biology

* Appointed jointly with the Gray Herbarium
Bibliography of Published Writings of the Staff
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The Arboretum provides a pleasant outdoor studio for young art students.
Notes from the Arnold Arboretum

WEATHER STATION DATA — 1975

Average temperature for 1975: 62.0°
Precipitation for 1975: 55.35"
Snowfall during winter of 1974–75: 39.3"
Warmest temperature: 100° F on August 3
Coldest temperature: –1° F on February 10
Date of last frost in spring: April 30, 1975
Date of first frost in autumn: October 30, 1975
* Growing season for 1975 was 184 days

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* Growing season — The growing season is defined as the number of days between the last day with killing frost in spring and the first day with killing frost in autumn. This time is determined by the last spring and the first fall temperature of 32 degrees F. or lower.

Spring 1976 began precariously. It was one of the earliest in many years; the result of an unusually warm ten days in April. Temperatures began rising on the 15th, and reached a record high of 95° F on the 19th. Five days of warm weather followed until the 24th of April when a sudden drop of 30° F resulted in damage to many flowers and developing buds. The floral displays of Magnolia and Forsythia were prematurely ended by the sudden change of temperature, and on top of Bussey Hill the flower buds of Davidia involucrata and Chionanthus retusus never developed.
The remaining days of April and early May were seasonably cool with day temperatures in the 50's and 60's and night temperatures in the 30's and 40's. In spite of these cooler days, the spring season progressed two weeks ahead of time so that visitors to the Arnold Arboretum on Lilac Sunday found the early Syringa vulgaris varieties past their peak and the later lilacs just coming into bloom.

James A. Burrows
Botanical Embedding

by Sheila Magullion

This article is not intended as a detailed guide to embedding, but discusses only the basics of botanical embedding and some of the procedures that have been moderately successful for me. As with all practical matters, experience is the only real teacher, and the hope here is to provide a starting point for readers interested in pursuing the subject.

To embed is "to lay in surrounding matter — as to embed in clay or sand," according to Webster. A simplified outline of the process of surrounding dried horticultural material with plastic is to lay the specimen on a supporting layer of plastic in a suitable container, cover it with another layer, and when the resulting block has hardened, remove it from the mold to be sanded and polished.

The plastic used is a polyester resin that comes from the manufacturer as a light blue, syrupy liquid with a strong gaseous odor. On the addition of a catalyst (usually M.E.K. peroxide), it turns green, then clear, and eventually cures hard and odorless with some shrinkage. Technical books on plastics in general include information on the make-up of embedding plastic (or casting resin, as it also may be called), and the exact manner in which it reacts to the catalyst. Knowledge of this process is a prerequisite to understanding and solving some of the problems that may arise in embedding.

It should be mentioned that both the plastic and catalyst are inflammable — the catalyst highly so — and although the makers usually state that the plastic is no more toxic than ordinary house paint, I find that it is, especially when large quantities are curing. As a safety precaution, an exhaust fan should be operating while the odor is noticeable.

It is advisable to have the work area located away from food and food preparation because of the insidious odor that is readily transferred. A place where the materials may be left undisturbed for several days at a time, and where the inevitable spill will not be a tragedy is necessary; the plastic has great adhesive qualities and once hardened is almost impossible to remove. In the liquid or tacky stages it can be taken off one's person with an abrasive cleaner, and off clothing, if tackled immediately, with a strong detergent. Most other surfaces, including measuring and mixing containers, can be cleaned with a solvent, or detergent and hot water. Heatproof glassware can be boiled in a strong detergent solution. Cleaning of equip-
ment is not easy, so whenever possible disposable items should be used. Clean-up material and the plastic itself should not be disposed of by way of household plumbing.

*Flower Drying*

Drying the botanical material is a very important part of the embedding process. Since there is so much excellent literature available on the subject, only a few points in relation to the preparation of the items for embedding will be mentioned here. It is essential that the material be quite dry and as perfect as possible before it goes into the plastic. Any flaws will worsen and appear magnified in the finished cast, and improperly dried items will discolor.

Select perfect flowers just opened or opening. Mature blooms often develop brown edges in the drying medium and are much more likely to become transparent in the plastic.

Flowers with woody stems attached should be removed from the desiccant when the petals are crisp; then the stem portion is given extra time to dry either in or on top of the drying medium. Flowers such as roses with heavy calyces require similar treatment.

Large leaves can trap air bubbles when positioned in the plastic, so care must be taken to preserve their natural contour and to avoid flattening them in the drying process.

Leathery evergreen leaves turn brown unless given time to dry thoroughly. They also are prone to "silver" when embedded, as are nuts, pine cones, and certain woody materials.
Silvering occurs when the plastic fails to adhere to the embedded specimen, creating a void that gives the illusion of a silver coating. The exact cause of the trouble is uncertain; the shrinkage of the plastic or specimen, or the presence of a barrier substance are two theories. Some authorities advise preparing difficult materials by soaking them in various solvents. Unfortunately, this has not yet worked for me and silvering remains a problem. In any case, I think it is very important that material prone to this difficulty receive long and careful drying to insure that all shrinkage has taken place before the embedding process.

Dried pine cones, nuts and seeds can be stored indefinitely under ordinary room conditions without deterioration. Autumn leaves when dried also will keep their color and form for months with a minimum of fussing. Other material must be kept closely covered at all times and is best embedded as soon as possible after it is thoroughly dry. If storage is necessary, light and humidity should be excluded to preserve flower color, and to keep fragile items crisp.

**Molds**

Almost any leakproof container other than those made of copper, rubber, and certain plastics can be used as a mold for the plastic while it is setting. However, in order to produce the most satisfactory results, the following points might be considered before making a selection.

Square and rectangular casts with straight sides are easier to sand and polish than are those of other shapes, and in general are more satisfactory to display.

It is much easier to remove the hardened cast from a flexible mold than from a rigid one; however, as the inevitable shrinking takes place during the gelling process, the sides of a flexible mold will draw in. All rigid molds should be treated with mold release before the plastic is poured.

When hardened, the plastic will mirror exactly the container in which it was set; a glass surface will produce a cast with a glasslike finish that requires no sanding or polishing. Most miscellaneous objects such as tin cans have bumps and seams that are transferred to the cast and will have to be sanded out later. Materials that scratch easily and are difficult to clean should be avoided if the molds are to be reused.

When only a few small specimens are to be embedded, suitable molds can be found among the commercially available ceramic or plastic types; or there are specially designed metal molds that can be taken apart to facilitate removal of the cured cast. The sizes available limit their usefulness for most botanical embedding.

Satisfactory containers, mostly round, can be found among laboratory glassware; however these are expensive and have a limited life.

*Stems are allowed extra time to dry thoroughly on top of desiccant.*
Euonymus leaves and fruits that have silvered badly.
expectancy. Items with beading around the rim make removal of the cast difficult without breakage. Tupperware and freezer containers in heavy polyethylene plastic come in acceptable shapes and sizes and some bakeware may be useful. Kitchenware should not be used for food after being used as a mold for the plastic.

If a number of larger casts are contemplated, it usually will be more satisfactory to make molds to the required specifications. Aluminum or other light gauge metal makes up into quick easy molds, inexpensive enough to be considered disposable. Aluminum sheets can be measured and ruled with a pencil and a long straight ruler, and cut into strips with kitchen scissors. Right angle corners are made by bending the strip against the ruler, or any straight sided object, and joining the ends with Scotch or masking tape to make a frame; this is sealed to the base with caulking cord, or similar material, to form a leakproof container. Four pieces of wood strip or plate glass can be made up in the same way. Wood must be covered with Mylar or cellophane to make it waterproof.

The base need not be of the same material as the sides. An aluminum base sometimes permits a large thin cast to warp, but on the other hand presents no removal problems as it needs no mold release and can be peeled off easily as soon as the plastic has hardened. If the cast is to be displayed bottom side up, a glass base will allow the work to be checked at all stages for bubbles and general effect. Plate glass should be used to minimize the possibility of cracking from stress as the plastic sets.

Calculating the Catalyst

This is a very critical phase of the embedding procedure. If too much catalyst is added, the plastic will set too quickly and in the process generate internal heat; the degree of heat reached being in direct proportion to the amount of catalyst used. This internal heat produces adverse results such as bleaching and silvering of the embedded specimen and fracture and splitting of the cast. Shrinkage also seems to increase. Conversely, too little catalyst will keep the plastic under control but it will not cure to the desired crystal clarity.

When determining the percentage of catalyst to plastic, the two most important factors to consider are the quantity of plastic needed to cover the specimen, and the temperature at which the work is to be done.

Most instructions advise working at a temperature between 70 and 75 degrees. I have found temperatures as low as the upper 50s to be quite satisfactory, especially when embedding large and difficult items, and would postpone beginning any major project if the temperature of the work area were above 70 degrees. The plastic takes longer to set in this lower range, but there will be much less danger of internal heating.
A fast setting formula is used for all base layers, which are usually less than 1/4 inch deep, and for very small casts. However, as the size of the block increases, decreasing amounts of catalyst are needed for the covering layer. Material requiring a mold 5 inches square and larger can be covered more safely by two or more layers. The drawback here is the noticeable dividing line between layers, especially when slow setting mixtures are used. Flowers with large fragile petals should be covered completely with one pouring or layer, otherwise the portion of petal left exposed will probably become limp and collapse into the plastic.

Be sure to select a resin specifically designed for botanical embedding, and use the manufacturer's instructions as a general guide. Some experiments with small expendable material will develop experience and confidence.

Embedding Procedure

The specimen probably will need to be cleaned with an artist's brush to remove dust and any remaining traces of desiccant. Trim it to fit comfortably into the selected mold, establish a plan for the exact position of the arrangement, and determine the quantity of plastic that will be needed to cover it.

This can be calculated mathematically. In metric measurements, \( L \times W \) divided by 30 will give the number of ounces necessary to
make a layer 1 cm. deep, or the quantity can be measured by filling the mold with water to the required depth and transferring it to a measuring container.

Make sure the mold is clean and dry and apply mold release if necessary. Measure into a small mixing container enough resin for the base layer, and with an eye dropper add the catalyst to make a fast setting mixture. Stir thoroughly for at least a minute or until all traces of the catalyst have disappeared. The catalyst will spread outwards to the circumference of the container and must be stirred back into the center to insure thorough blending. Pour the mixture into the mold, cover it with a tent of paper to keep out dust and foreign objects, and leave it to gel for approximately an hour or until it is firm but still very tacky.

Using tweezers or forceps, position the specimen so that it makes contact with the plastic in at least two or three places, particularly if it is a spray or consists of several small pieces. If possible, arrange leaves and campanulate flowers so that air can escape. Minor adjustments can be made for a few minutes; fragile items should be moved as little as possible after being positioned on the base layer of plastic.

*Positioning a specimen on base layer of plastic.*
Cover the mold until the specimen has adhered firmly to the supporting layer. This probably will take less than an hour, but the project can be left for longer periods or even overnight. Any part of the specimen that has not adhered will float to the surface when the covering layer is poured; if allowed to remain there, the fragment will be moved by the setting action of the plastic to the side of the mold, ruining a cast that might otherwise have been usable.

If this mishap befalls a valuable or irreplaceable item, the situation sometimes can be saved by waiting until the covering layer has begun to set. The wayward object then may be pressed back into its position on the base layer very gently with the stirring rod, and held in place until it has been caught by the setting plastic. This is time consuming and irritating and it is much better to avoid the problem when the item is positioned by trickling a few drops of catalyzed plastic over any part that may fail to adhere.

Measure resin and catalyst to make the covering layer. Mix thoroughly as before and pour it into the mold, taking care not to direct the stream onto any fragile areas. Let the resin run down the stirring rod to break the force and also to help eliminate air bubbles. Again cover the mold with the paper tent and leave it to set overnight. If another layer is needed to cover the specimen, repeat the procedure the next day using the same formula as for the first layer.

An identifying label written or printed on plastic film can be placed on the layer preferred. If it is to be set on the supporting or base layer, place it in position after the covering layer has been poured so no air will be trapped under it. Unlike plant material, it will not rise to the surface.

Some thin textured and light colored flowers become transparent while the plastic is setting. If this tendency is aesthetically displeasing, it can be prevented to a great extent by waiting until the catalyzed plastic begins to turn clear before covering the specimen. The timing has to be very exact in order to permit the air bubbles trapped in the specimen to be released and rise to the surface before the plastic sets.

**Sanding and Polishing**

The surface exposed to the air does not cure completely for some days and will remain slightly tacky to the touch. If sanding is attempted at this stage the paper will gum up and become useless immediately. To overcome this some instructions advise curing the cast by applying gentle heat, but as this can very easily result in damage to a flower of unstable color, I prefer to finish the cast with a very thin layer of plastic of the same fast setting formula used for the base. When it has set, the mold and contents can be moved to a warmer situation where it may be left for a few days to cure to workable hardness.
If a flexible mold was used there will be no problem in removing the cast at this point, but with rigid molds more curing time may be needed for the cast to come free. If the embedded item is sturdy enough, gentle top heat may be applied using a 40-watt light bulb inside a cardboard carton; or the mold can be given alternate hot and cold water treatment. Placing the mold in the refrigerator for a few hours may be enough to release the cast. Glass molds sometimes shatter under this cold treatment, so they should be securely enclosed in a heavy paper bag as a precaution.

The sanding and polishing operation is easier if done by machine; however, if none is available satisfactory results can be accomplished by hand rubbing. Sanding is done wet with four grades of waterproof silicon carbide paper.

A small cast that can be grasped comfortably in the hand may be sanded by laying a sheet of 120 grit paper on a flat bench and rubbing the cast across it until the surface is completely smooth. A large cast of 4 inches or more is easier for a small hand to manage if it is placed on a wet towel or thin piece of wettex laid on the work area, then rubbed with the sanding paper which has been wrapped around a piece of wood or a sanding block. At intervals the cast and the paper should be washed to remove accumulated sludge and to check progress.
When there are no traces left of the original top surface the same procedure is repeated with the 220, 400, and 600 grits. Before moving on from the 220 paper make sure there are no deep scratches left from the 120 grade. Depending on the type and texture of the mold that was used, the bottom and sides may only need to be sanded with the 600 grit. Rottenstone can be used for the final sanding operation.

Hand buffing does not produce the same finish as a buffing wheel, but brisk rubbing with a soft cloth and either silver polish, auto polish, or one of the polishes sold specifically for plastic will produce a very satisfactory lustre. A final gloss can be added with a coat of spray-type furniture polish.

Sheila Magullion is a Friend of the Arnold Arboretum and an active volunteer who has been working on an experimental embedding project for several years. Many of her beautiful casts of Arboretum plants are on display in the entrance hall of the Administration Building in Jamaica Plain.

A group of finished casts.
Materials

For Flower Drying
Desiccant
- Sand
- Silica Gel (hobby shops, garden supply stores, etc.)
- Boraxo
- Cornmeal

Rigid, leakproof containers that can be covered easily.
Camel’s hair brush for cleaning flowers.

For Embedding

Level work bench
Newspapers to protect work surface, floor and surroundings.
Plastic (hobby shops are possible sources of suitable types)
Catalyst — comes with plastic.
Eye Droppers — usually come with catalyst.
Measuring and Mixing Containers — glass or disposable laboratory containers. Pyrex glassware (½-pint to 1-quart pitchers), paper cups (unwaxed), coffee cans.
Stirring Rods — laboratory glassware, wire made from coat hangers or such.

Molds
Mold Release — (hobby shops or same source as plastic).
Brush — for release.
Solvent
Detergent — Tide, Boraxo.
An old saucepan for cleaning up.

For Polishing

Sanding paper — 120, 220, 400, 600 wet strength.
Any silver polish, auto polish, polishing cloth (or any old soft rags).
Furniture polish — Pledge.

Suggested Reading

Arnoldia Reviews


This extraordinary volume is primarily a reference book but of a special kind — it has both winter and summer keys. The usual leaves, flowers and fruits of trees are described and depicted, but in addition spring and fall leaf color are noted as well as winter bark and bud. There are discussions of habitat, hardiness, cultural needs, and ecological companions for all the trees cited. The geographical distribution of the various species is mentioned.

Everything is in this volume to aid the serious student in finding answers to his questions (by student is meant the amateur tree-lover rather than the academician). Basic botany and taxonomy are included, there is also a very high component of aesthetic pleasure in the trees depicted and the physical make-up of the book itself. The craftsmanship in the drawings by the author’s wife is of the highest order, and the artist is obviously a knowledgeable observer. The author’s descriptions seem to be accurate and the choice of accompanying photographs is superb. The work itself is on the finest quality paper, exquisitely printed, and no typographical errors were observed! The reviewer has seldom met a volume as admirable.

ELINORE B. TROWBRIDGE


In this small volume the interested reader will find no construction details for rock gardens, no discussion of ventilation systems for the alpine house, and no suggestions for the domestication of even the most docile of the alpine flora. No, this is not a rock gardening book at all, but a song in celebration of the natural beauty of the Alps.

The book is divided into sections that consider the flora of the Alps on the basis of altitude, local habitat and season of bloom. Additional sections briefly deal with the glacial period and local common names and traditions surrounding the plants. Dr. Wendelberger’s concern for the delicate balance of life in the mountains is evident throughout the book, periodically surfacing in a description of once-rich meadows despoiled by man’s careless use, or in a comment about the tourist’s role in the gradual decline of native plant populations.

Although Dr. Wendelberger credits the book’s success to its lavish adornment with full-page color illustrations, the real charm of the volume lies in her own love of the mountains and her ability to convey this love to the reader. Her prose is lyrical despite occasional lapses which may be due to difficulties in translation, each phrase as delicately balanced as the mountain flora itself.

This is not a book to which the collector of alpines will turn again and again for information. There is nothing here for which a more com-
prehensive reference does not already exist. Rather, this is a book for the lover of flowers, offered as a cordial invitation to spend a rainy afternoon visiting, or revisiting, the enchanted world of alpine flowers.

**JENNIFER HICKS**


Subtitled "Rediscovery of the North American Laurels," Jaynes' book on laurels (*Kalmia*) fills a gap in the horticultural literature by bringing together much of the available knowledge on these beautiful plants. His book will doubtless please the growing band of laurel enthusiasts, as well as all horticulturalists interested in shrubs, particularly those who grow rhododendrons.

All aspects of growing laurels are considered, much attention being paid to their genetics, breeding and hybridisation, subjects on which Jaynes himself has carried out much original work. Propagation of laurels, both from seed and vegetatively, is dealt with in detail, as are all aspects of growing the adult plant and of protecting it against pests. J. E. Ebinger contributes two chapters, one on laurels in the wild and the other on their toxicity.

It should perhaps be mentioned that the classification of *Kalmia* proposed by Southall and Hardin (referred to briefly by Ebinger), differs considerably in detail from that adopted by Ebinger himself. Southall and Hardin recognize more species of *Kalmia*, but fewer varieties and forms. Regarding the latter, the wisdom of recognizing forms based on polyetalous and apetalous variants may perhaps be questioned, the "apetala form" mentioned on pp. 26 and 27 is not recognized by Ebinger in his formal revision. It is not clear just what the 25 distinct traits of mountain laurels referred to on pp. 35 and 157 are, the table 13–1 listing many more than 25 variations. A number of illustrations, unfortunately including some of the colored ones, lack clarity, printing errors are pleasantly few.

All in all, this is a useful book which should stimulate more interest in one of the finer groups of shrubs native to North America.

*PETER F. STEVENS*

*One Hundred Great Garden Plants.* William H. Frederick, Jr. New York: Alfred A. Knopf. vi + 207 pp., illustrated. $15.00.

With few exceptions, this book admirably fulfills its self-avowed purpose — to introduce the author's personal choices of the 100 best trees, shrubs and groundcovers for use in the home landscape. One might, of course, take issue with his selection, for everyone has favorites, but one can hardly find fault with his presentation. There is an unmistakable impression that the author is on intimate terms with each and every one of the 100 plants mentioned; this is borne out when one learns that each specimen included is cultivated by Mr. Frederick on his own 25-acre property. It is, no doubt, from daily contact such as this that the author is able to write with such feeling about his choices.

Each specimen is presented in a one- or two-page essay and is accompanied by a color photograph that very effectively captures the nature of the individual plant. In addition to plant descriptions, the essays include observations on care and intriguing historical vignettes. The author is not content to merely offer descriptive paragraphs on the plant material, there is a multitude of good advice on how best to fit the specific plant into the home landscape. He discusses color, texture and structural form, and freely dispenses advice on companion plantings to further enhance the appeal of the various plants he has chosen.
The essays alone are sufficient reason to purchase this volume, but there are other reasons as well. The print is easily readable, and a very pleasant balance, both visually and content-wise, exists between the written words and the photographs, which are exceedingly lovely and capture subtle nuances of most of the plants mentioned. Indeed, it is hard to find much fault at all with this very pleasing little book. It would make a lovely housewarming gift for the new homeowner.

MARGO W. REYNOLDS


Harold Bruce is one of that small but very fortunate band of people who are born with eyes that see and with hearts made to sing by the beauty of the world about us. He lives in Delaware which he has explored quite thoroughly, but he also has made many excursions to the north, south and west. He writes with much charm and with a great deal of knowledge. Nearly every page contains useful advice and bits of information new even to the fairly knowledgeable reader. The book makes no pretense of being a botanical textbook, but Bruce discusses some subjects in considerable detail: the trilliums, the hardy hollies, the pine tree tribe and others.

He describes many trips to the seashore, the barrens and the piedmont, and the reader feels himself included in these explorations and is delighted with the companionship offered and the very interesting information given. I was very pleased to find properly extolled the many virtues of the hobblebush (Viburnum alnifolium),—perhaps the most beautiful of our deciduous, flowering shrubs — which grows well in quite deep shade. In describing trees that contribute to autumn color, the author, however, makes only passing reference to the sugar maple (Acer saccharum) as one that turns a good yellow. (Perhaps sugar maples do not thrive in the latitude of Delaware.)

The book contains some 28 beautiful colored plates and the rather wide margins are adorned with very good line drawings and also with short synoptic sentences such as students often scribble on the margins of their textbooks. This book is warmly recommended both for the pleasure of its reading and for the information contained.

ALLEN BRAILEY


"This book was designed to fill the long felt need for a popular all-colour guide to garden conifers, written and compiled in such a way as to be easily used and understood by the average home gardener." This introductory statement is well executed by the author in the production of a handsome volume featuring 516 superb illustrations of garden conifers, mostly cultivars, ranging from Abies to Widdringtonia; another 38 colored illustrations of conifers in garden use follow. No other volume approaches the excellent color reproduction so essential in distinguishing horticultural varieties in conifers. The vast majority of the photos were from New Zealand locations, the author's home country, and are of young plants. The author knows his plants and the descriptions often indicate this familiarity, as "an irregular, dumpy little heap of cheerful, dark-green foliage bearing little resemblance to its towering forest parent."

The general descriptions and suggestions on cultural methods are good, and a helpful glossary is supplied. Only the few paragraphs on diseases seem inadequate for United States readers.

RICHARD A. HOWARD
Spring Events

The Arnold Arboretum is pleased to announce several spring activities to be held in conjunction with the Massachusetts Horticultural Society. Registration in the following is open to the members of both organizations and spaces are limited. An early registration will assure you a place.

ARBORambles

Series: $8.00 members; $12.00 non-members
Individual walks: $2.50 members; $3.50 non-members

Informal walks and talks on the Arnold Arboretum grounds one Sunday a month throughout the spring. Topics of seasonal interest will be featured each month and the informal nature of the walks will allow ample time for questions. We will meet rain or shine, so come prepared. Walks will start from the Administration Building promptly at 2:00 p.m. and will last approximately two hours.

Sunday, March 20  Sunday, May 15
Sunday, April 17  Sunday, June 19

DWARF SHRUBS FOR THE HOME LANDSCAPE

$3.00 members, $5.00 non-members

Dwarf shrubs are low-maintenance, eye-catching, and provide colorful accents for terraces, patios and small city spaces. Selection, care and cultivation will be discussed, utilizing the Arboretum’s renowned collection. Registration limited to 25. Class will be held at the Dana Greenhouses, 1050 Center Street, Jamaica Plain.

Monday, April 4 10:00 a.m. — 1:00 p.m.  Instructor: Gary Koller

A special lecture series will be offered in late winter for A.A. and M.H.S. members only. We have engaged three exciting speakers and are very enthusiastic about the series. The lectures will be held on three consecutive Tuesday evenings at the Massachusetts Horticultural Society, 300 Mass. Ave., Boston. The talks will begin at 7:00 p.m. and will be followed by refreshments. Subscription for the series is $12.00. Individual lectures will be $6.00. Registration must be made in advance by sending a check, made out to the Mass. Horticultural Society, to Horticultural Hall, 300 Mass. Ave., Boston, Mass. 02115, attn: Pegze Campbell.

Tuesday, January 25 — “Plant Hunting Around the World”
George Pride — Arnold Arboretum

Tuesday, February 1 — “The Plants of South Africa”
Steven K-M Tim — Brooklyn Botanic Garden

Tuesday, February 8 — “Indoor Gardening Revisited”
Thalassa Cruso — nationally-known gardener
* AN AFTERNOON WITH NURSERY CATALOGS

This session will be devoted to studying various catalogs offering seeds and plants for both indoors and outdoors. Common and unusual material will be reviewed. A remarkable opportunity to share your experiences with others and get an early start on your spring gardening.

Tuesday, March 8
1:00 p.m. — 3:00 p.m.
Fee: $3.00; Friends $2.00
Instructors: George Pride, Assoc. Horticulturist, and Richard Weaver, Taxonomist

* AN EVENING WITH NURSERY CATALOGS

The content of this course is identical to the one above. Fees and instructors are also the same.

Tuesday, March 15
7:00 p.m. — 9:00 p.m.
Meet at the Red Schoolhouse, Case Estates, 133 Wellesley St., Weston

* (These events are not offered in conjunction with the Massachusetts Horticultural Society.)
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