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New York Botanical Garden

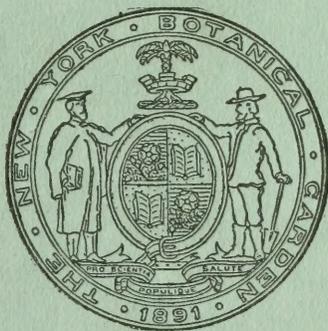
BRONX PARK

DESCRIPTIVE GUIDE

TO THE

GROUNDS, BUILDINGS AND

COLLECTIONS



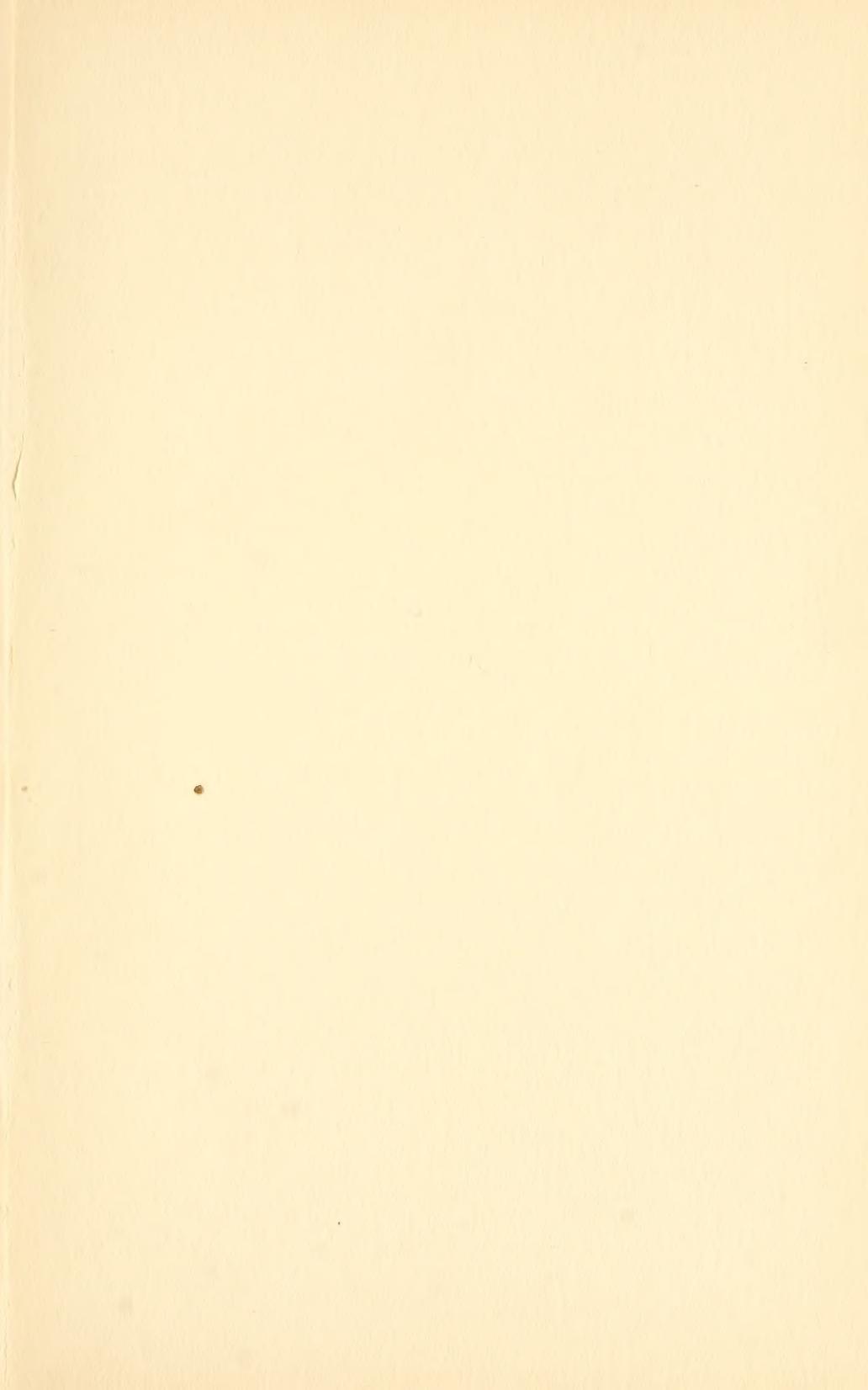
NEW YORK

SEPTEMBER, 1916

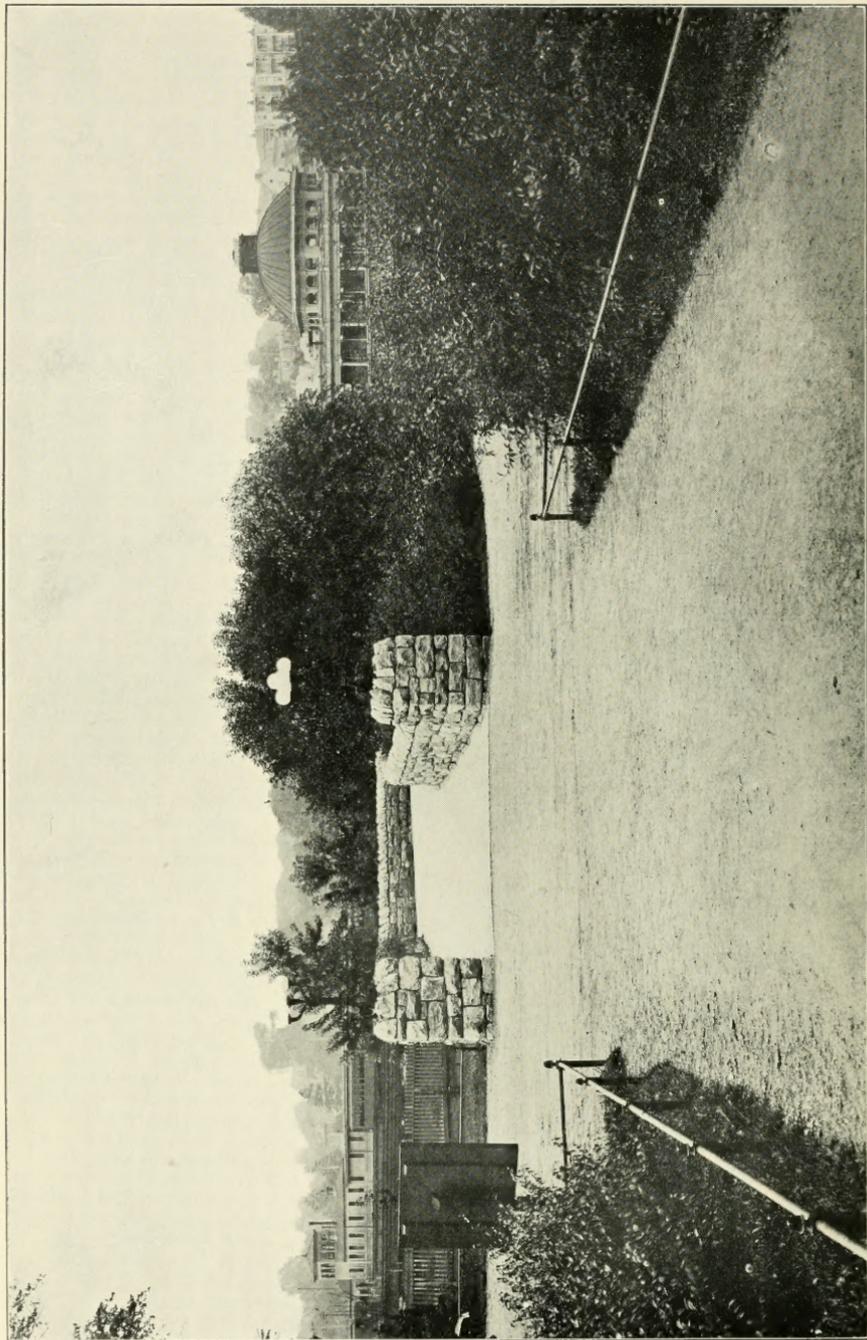
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THE NEW YORK BOTANICAL GARDEN







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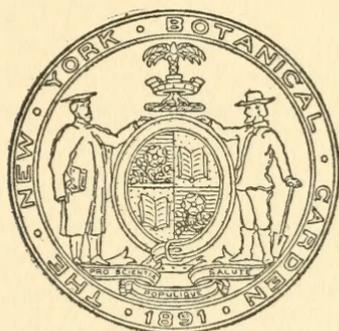
NEW YORK BOTANICAL GARDEN

BRONX PARK

Descriptive Guide

TO THE

Grounds, Buildings and Collections



Reprinted from the
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DESCRIPTIVE GUIDE TO THE GROUNDS, BUILDINGS AND COLLECTIONS

Third Edition*

Location

The New York Botanical Garden is situated in the northern part of Bronx Park, north of Pelham Avenue, the reservation including nearly 400 acres of land of a very diversified character, furnishing natural landscapes of great beauty and variety.

Means of Access

The Garden is conveniently reached in the following ways:

1. By the Harlem Division of the New York Central and Hudson River Railroad to The Botanical Garden Station.
2. By the Third Avenue Elevated Railway system to the terminal station of that road at Bronx Park.
3. By the Subway, Lenox Avenue and West Farms branch, with transfer at 149th Street and Third Avenue to Elevated Railway, thence to Bronx Park Station.
4. By trolley car on Webster Avenue to 200th Street or the Woodlawn Road. This line connects with lines from the western part of The Bronx on Fordham Road, and on Tremont Avenue, and also with the line to Yonkers.
5. By trolley car on the White Plains road east of Bronx Park from West Farms, Williamsbridge, and Mt. Vernon, connecting with lines from the eastern part of The Bronx at West Farms and at Mt. Vernon.

* For first edition see Bulletin no. 16: for second edition see Bulletin no. 23.

6. By trolley car, on the Southern Boulevard to Pelham Avenue. This line connects with lines from the southern and southeastern parts of The Bronx.

7. By driveways in Mosholu Parkway from Van Cortlandt Park; from Pelham Bay Park through Pelham Parkway; through the Crotona Parkway and Southern Boulevard from Crotona Park; there are also driveway entrances at 200th Street, convenient for carriages coming from Jerome Avenue; at Newell Avenue, at the northern end of the Garden, for carriages coming from the north; at Allerton Avenue on the eastern side of the Garden for carriages coming from the east; and at the Woodlawn Road, convenient for carriages coming from Yonkers, and from other points west and northwest of the Garden; there are three driveway entrances from Pelham Avenue.

8. The White Plains Avenue Extension of the Subway, with three stations east of the Garden is approaching completion.

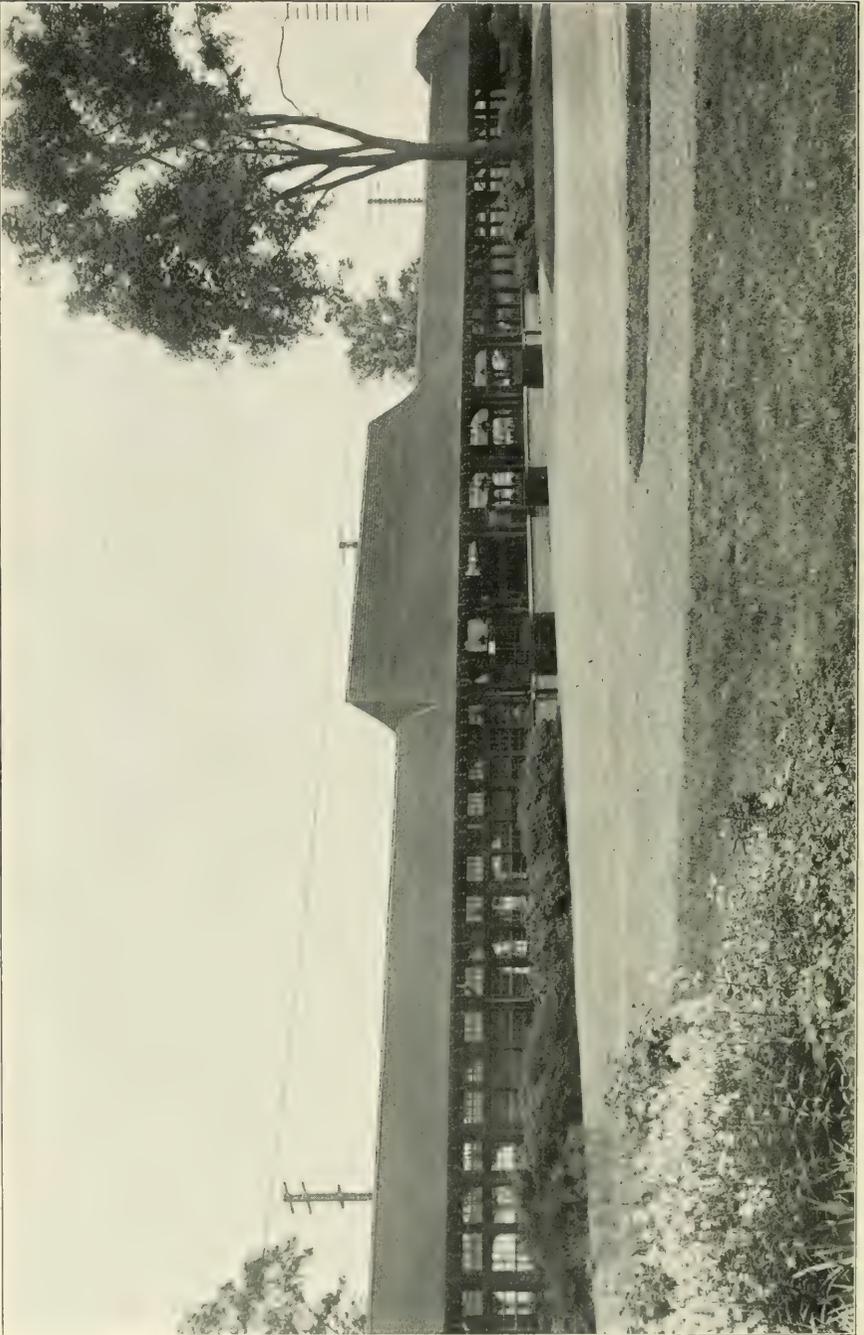
Purposes

The New York Botanical Garden was established by an Act of the Legislature of the State of New York passed in 1891 and amended in 1894 "for the purpose of establishing and maintaining a Botanical Garden and Museum and Arboretum therein, for the collection and culture of plants, flowers, shrubs and trees, the advancement of botanical science and knowledge, and the prosecution of original researches therein and in kindred subjects, for affording instruction in the same, for the prosecution and exhibition of ornamental and decorative horticulture and gardening, and for the entertainment, recreation and instruction of the people."

General Plan

Features of especial interest are:

1. The largest conservatories in America, for the cultivation of plants of tropical regions, one located near the entrance at the elevated railway station, and a second very



NEW YORK CENTRAL RAILROAD STATION

large range, partly constructed, near the Allerton Avenue entrance on the eastern side of the Garden.

2. The largest botanical museum in the world, located near the Botanical Garden station of the New York Central Railroad and the Mosholu Parkway entrance. This building includes a large lecture hall for public lectures in the basement; and the library, laboratories for instruction and research, and the herbarium, on the upper floor.

3. The pinetum, or collection of cone-bearing trees, mostly evergreens, brought together on the hills and slopes on all sides of the conservatories, range 1, and in the space between that structure and the museum building.

4. The herbaceous garden, situated in a valley east of the conservatories, range 1, near the Southern Boulevard entrance, containing collections of hardy herbaceous plants, arranged by botanical relationship, and also a collection of similar plants, arranged to demonstrate elementary botany; the economic garden, a plantation designed to illustrate hardy plants whose products are directly useful to man, is installed in the northern part of the same valley.

5. The fruticetum, or collection of hardy shrubs, located on the plain northeast of the museum building at the Woodlawn Road entrance and extending northward into the north meadows; this collection is also arranged by botanical relationship.

6. The deciduous arboretum, or collection of trees which lose their leaves in the autumn, located along nearly the entire eastern side of the grounds from Pelham Avenue to Williamsbridge.

7. Extensive flower gardens at conservatory range 1, along the path approach to this range from the Third Avenue Elevated Railway Station, and along the west border north to the Mosholu Parkway. The total length of flower beds is over one mile.

8. The mansion, a stone house, built by the Lorillard family in 1856, stands on the east side of the Bronx River, above the waterfall. It contains meeting rooms, board

rooms, horticultural laboratories, the collections of the Bronx Society of Arts and Sciences, the office of the Secretary of the Horticultural Society of New York, and the shops of the Garden are in its basement.

9. Special collections of hardy plants in various parts of the grounds, including willows in the north meadows, Japanese cherries and a magnolia group in the arboretum, forest herbaceous plants on the wooded bank north of the long bridge east of the Bronx River; vines and climbers on an arbor east of the economic garden, an iris garden at Pelham Avenue and the Southern Boulevard; lilacs near the museum building and at the foot of the Bronx Boulevard retaining wall, and conifer groups and rhododendrons at various points and other special collections at other places. A large rose garden is being constructed in a valley south of the mansion.

In addition to these artificial features, the following natural features are noteworthy:

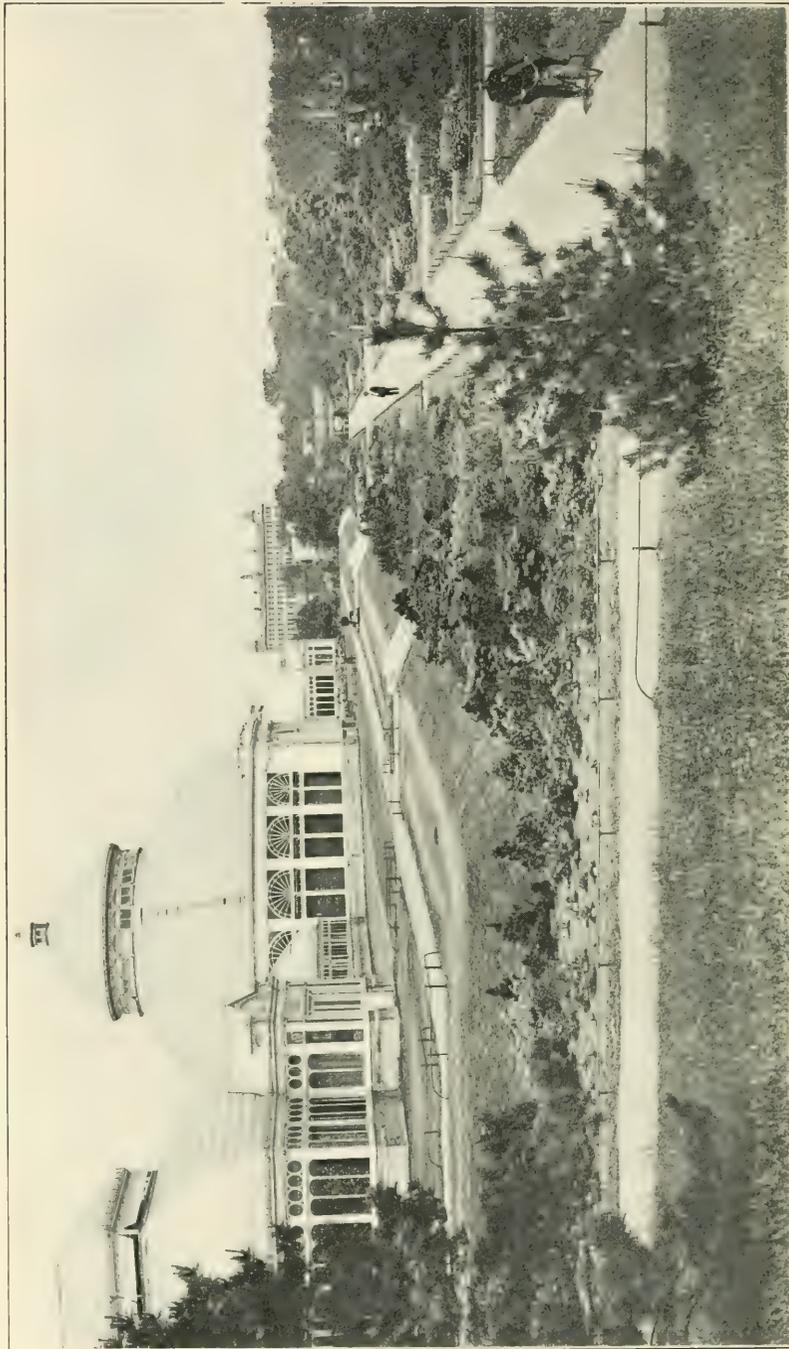
10. The hemlock forest, a grove of the Canadian hemlock spruce, clothing the hills between the museum building and the Bronx River and covering about forty acres, considerable portions of it being primeval.

11. The gorge of the Bronx River, extending south from the waterfall at the Mansion, along the edge of the hemlock grove. The river plunges through its gorge in a series of rapids passing into quiet waters before it leaves the Garden under the Linnaean Bridge.

12. The north meadows and river woods along the Bronx River from the northern end of the hemlock grove to the northern end of the Garden.

13. Deciduous woodlands on rocky ridges in the southern and central parts of the reservation.

14. General park features.



CONSERVATORY RANGE No. 1, AND FLOWER GARDENS

1. The Public Conservatories

Range No. 1

This great glasshouse, located but a short distance from the terminus of the Third Avenue Elevated Railway, is 512 feet in length, with a central dome about 90 feet in height, and wings extending from the main range in such a way as to form a court open to the southwest. The area under glass is about one acre. The building stands on a terrace 5 feet in height, approached by six flights of cut granite steps connecting with the path and driveway approaches. The house contains fifteen compartments, separated by glass partitions and doors.

House No. 1 contains palms of numerous species from all parts of tropical and warm regions, both of the Old World and the New. Of West Indian palms, the collection contains the royal palm of Cuba and Florida, an elegant plant of the corozo palm (*Acrocomia media*) of Porto Rico and the Windward Islands; the cocoanut palm, planted in all tropical countries for its fruit and for the numerous uses to which its fiber, wood and leaves are applied; it is not definitely known that the cocoanut palm is a native of the West Indies, and where in the tropical regions it actually originated is uncertain. Other tropical American palms are illustrated by the silvertop palm (*Coccothrinax argentea*), of Florida and the West Indies and by the curious Mexican *Acanthorhiza aculeata* with spine-like roots on its trunk. Old World species are shown in a very large tree of the Chinese fan-palm, by the date palm (*Phoenix dactylifera*) of northern Africa, and by numerous other large species from the Pacific islands. Another Old World palm is *Calamus asperimus*, of Java, curious in its climbing habit; the specimen here is over one hundred and fifty feet long; the long tail-like appendages to the leaves, which have backwardly turned spines, enable the palm to climb on surrounding vegetation. Related to the palms and shown by numerous specimens in this house, we find a number of

species of the Panama hat-plant family, the most conspicuous being the Panama hat plant (*Carludovica palmata*), from the young leaves of which the costly Panama hats are made. Opposite the entrance to the court in this house, is a group of bamboos, which belong to the grass family, the most noteworthy of them being the Chinese bamboo (*Bambusa vulgaris*), whose stems reach into the upper part of the dome; this plant grows with great rapidity each year by new shoots which come up from under ground, our measurements showing that they reached 65 feet in height in 95 days, a rate of about 8 inches a day. The plant has been introduced into the West Indies, and in places where it grows its stems are put to a great variety of uses in construction, for water pipes and for various utensils.

House No. 2 also contains specimens of the palm and Panama hat-plant families, the smaller specimens of tropical species being exhibited here. The collections of palms now include about 175 species.

House No. 3 contains specimens illustrating several families of monocotyledonous plants of tropical regions. The amaryllis family is represented by a number of species of the spider lily (*Hymenocallis*), bearing large white flowers, the commonest being *Hymenocallis expansa* from the sandy coasts of the West Indies; large plants of the genus *Crinum*, some of which have white flowers and some red or purple, may be seen on the middle bench, and the maguey of the West Indies (a spiny-leaved relative of the century plant, native of the West Indies, and used there for hedges), on the northern bench; this name maguey is also applied in parts of the West Indies to species of *Agave*, which will be found in house 6.

Numerous representatives of the dracaena family, many of which are used for ornamental planting in the tropics, are on the north bench, with a few representatives of the same family on the west end of the south bench. Larger plants of this family will be found in house 4 adjoining. The collection of the genus *Sansevieria* is also located on

the south bench; many species yield a tough and valuable fiber from the leaves; they are commonly referred to as bowstring-hemp. The collection of screw-pines, *Pandanus*, occupies a large part of the south bench, the larger specimens being on the center bench opposite, and in the adjoining house 4.

The tacca family, *Taccaceae*, is here represented in two genera, *Tacca cristata* and *Schizocapsa plantaginea*, both on the north side of the center bench. This family is closely related to the amaryllis family.

The arrow-root family is illustrated by the arrow-root (*Maranta arundinacea*), native of South America, but widely cultivated in the West Indies, its roots furnishing the commercial product; *Calathea* comprises a large number of tropical American plants noteworthy for their fine foliage; and there are other genera represented.

House No. 4. Here are brought together many kinds of large tropical plants belonging to families also represented in the smaller houses, but too tall to be grown on the benches.

The interesting screw-pines, natives of the Old World tropics, are illustrated by several species, the leaves of which are used in the manufacture of mats, hats and baskets. These plants are not at all related to pine trees, the latter part of the name referring to the slight resemblance the leaves bear to those of pineapple plants, which are commonly called *pinés* in the tropics, while the remainder of the name was suggested by the spiral arrangement of the leaves.

In this house may be found large specimens of the aroid family, the most noteworthy one of these being a magnificent plant of Veitch's tail-flower (*Anthurium Veitchii*), from Colombia, which is believed to be the most elegant plant of its kind in cultivation; climbing on trunks of trees set as supports, will be found a number of vines of the genera *Philodendron* and *Monstera*, one of these, *Monstera deliciosa*, is a Mexican plant producing an edible fruit

with the odor of pineapple. Another is *Monstera lativaginata*; the early leaves differ widely from the mature ones. The main aroid collection will be found in house 10, and other plants at range 2.

A large tree of the common rubber plant, much grown in parlors, may be found in the center of this house, reaching to the roof; this is a native of tropical Asia and yields some rubber, but not in as great quantity nor of as good quality as the other rubber trees of South and Central America; it is a species of fig (*Ficus elastica*); other species of *Ficus* are shown in this house, notably a fine tree of Roxburgh's fig, which bears its inedible fruit in bunches near the base of the tree, and a specimen of the Banyan tree (*Ficus benghalensis*). Chocolate trees (*Theobroma Cacao*), native of tropical America, may be found near the northern door of this house; the small white flowers are produced on the trunk and on branches, and a few of them develop into the large woody pods containing the seeds or chocolate beans, which are dried and ground up into chocolate and cocoa; specimens illustrating the chocolate industry will be found in the economic museum. The papaya, or papaw, also of tropical America, is here also; its fruit, esteemed as an aid to digestion, is borne just under the crown of leaves. A specimen of the bread-fruit tree (*Artocarpus incisa*) may also be seen here; originally from the islands of the Pacific, it was introduced into the West Indies in the latter part of the eighteenth century.

Several interesting tall vines climb on the pillars of this house, and on supports along the sides, among them the night-blooming jessamine (*Cestrum Parqui*) of tropical America, which opens its flowers after dark and exhales a delicious perfume, the flowers remaining open during part of the morning; Henderson's *Allamanda*, of Brazil, with its showy large yellow flowers, climbs to the roof.

House No. 5. The plants in this house are from desert regions. Especial attention is called to their fleshy stems or leaves which serve as storage organs for a water supply

to carry them over periods of drought. On the right hand bench, as one enters from No. 4, are mainly plants from southern Africa: the carrion flowers (*Stapelia*), relatives of our common milkweed of the roadsides; *Gasteria*, *Haworthia*, and other South African representatives of the lily family; and the fig-marigolds, *Mesembryanthemum*, belonging to the carpet-weed family.

On the end of the center bench, opposite to the entrance from house 4, is the collection of the fleshy members of the spurge family, Euphorbiaceae, mostly natives of the Old World. These closely resemble forms of the genus *Cereus* and related genera of the cactus family, to be found in houses 6 and 7. In fact the adaptation to an arid environment, by the thickening of stems or leaves, is strikingly illustrated in the plants of several families contained in the collections in houses 5 to 8. On the westerly side of the center bench are the aloes, mainly South African members of the lily family. A large part of the remaining portion of the center bench and the side bench on the east side are devoted to members of the orpine family, many of these interesting and beautiful forms. The echeverias from Mexico and Central America, and the sempervivums or house-leeks, from the Old World, are conspicuous among these. Among other genera represented are *Sedum*, *Kalanchoë*, *Pachyphytum*, and *Crassula* (in house 6 are large specimens of *Crassula portulacea*). Many of the stone-crops are hardy plants and a collection of these may be found at the herbaceous grounds. A large number of specimens belonging in this house and in the three following ones may be found during the summer in the beds in the conservatory court.

House No. 6. This is also a desert house. On the corner benches is a collection of century plants (*Agave*), a large genus known only from the New World; other and larger plants of this same genus may be found in the central portion of the house. Conspicuous among these are: the thread-bearing agave, Queen Victoria's agave, the

sisal plant (*Agave sisalana*); and the common century plant (*Agave americana*). The first two are decorative and curious; from *Agave sisalana* is manufactured the sisal hemp of commerce; the last, *Agave americana*, is well known, and it is from the sap of related species that the Mexican drink "pulque" is obtained by fermentation. It is popularly believed that the century plants flower but once in a hundred years, and then die; it is true that the plant dies when done blooming, but it blooms at a much earlier age than a century, sometimes when but eight or ten years old, it is said. The collection of West Indian Agaves is especially rich in species. A curious desert plant among the century plants on the side bench is called by the natives of Mexico, its native country, "huariqui" (*Ibervillea sonorae*); during the rainy season green stems arise from these large woody plant-bodies, which at other times remain in a resting condition.

A group of the dracaena family may be found in the central portion of this house. This comprises members of the genera *Aloe*, *Yucca* and *Dasylyrion*. A group of cacti may also be seen here, the most imposing figure of which is the giant cereus, *Carnegiea gigantea*, known as "sahuaro" by the Mexicans and Indians of its native country, Arizona and Sonora. The plants here shown were obtained by an expedition sent to those regions by the Garden in 1902, and are the largest specimens in cultivation in the east. Several large specimens of the hedgehog cactus, secured at the same time, form part of this group; the Indians in the desert often secure a supply of drinking water from these plants by cutting off the top and macerating the interior substance.

Houses Nos. 7 and 8 are wholly occupied by the cactus family. The collections here have been greatly enriched and enlarged in the past few years by extensive explorations made in South America, in cooperation with the Carnegie Institution, and from other sources. These collections, the richest in species in the world, have been

assembled to facilitate the production of a monograph on this family now in course of preparation by the Garden in cooperation with the Carnegie Institution. In addition to the plants in these houses, many hundreds of others are located at the propagating houses. Nearly all these plants are devoid of leaves, these organs, when present, being mostly small and inconspicuous; in the genus *Opuntia* they are usually present on the young growths as awl-shaped bodies, while in some few species they are much larger and remain for some time; in the genus *Pereskia*, specimens of which will be found in house No. 8, the leaves are large and well developed. The stems of the cacti are fleshy and assume a great number of forms; in *Opuntia* the stem is composed of joints, either cylindric or broad and flattened. In *Cereus* and related genera the stems are angled; in *Carnegiea* they are thick massive columns with many longitudinal ribs; in *Echinocactus* the plant-bodies are but little elongated, or almost globular, while in other genera the plant-body is covered with rows of spirally arranged projections. The flowers of many cacti are exquisite in form and color; they are borne on various parts of the plant-body, in the turk's-head cactus on a curiously modified portion of the top.

In house 7 on the north bench and the north part of the center bench is the genus *Cereus* and its many related genera, *Pachycereus*, *Cephalocereus*, *Leptocereus*, *Acanthocereus*, *Nyctocereus*, *Hylocereus*, *Selenicereus*, *Harrisia*, and others. Among these is the old-man cactus, *Cephalocereus senilis*. On the west end of the center bench and on the side bench opposite is a collection of the genus *Epiphyllum*, often known as *Phyllocactus*. The broad flattened parts of these plants are stems and not leaves, the flowers being borne in the notches along their edges. The flowers are very showy; many of them beautiful in the extreme. On the south side of the center bench are plants of the hedgehog cactus, *Echinocactus*, and also of *Echinocereus* and *Echinopsis*. On the south bench is a

collection of cactuses, largely of the genus formerly known as *Mamillaria*. Here also will be found specimens of *Echinocereus*, *Echinocactus*, and of the curious Turkshead cactus which bears its flowers on the red cap to the plant, hence its popular name.

House 8 is mainly devoted to the collections of the genus *Opuntia*. On the center and north benches are the platyopuntias, those with broad flat joints, while on the south bench will be found the cylindropuntias, or those with rounded stems. Among the platyopuntias are a number of plants of Burbank's so-called spineless cactus; these were obtained direct from Mr. Burbank in 1912, and it is curious to note that many of them are now developing spines. It is claimed that these plants are valuable for fodder in arid regions. As already remarked above, the leaves of the opuntias are usually small and awl-shaped and occur on the young growths. In this house will also be found the genus *Pereskia*, in which the leaves are normally developed. One of the commonest of these is the Barbados gooseberry, *Pereskia Pereskia*, of tropical America. *Pereskioopsis* is a related genus of which a number of species will be found here and its leaves are also well developed.

An interesting economic plant in this house is *Nopalea coccinellifera*, upon which the cochineal insect breeds; it is from these insects that the dye cochineal was obtained.

Few of the cacti are of economic importance. A number of different kinds are used for hedges in tropical America. Certain species of *Opuntia* produce edible fruits known as Indian figs. These are offered for sale in the fruit stores in New York at the proper season. In the island of Grand Turk certain species of *Opuntia* which grow there are used in making a soup, known as pear soup, the young joints of the plant being used for the purpose.

House No. 9. This is the aquatic house, and plants which find their homes in the water or require much moisture are brought together here. From the bridge spanning the pool the various features may be readily observed.

Fringing the pool on the right, as one enters from house No. 10, are members of the sedge and grass families, while on the left hand side the fringe is made up entirely of grasses, largely of the graceful bamboos. Of special interest among the sedges is the Egyptian paper-plant (*Cyperus Papyrus*), from which many of the ancients obtained their writing paper. Among the grasses by far the most important is the sugar cane (*Saccharum officinarum*); from the lower portions of its stalks the juice is extracted by pressure, and from this juice sugar is manufactured. Among the plants in the pool are many with attractive flowers; conspicuous among these being water-lilies (*Castalia*), of which there are several different kinds; the water hyacinth; the parrot's-feather, with its delicate feathery masses of green; the water poppy; the water snowflake; the water lettuce and golden-club, members of the aroid family; the floating fern; and some odd little plants related to the ferns, members of the genus *Salvinia*.

House No. 10 contains specimens of the aroids, represented by a large number of different species, located on the center and end benches and also under the benches. The plants of this family (*Araceae*) are mostly of tropical distribution, but they are represented in our northern flora by the skunk cabbage, the jack-in-the-pulpit, and the sweet flag; the most familiar one in cultivation is the calla lily (*Zantedeschia aethiopica*), not botanically a lily. The plants all have spikes of very small flowers closely massed together, and usually subtended by a broad leaf-like structure which is known as the spathe; this is usually highly colored, pure white, yellow, red or scarlet, and is commonly thought of as the flower, though not botanically so; species of *Anthurium*, known as tail-flowers, are abundant in the West Indies and tropical America, as is the genus *Philodendron*, signifying tree-loving, on account of many species being vines climbing high on the trees in tropical forests; numerous species have underground stems and branches which contain much starch and are cultivated

in the tropics for food, under the name of yautias and taros. Plants of the same family, too large for exhibition in this house, may be found in house No. 4. This house is occupied also by plants of the pineapple family, these being on the side benches. These are mostly plants which live on the trunks and branches of trees in tropical forests, and are therefore called epiphytes, signifying plants growing upon other plants; many of them are exceedingly beautiful in foliage and in flower; the so-called Florida moss, or Spanish moss, clothes the trees of the live-oaks in the southern Atlantic States, and is not a moss at all, but a plant bearing small flowers which show its relationship to others of this family. The pineapple itself, doubtless the most familiar member of this group, has been cultivated in tropical regions for an indefinite period for fruit, and is not certainly known in the wild state; the pineapple fruit is the ripened bunch of flowers which forms at the top of the stem; the plant is propagated by cutting off the tuft of leaves, which is found on the top of the fruit, and by suckers which sprout from the side of the plant near the ground; it is an exception to the tree-loving habit of most of the family, in growing on the ground, and is cultivated in the Bahamas and on the Florida Keys, often in very rocky soil. One of the very spiny-leaved species, *Bromelia Pinguin* is widely utilized as a hedge plant in the West Indies. Other members of this family will be found at range 2.

House No. 11. Here are brought together many kinds of tropical plants belonging to the banana, ginger and canna families. There is also here, on a corner bench, a collection of pineapple plants, some of them with beautiful variegated foliage. The collection of bananas and their relatives occupies the greater part of the space and one or more of the specimens is usually in fruit; the collection contains both the edible, commercial bananas and the plantains, and also several species whose fruit is not edible, but whose interest lies in their decorative leaves and flowers. The

stems and leaves of all these plants contain some fiber, which is produced in enormous quantities in the Philippine Islands from *Musa textilis*, and is the well-known Manila hemp. The supply of fruit for the United States comes mostly from Central America and the West Indies, and some from northern South America. Bananas will grow in southern Florida, but the rocky soil of that region is not well adapted to their cultivation. The traveler's tree, from Madagascar, is shown in several fine specimens, and gets its English name from the fact that the axis of each long leaf-stalk contains a great deal of water which can be tapped and drunk. The bird-of-paradise plants, which take their name from their gaudy flowers, will be found in this group; they are natives of southern Africa and belong to the genus *Strelitzia*. Another genus of the banana family, *Bihai*, is also represented by several species, called wild plantains, natives mainly of tropical America.

Here also may be found several species of the genus *Costus* and of other genera of the ginger family, including the ginger plant (*Zingiber Zingiber*).

House No. 12. The plants in this house, as well as those in house No. 14, are mostly natives of warm-temperate regions, and are arranged in botanical sequence, with a view to furnishing a collection for the comparative study of plant families and genera; to make this as complete as possible, as many representatives of families and genera are brought together as space and cultural conditions permit. Cultural requirements necessitate placing the ferns and their allies somewhat out of their sequence position, at the south end of the west side bench. The east side bench is devoted to the pine family, the yew family, and to the endogenous plants, the last named terminating with the orchids, next the banana house. The sequence of exogenous plants begins on the west side bench, as one enters from house No. 13, crosses to the central bench at the ferns, and continues around that, ending in this house with the loasa family, near the fern house. The sequence is then con-

tinued in house No. 14, beginning with the mezereon family on the north side bench, at the entrance from house No. 13, continuing around the central bench and ending with the thistle family on the end of the south side bench near the entrance to house No. 13.

Among the more interesting species on the west side bench are many Australian plants, represented by grevileas, hakeas, and others; a group of insectivorous plants may also be found here; among these are the pitcher plants (*Sarracenia*) in several species; the pitchers contain a liquid in which the insects are drowned, the fluid resulting from their decay being absorbed by the pitchers; these structures form a part of the leaves and are a modification of the petiole. The sundews (*Drosera*) secrete a sticky substance from the gland-hairs on their leaves, which can digest insects and other animal matter. On the central bench may be found a group of the rue family; to this belong, among others, the oranges and lemons, of which a number of small specimens are here, others being placed in house No. 13. A peculiar plant of this family is *Agathosma apiculata*, of southern Africa; its leaves are full of glands which secrete an oil exhaling a disagreeable odor quite apparent at times. On the east side bench are members of the lily family and the amaryllis family, with many other endogenous plants, including a collection of orchids which grow in warm temperate regions or in the mountainous sections of the tropics. In the yew family, perhaps the most interesting are two small plants of the "stinking cedar" (*Tumion taxifolium*) so-called by the natives where it grows; it is known to occur in a wild state in a small area along the Apalachicola River in Florida.

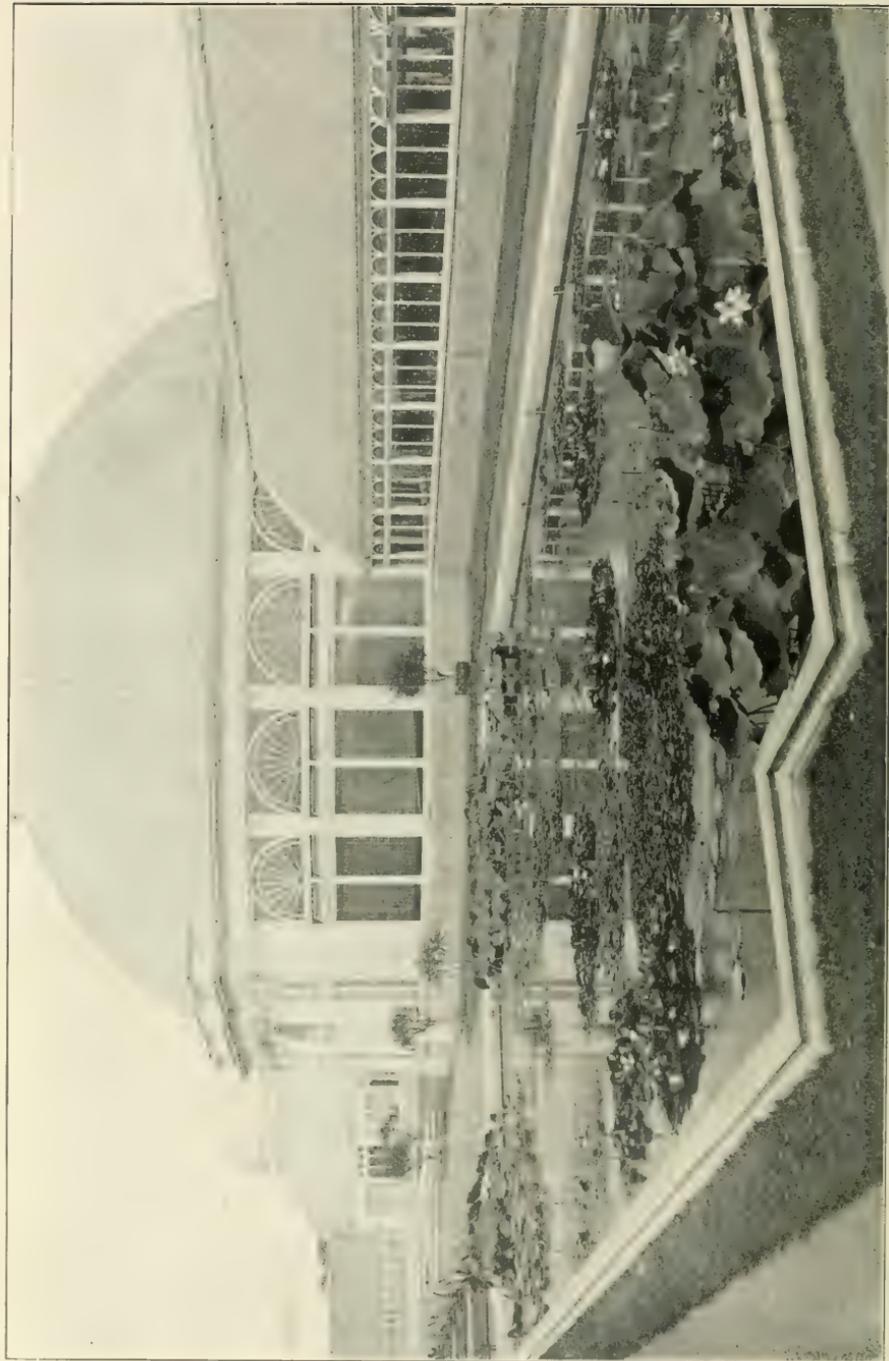
House No. 13. This house contains such plants of warm-temperate regions as are too large for proper exhibition in houses 12 and 14. The endogenous plants may be found on the side next house No. 14; the remainder of the house is occupied by exogenous plants. Opposite the entrance from house No. 14 is a group illustrating the pine family

and the yew family. The most conspicuous objects among the former are the araucarias, which take the place in the southern hemisphere of the pines in the north; *Araucaria brasiliana* and *A. Bidwillii* are prominent among these; the common Norfolk Island pine (*Araucaria excelsa*) is shown in several large specimens. To the right of this, across the path, will be found specimens of the New Zealand flax (*Phormium tenax*), and on one of the trellises in the rear is a vigorous plant of the Cherokee rose. To the left, a little beyond the pine family, is the myrtle family; prominent in this is a group of the gum-trees of Australia and Tasmania (*Eucalyptus*); these trees occur in large forests, and sometimes attain a height of 200 to 400 feet. A large specimen, some ten or twelve feet tall, of the bottle-brush tree (*Callistemon citrinus*) will be found here; the red flowers are borne in long cylindrical clusters, much resembling a common bottle-brush, whence the popular name. In the corner to the right is a specimen of the camphor tree (*Cinnamomum Camphora*), from which the camphor of commerce is derived. Opposite the camphor tree is a group containing the common garden camelia, and the important commercial plant, *Thea sinensis*, from which is obtained our beverage tea; black and green teas are obtained from the same plant, the difference in color being due to the method of preparation; the tea plant is extensively cultivated in many warm and tropical countries, tea as a beverage having been used by the Chinese from time immemorial; its first introduction into Europe is said to have been by the Dutch in 1610. Further along to the left, beyond the group of Australian acacias, of which there are many specimens, are several plants of the fig tree (*Ficus Carica*), from which the edible figs are secured; the leaves drop off in winter, and so for a short time the plants are placed elsewhere. Here also is a group of oleanders; a poisonous principle occurs in the flowers and leaves of these plants, and especially in the bark. A plant of great economic importance in the olive family is the olive

tree (*Olea europaea*), of which a small specimen may be found near the oleanders; this plant was originally from the Mediterranean region and the Orient, but has now been largely introduced into cultivation in other warm countries; in the middle of the eighteenth century it was first introduced into California, at San Diego, it is said, and is now largely cultivated in southern California. On one of the columns is a fine plant of *Bougainvillea*, a native of Brazil; the bracts which surround the small flowers are bright magenta colored; when in full bloom the plant makes a gorgeous show. On one of the trellises back of the group of the amaryllis family is a plant of the yellow jessamine (*Gelsemium sempervirens*) of the south; it sends out its pretty flowers usually in February, and they persist for several weeks. In this house may also be found a number of palms. Among these may be mentioned the characteristic fan-palm of the California desert (*Neowashingtonia robusta*), and the palmetto (*Sabal Palmetto*), of our southern States. A few temperate tree-ferns are also placed here.

House No. 14. The general arrangement of this house was mentioned when describing house No. 12. Entering from house No. 15, to the left may be found plants of the rosemary; this enjoys a reputation of long standing, for it was held in high esteem by the ancient Greeks and Romans, being regarded by them as the emblem of fidelity. A little further to the left is the parachute flower (*Ceropegia Sandersoni*), from Natal. On the right are many interesting members of the thistle family. On the other side of the house may be found *Aucuba japonica*, from Japan, and *Corokia Cotoneaster*, from New Zealand, both members of the dogwood family, but not much resembling our common flowering dogwood. Other plants of interest may also be found here.

House No. 15. The orchid family, to which this house is devoted, is a widely distributed one, occurring in all tropical regions, but finding its greatest development in the Old World in India and the Malayan region, while in the



COURT OF PUBLIC CONSERVATORIES, RANGE 1

New World its greatest numbers occur in Brazil and other parts of northern South America. In temperate regions relatively few species are found, while in very cold countries they are entirely absent. Most of the tropical forms are epiphytes, that is, they grow upon trees and usually have bulb-like or thickened stems and fleshy leaves for the conservation of their water supply, as, from their habitat, this supply must be precarious. In temperate regions nearly all of the species are terrestrial, and have thin leaves, the soil about their roots serving to protect them from the cold and also giving them a more constant water supply: they do not, therefore, need pseudobulbs or thickened stems. Coming from all parts of the world as they do, their blooming time varies greatly, so that at almost any time of the year, be it winter or summer, some of these interesting plants may be found in bloom.

At range 2 is another large collection of orchids.

On the central bench is an interesting palm, the double cocoanut (*Lodoicea maldivica*), a native of the Seychelles Islands, also known as the coco de mer, and coco des Maldives, and one of the rarest palms in cultivation. The tree in its native wilds attains a height of ninety feet, bearing aloft a magnificent crown of green leaves which make it an important feature of the landscape. This is the only plant in this house not a member of the orchid family; it is kept here for cultural reasons.

Conservatory Court. There are three attractive features here during the open season, viz., the display of tulips in the spring, followed by the collection of desert plants, and the water lily collection. The water lilies may be found in two tanks, one in each end of the court. In the easterly tank are placed the hardy sorts, such as are able to withstand the severe cold of our winters, which remain permanently where they are, winter and summer. In the westerly pool are the tender kinds, or such as require protection during the winter, and many of these are stored in a warm cellar during winter and placed on view again in the

spring. The most conspicuous of the tender sorts are the royal water-lilies from South America; these are not hardy in this climate, and, as they are too large to protect from the cold, they are grown anew from seed each year; the seeds are sown in the propagating houses late in winter, and the young plants placed on view late in the spring or in early summer.

In summer the collection of desert plants is in the beds in front of the entrance to house No. 1. The central bed contains American desert plants only, made up largely of members of the cactus, amaryllis and lily families. The bed parallelling this to the west contains a collection of cacti, members of the genus *Opuntia*, prickly pears, with flat stems or joints, all natives of the American desert. In a bed parallelling this on the opposite side of the central bed is a collection of desert plants from southern Africa. Placed transversely to this is a small bed with desert plants of one family, containing representatives from both the Old World and the New. A corresponding bed on the other side of the court is devoted to desert plants from the Old World. Near to this is a small bed containing plants of the genus *Opuntia*, only those with round stems or joints. In the corresponding bed on the other side of the court is a collection of desert plants belonging to the spurge family. Many plants from house No. 13 are also moved into this court during the summer.

Range No. 2.

This range is located on the easterly side of the grounds, in the midst of the deciduous arboretum. The completed portion consists of a transverse section, running east and west, divided into three compartments, and three houses at right angles to this one of which is divided into two compartments. The tropical ferns and their allies, most of the cycads, and parts of the orchid and pine-apple families are exhibited here. Other members of the orchid and pine-apple families and a few cycads will be found at

range 1, the orchids in houses 12 and 15, the members of the pine-apple family in house 10, and the cycads in house 1.

In house No. 1, the easterly compartment of this transverse portion, the collection of sago palms or cycads has been installed. This family of plants is represented by large specimens of *Cycas revoluta*, from Japan; by *Cycas circinalis*, from the Molucca Islands; by a single plant of the rare *Stangeria eriopus*, from southern Africa, where it is known as the kaffir's-head; by a number of specimens of the genus *Zamia*, including the small Florida coonties; and by the Kaffir-bread (*Encephalartos*), two species, from Africa; the stems and trunks of plants of this family contain much starch, which is extracted, in the countries in which they grow, by crushing and washing, and pass into commerce under the name of sago starch. Other specimens are in the south end of the middle one of the smaller houses.

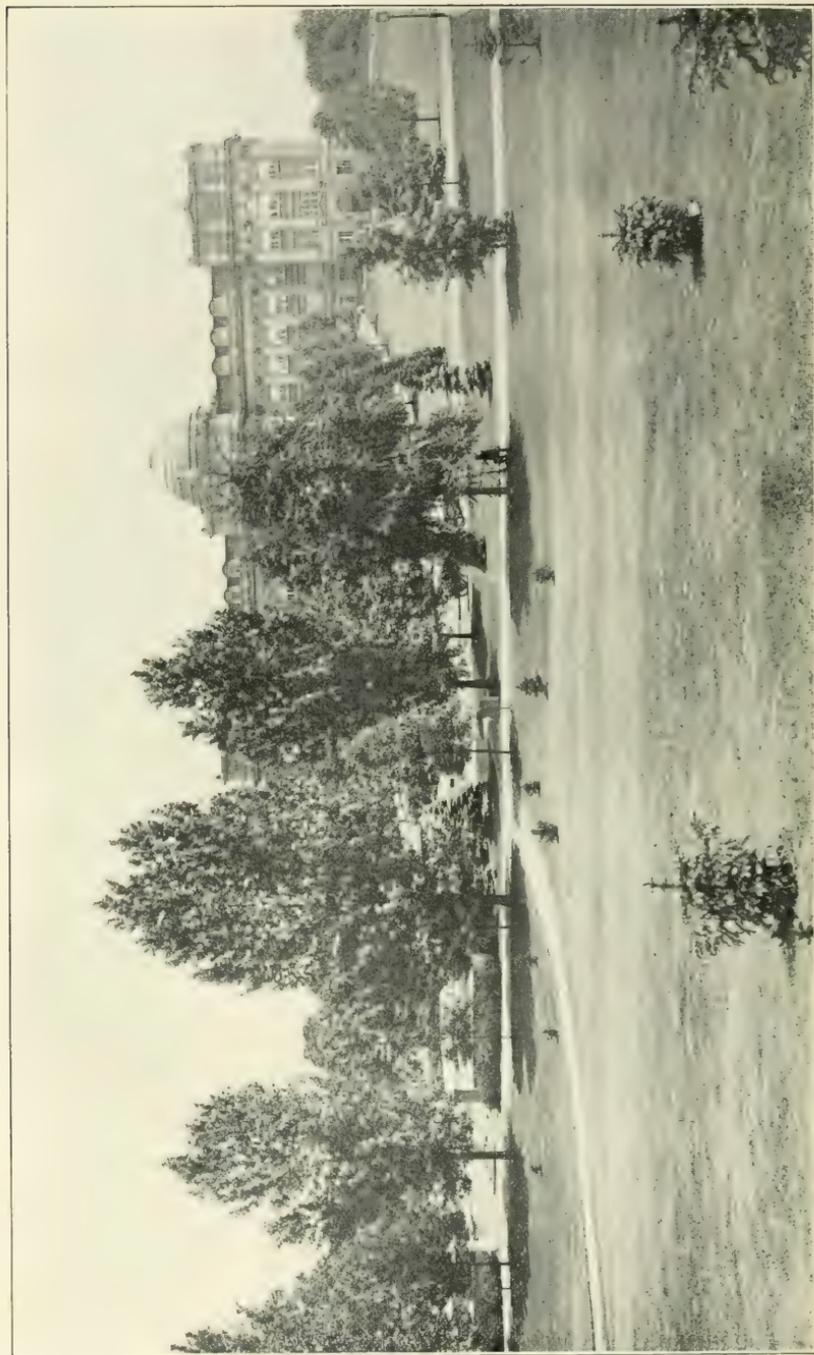
In houses 2 and 3 are the tropical tree-ferns and the larger specimens of the low ferns and fern-allies.

The graceful tree-ferns mostly inhabit the mountains of the tropics, commonly at an elevation of 1500 feet or more. Many of the plants here have been secured by Garden expeditions to different parts of the American tropics. Another feature of interest is the collection of staghorn-ferns, hanging over the walk in the center house; the application of the common name staghorn is quite evident in several of the species. Suspended from the roof in baskets are many desirable ferns. A fern from China and Tartary, known as the Scythian Lamb (*Cibotium Barometz*), may be found here; it is of interest as forming the basis of a marvellous tale, current in early times, to the effect that on a vast plain to the eastward of the Volga occurred a wonderful plant, looking like a lamb; this animal, so the story ran, was supported upon a stalk and as soon as it had exhausted the vegetation at hand died from starvation.

In house 4 is a collection of exogenous tropical plants. These are arranged in botanical sequence, the families

appearing to the right or left of the walk, or both, as cultural conditions require, the sequence beginning at the north end on the west side, terminating at the same end on the opposite side of the house. On the right, as one enters from the north door, is a collection of the pepper family, Piperaceae. These are largely of the genus *Peperomia*; many of these plants have been collected by Garden expeditions to the West Indies. Plants of the genus *Piper* are usually large, and the larger ones will be found on the center bench nearby. The nettle family follows, represented by such plants as the odd *Procris*; *Pilea*, in several species, including *P. microphylla*, the artillery plant; the *Gyrupia* poison-tree, a native of Australia, one of the most vicious of the stinging nettles—at fruiting time the dull purple of its fruit makes it quite attractive; and the two-lobed *Boehmeria*, from Japan. The flat-stemmed *Muhlenbeckia*, native of the Solomon Islands, belongs to the knotweed family. As one proceeds, many species of figs will be found on both sides of the walk, including the common rubber plant of our homes. Further on is the laurel family, one of the interesting plants belonging here being the alligator pear, the fruit of which is edible and much used as a salad and otherwise in the tropics. Near this is the custard-apple family, including the cherimoyer, an edible fruit, native of tropical America. Along the west walk, about the center of the house, are the senna and mimosa families, represented by numerous individuals. To the senna family belongs the poinciana, commonly grown in Florida and tropical countries on account of its decorative red flowers. To the mimosa family belong the sensitive plants, of which there are two here which show this characteristic noticeably, *Mimosa pudica* and *Mimosa Spegazzinii*.

Near the south end of the house is a collection of the spurge family. Here will be found the genus *Codiaeum* in many colored forms, usually known as garden crotons. Other genera represented are *Croton*, *Phyllanthus*, *Xylo-*



THE MUSEUM BUILDING AND APPROACHES

phylla, *Antidesmia*, and *Acalypha*. At the end of the house, on the west side, are two plants of the curious West Indian ivy, belonging to the genus *Marcgravia*. On the east side of the house, at the south end, is a large collection of begonias, both on the benches and planted out underneath. Further on is the meadow-beauty family, largely represented in tropical regions, to which belongs our native meadow-beauty, *Rhexia virginica*. Other families following are the vervain, acanthus, potato, Madder and thistle, the last two near the north door.

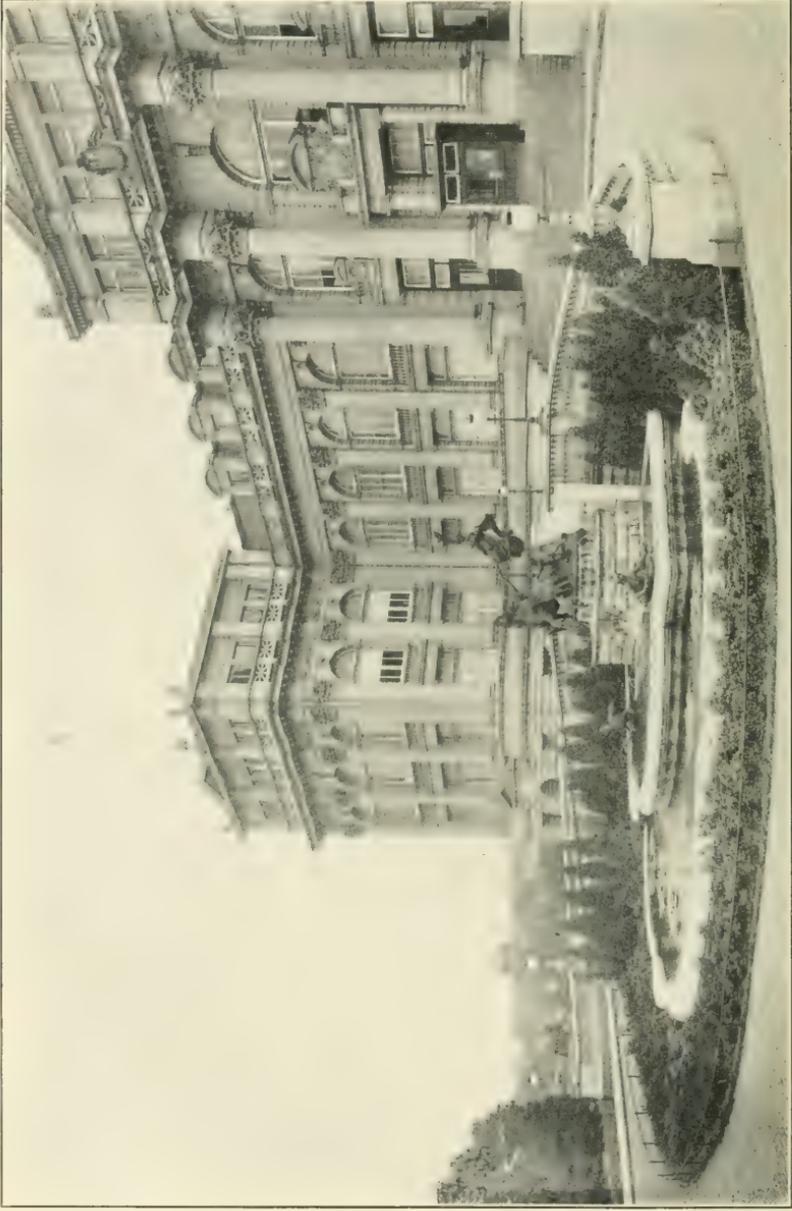
In house 5 is a collection of tropical ferns arranged in botanical sequence, thus bringing closely related families and genera into juxtaposition and enabling a comparative study of these plants to be made. It is only possible to represent in this sequence the position of the tree-ferns by very small specimens. These may be studied to better advantage in the larger houses. At the south end of this house is a part of the collection of cycads. *Microcycas calocoma*, a rare Cuban member of this family, is among these. There are a number of specimens of the American genus *Zamia*, including representatives from Florida and the West Indies. Other specimens, including the larger ones, will be found in the easterly house of the transverse range.

The easterly of the smaller houses is divided into two compartments. House 6 is known as an East Indian house. Here are grown mainly such orchids as require a close humid hot atmosphere. Among the larger and more interesting of the genera represented are: *Vanda*, widely distributed in the East Indies and the Malay Archipelago, many of them with large and showy, often sweet-scented, flowers; *Phalaenopsis*, also native in the East Indies and Malay Archipelago; *Angraecum*, of tropical Africa and the Mascarene Islands; *Macroplectrum*, from Madagascar and the Mascarene Islands; *Dendrobium*, a number of species, a large Old World genus of over 500 species; *Paphiopedilum*, Venus-slipper, an Old World representative of the

group containing our lady-slippers, *Cypripedium*. Other plants requiring this treatment are the East Indian Pitcher-plants, *Nepenthes*, a collection of which will be found here. They are mostly vines, growing naturally on trees, their leaves curiously modified at the ends into hollow structures, provided with lids, and technically known as pitchers, which are often wrongly regarded as the flowers; these pitchers contain water and secrete from their sides a liquid which digests insects that fall or crawl into the pitchers; this form of nutriment is apparently not necessary at all, however, to the growth of the plants; the flowers are small but borne in large clusters arising from the stems and may often be seen in this collection.

In house 7 is a large collection of orchids requiring cooler and less humid conditions. Large or interesting genera represented here are: *Stanhopea*, in several species, an American genus, with large odd-shaped flowers in pendulous racemes; *Epidendrum*, a large American genus, ranging from South Carolina and Alabama, through the West Indies and South America; *Gongora*, also a genus of tropical America; *Oncidium*, a large genus of tropical America, with a maximum development in South America; *Pleurothallis*, American orchids, usually small, sometimes but a half inch tall, and often forming mats on tree trunks, commonly at considerable elevations. In this house will also be found a large collection of bromeliads, of the pineapple family, in such genera as *Tillandsia*, *Vriesia*, *Hohenbergia*, *Pitcairnia*, *Cryptanthus*, and *Aechmea*. Other representatives of this family will be found at conservatory range 1, houses 10 and 11.

Power Houses. Steam for heating the conservatories, range 1, is supplied from the power house, located near the New York Central Railroad just south of the 200th Street entrance and connected with the conservatories by a subway about six hundred feet long containing the steam mains; five boilers are installed and supply steam not only to the conservatories, but also to the museum building through another subway about twelve hundred feet in length.



MUSEUM FRONT AND BRONZE FOUNTAIN

Steam for heating the conservatories, range 2, is supplied from a boiler house near this structure, a little to the north.

2. The Botanical Museum

The Museum Building has a frontage of 312 feet, and in so far as now constructed, a depth of about 90 feet; the plan of this building contemplates its future extension toward the rear, so as to form a quadrangle enclosing a court. The architectural style of the building is Italian Renaissance. The walls are of light-colored brick and the trimmings of terra-cotta. It has a steel frame and concrete floors. Three floors are devoted to public exhibits, while the upper floor contains study rooms, the library, laboratories and herbarium, which may be used and consulted by permission.

The building is approached by two straight driveways and accompanying sidewalks leading from the main park driveway near the New York Central Railroad station; this front approach to the building is ornamented by a bronze fountain executed by the sculptor Carl E. Tefft, and by terra-cotta fountains and marble seats designed by R. W. Gibson, the architect of the building. The vista lines are formed by four parallel rows of tulip trees.

The public collections in this building are:

I. THE MUSEUM OF ECONOMIC BOTANY

This occupies the entire main floor, and comprises both crude and refined products of plants used in the arts, the sciences, and the industries, as well as illustrative photographs and drawings. The specimens are arranged as products, including foods, drugs, fibers, gums, resins, sugars, rubbers, spices and flavoring-agents, dye-stuffs, tanning-materials, plant-constituents, fixed- and volatile-oils, cork, starches, and others as indicated by the accompanying floor plan.

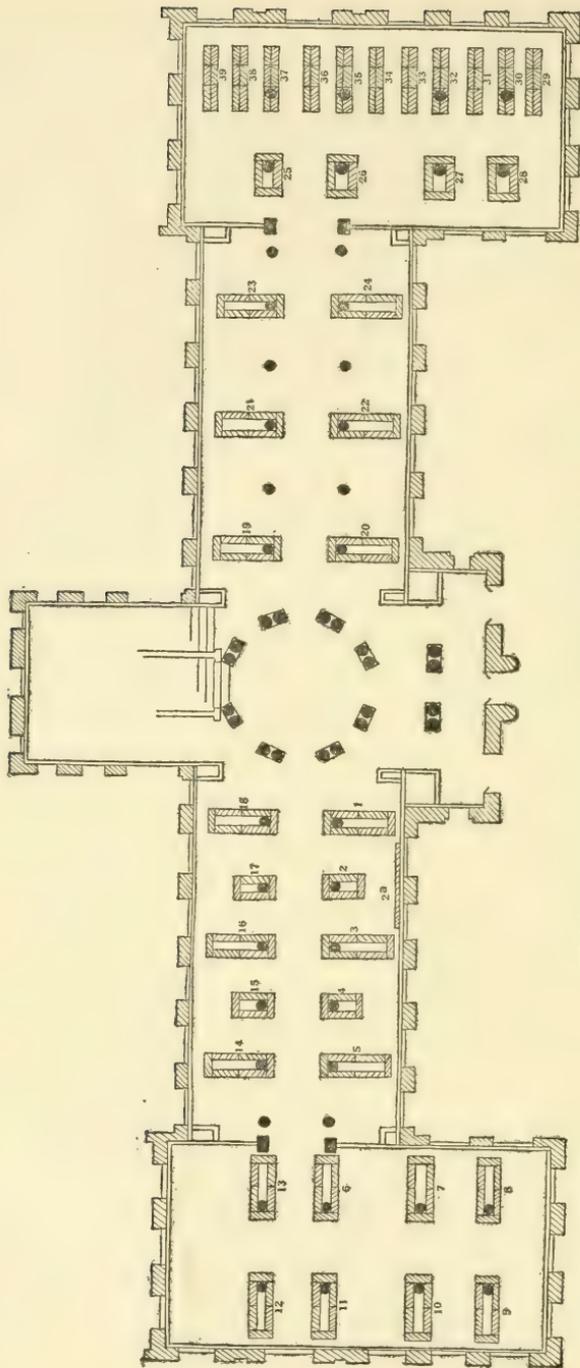
The arrangement of the larger groups is as follows: Foods and fibers occupy the west hall, the former in cases on the north side, the latter on the south. The west wing

is mainly given over to exhibits other than foods, fibers, drugs, and woods. The east hall contains the drugs, while to the east wing are assigned woods and wood-products, and a collection illustrating North American dendrology.

Fibers. Cases 1 to 26.—In the first case of the series devoted to fibers may be found cotton, now the most important of the vegetable fibers. It is derived from the fruit of the cotton plant (*Gossypium*), being the hairs that cover the surface of the seeds. The fruits from several different kinds of cotton-plants may be seen with the cotton bursting from the capsule, while some of the many different products are also shown.

The fiber of other plants, derived from leaves, stem, bark, roots, and other organs is of great economic importance and is used, either in practically its natural condition, as may be seen by the specimens of fans, hats, boxes, bags, baskets, mats, matting, crude ropes, brooms, ornaments, and toys; or it is manufactured into articles of commerce after processes which remove it considerably from its natural aspect or condition; for example, linen, which is made from the flax plant; cloth, twine, and rope, made from jute, hemp and abutilon-fiber; and paper made from wood and other fibers.

Rubber and Allied Products. Cases 27 and 29.—The first case in the west wing contains rubber and allied products. Here are the implements and utensils used in collecting the rubber "milk" from the trees which grow in tropical forests. Rubber is derived mostly from trees belonging to the mulberry family, spurge family and dogbane family. Rubber, India-rubber, or elastica consists chiefly of the peculiar substance caoutchouc, which, in the form of an emulsion, constitutes the milky juices of many plants, existing in special milk-tubes of the bark and wood. The bark is cut or punctured, when the milk exudes and is caught in some receptacle. The milk is coagulated by various methods, mostly by subjecting it to the action of



FLOOR-PLAN, MUSEUM OF ECONOMIC BOTANY

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| 1-5. | Cases 1-26 | Fibers |
| 6. | Cases 27-29. | Rubber and allied products |
| | Case 30. | Perfumery |
| 6 and 7. | Cases 31-35. | Spices and flavoring agents |
| | Case 36. | Dye stuffs |
| | Cases 37-38. | Tanning materials |
| | Cases 39 and 40. | Fodder plants |
| | Cases 41-44. | Tobaccos and masticatories |
| | Cases 45-49. | Beverages, including chocolate |
| | Case 50. | Miscellaneous specimens |
| | | 10. Cases 51-56. Fixed oils and volatile oils |
| | | 11. Cases 57-62. Resins |
| | | 12. Cases 63-68. Plant constituents |
| | | 13. Case 69. Starches |
| | | Cases 70-72. Cork and paper |
| | | Cases 73 and 74. Sugars |
| | | Cases 75-100. Foods |
| | | 14-18. Cases 101-118 and 201-218. Drugs |
| | | 19-24. Cases 119-200. Woods and North American dendrology |
| | | 25-39. |

smoke, and the coagulated mass, after losing water by slow evaporation, takes on the dark color, toughness, and elasticity characteristic of rubber. Rubber is more valuable in proportion as its percentage of caoutchouc is greater, and that of its resin less. The most important source of rubber is the tree *Hevea brasiliensis*, Para Rubber, native of Brazil, now very extensively planted in the East Indies.

Several varieties of rubber may be seen in the different stages of refinement, together with some articles as manufactured for the market. Here, too, are two allied products gutta-percha and balata, which are derived from the trunks and foliage of certain trees belonging to the sapodilla family. These trees grow in many portions of the tropics.

Perfumery. Case 30.—This case contains a collection of the essential oils and other aromatic constituents of plants which are used in the making of perfumery, together with the plant parts from which they are extracted. Two general methods are followed in the making of perfumes from such products. By the first, the aromatic and volatile constituent is extracted by distillation, a definite portion of which is then used in making a given amount of perfume. By the other, some substance, usually an odorless fat, is brought into contact with the vegetable matter containing the odorous principle, and the latter is thus permitted to diffuse itself through the fat, which is used as a perfume.

Spices and Flavoring Agents. Cases 31 to 35.—These substances form quite a large series in which is shown the parts of the plant that yield spices and flavoring extracts; for example, licorice. Licorice is the root of two species of shrubs which grow in the Mediterranean region of Europe and Asia. Spanish, French, Italian, Sicilian, or Greek licorice is the sweeter; Russian licorice is the lighter-colored. The underground runners are commonly included with the roots, but are inferior. The root contains gum, sugar, and the sweet substance glycyrrhizin, which is extracted

by boiling. The boiled liquid is strained and evaporated to form licorice extract. Some dry substance, as starch, is usually added to give it the hardness required to form "stick-licorice." The very best licorice is not made into "sticks," but is run into pans or tubs to form large, rather soft cakes. Ginger is a rootstock, the underground stem of the ginger plant; cinnamon is a bark; bay, sage, mint, and thyme are leaves; cloves are unopened flowers; mustard Tonka-bean and nutmeg are seeds, and mace is the outer coat of the nutmeg; and coriander, allspice, black-pepper, celery-seed, and caraway-seed are fruits. Vanilla, a specially cured fruit, is produced in many tropical countries, the best and highest-priced coming from the mountains of Mexico; fineness, rather than strength of odor, determines the value, and this depends upon the variety, the climate, the cultivation, and the method and care employed in curing; the wild product is the poorest. In cultivation the flowers are pollinated by hand. The fruits, resembling slender green bananas, are gathered before quite ripe and are exposed to a steam-sweating by various devices; they are then exposed to the sun each day, and wrapped in woolen blankets each night, for some time. By this process the odorous substance vanillin is developed. The vanillin may all be in the body of the vanilla ("brown beans"), or it may coat its surface in the form of shining white crystals ("frosted beans"). Before this curing process, vanilla contains no vanillin and has no special fragrance or flavor.

Dye Stuffs. Case 36.—The dye stuffs are represented by logwood, madder, alkanet-root, indigo, and oak-galls. The term "dye-stuffs" is applied to that class of vegetable products from which coloring matters useful for dyeing purposes are extracted. Such coloring matters may exist in any part of the plant, but are most often obtained from the wood, as from fustic, log-wood, and Brazil-wood. In such cases they are found in the older central tissue of the trunk, the so-called "heart-wood," but not in the outer

active tissue that constitutes the "sap-wood." From such trunks the sap-wood is therefore usually trimmed off before the logs are sent to market. In most cases, dye-stuffs show some coloration to indicate the presence of their coloring matters, although the color thus seen may be quite a different one from that which the material will produce when in practical use. Sometimes no coloration is to be seen in the dye-stuff, some chemical treatment being necessary to develop it.

Although the use of anilin or coal-tar colors has very largely replaced that of vegetable dyes, there is still a vast use of the latter. But for the introduction of the former, it is difficult to see how the demand for colors could have been supplied under modern conditions.

Tanning Materials. Cases 37 to 38.—The tanning materials are also very important from an economic standpoint. They depend for their value chiefly upon the tannic acid that they contain, but that other constituents contribute is clear from the fact that a substance containing less tannin may be more valuable than one containing a larger percentage. The tannin cures and toughens the skin, but other effects are required to produce the best quality of leather, especially that of "filling" the minute cavities. For this purpose white-oak bark seems to be preëminent and this continues to be the most valued tanning substance. It has become scarce and costly, and "oak leather" now brings the highest prices. The tannins are represented by saw-palmetto, mangrove, pine, hemlock, and sumac. The crude materials of the mangrove and the saw-palmetto are accompanied by their fluid extracts, which contain the tannic acid, and also by the spent material or refuse which remains after the extract has been made. This latter material may be used for other purposes.

Fodder Plants. Cases 39 and 40.—Following the spices are fodder plants, which are shown as sheaves. Fodders are derived chiefly from plants of the grass and bean families. Illustrations of the former are the varieties of hay

known as timothy, red-top, blue-grass, and orchard-grass. Such hays are made by cutting the plants when in bloom or early fruit, and drying entire. Another form of the same class consists of the plants of the grains, wheat, rye, oats, and corn, cut while young and dried. When dried after the removal of their grain, they constitute straw. The corn-plant, cut young, is often chopped up and stored fresh in pits and bins. Such fodder is called ensilage. The grains themselves, separated from the straw, are largely used for fodder. Illustrations of the second class are the plants of clover, vetch, lupine, meibomia, and peas, cut in a similar stage of growth and dried into hay. Fodders of this class are much more nutritious than the grass-hays, but are not so wholesome and must be fed sparingly, especially to horses.

Tobaccos and Masticatories. Cases 41 to 44.—Tobaccos are shown by a series of bundles of the cured leaves of the tobacco plants (species of *Nicotiana*) from different parts of America, and a series of articles as prepared for the market. Closely associated with tobacco are the masticatories or substances used for chewing. One of the most widely known forms is chewing gum, which is made by refining the crude chicle-gum, which is the hardened milky juice of the sapidilla and related plants. In rural districts the exudation of resin found on the bark of conifers is used for chewing while still in the crude condition, but this substance is now refined and sold in our larger cities just as is the now more commonly used chicle-gum. An adjacent series of cases is given over to:

Beverages, including Chocolate. Cases 45 to 49.—Beverages are represented by both the non-alcoholic, as coffee, tea, maté or Paraguay-tea, Jersey-tea, and fruit-juices, and the alcoholic beverages, as wine, beer, ale, and porter. Of the beverages just cited, maté or Paraguay-tea is perhaps little known in the northern hemisphere. It comes from a small tree in Paraguay and adjacent regions, and is chiefly cultivated for the production of Paraguay-tea.

The cured leaves are sold either in the entire condition or powdered, and afford the chief beverage of Paraguay and many parts of the Argentine Republic and southern Brazil. They contain much less caffeine than ordinary tea, and have a very different flavor, but are used for the same purpose and produce the same effect. Paraguay-tea is extremely cheap as compared with ordinary tea, and brief use makes people equally well satisfied with it. In the block of cases devoted to beverages may be found chocolate, which is derived from the seed of the chocolate tree (*Theobroma*). The collection shows the chocolate fruits, the principal commercial varieties of the seeds, unroasted and roasted, nibs of different degrees of fineness, germs, cocoa-liquor, cocoa-butter, cocoa-cake, and the same ground into "breakfast"-cocoa, with several varieties of confectioners' chocolate, as put up for the market.

Miscellaneous Specimens. Case 50.— In this case may be seen the substances used in the manufacture of insect-powders and related substances, and soap. Soaps are made from fats or fixed oils, acted upon while hot by a caustic alkali, or "lye," ordinarily by boiling the two together. The fat consists of one or more acids, variously combined with glycerin. The alkali takes away the acids, uniting with them to form soap, the glycerin being set free. Either animal or vegetable fats can be employed, the characters of the soaps differing more or less with the particular fat used. The character of the alkali, such as soda or potash, also modifies the quality of the soap. The soap may contain free alkali, free fat, free glycerin, or water, in variable proportions, all of which will modify its quality. Official soap (that used in medicine) should not float on water and should contain not more than 36 per cent. of water.

Fixed Oils and Volatile Oils. Cases 51 to 56.—The volatile oils form a large series, and in their manufacture various parts of the plants are used; for example, roots are used to make the oils of lovage-root, elecampane, and

muskroot; rootstocks or underground stems furnish the oils of calamus, ginger, orris-root, and wild ginger; herbage is the source of the oils of pennyroyal, tansy, spearmint, and peppermint; wood furnishes the material to make the oils of red-cedar wood and sandalwood; bark is the source of the oils of birch, cinnamon, and sassafras; leaves yield the oils of hemlock, spruce, pine, cedar, eucalyptus, and wintergreen; flowers yield the oils of cloves, lilac-flower, and orange flowers; fruits yield the oils of pepper, lemon, caraway, and fennel; seeds furnish the oils of mustard, wormseed, nutmeg, and almonds; while resins give us the oils of elemi, mastic, myrrh, and frankincense.

The fixed oils, at least from a commercial standpoint, are less numerous than the volatile oils, and those in common use are mostly derived from the fruits and seeds of plants; for example, olive-oil is contained in the fruit of the olive, linseed-oil is contained in the seed of the flax plant, castor-oil is stored up in the seed of the castor-oil plant, and cotton-oil abounds in the cotton seed. The castor-oil seed or "bean" consists, to the extent of about half its weight, of a fat or fixed oil. The ripe seeds are coarsely broken, and the shells, weighing about one third, are separated. The kernel is then pressed, and the oil squeezed out. By using heat a larger amount of oil is obtained, but the heat partly decomposes it, setting free ricinoleic acid, the result being a discoloration, a bad odor and taste, and a griping action. For this reason, it should be "cold-pressed" for medicinal purposes. In the intestines, partial decomposition of the oil occurs, whence results the purgative action. Perfectly fresh, cold-drawn castor-oil may have no disagreeable odor or taste, and has been used on bread, as a substitute for butter. The pulp remaining after the removal of the oil contains the very powerfully poisonous albuminoid, ricin. It is owing to this substance that castor-oil seeds are poisonous. About one fifth of the weight of cotton seed consists of a fat or fixed oil, the finer grades of which are largely used for

human food. This oil is both nutritious and wholesome, and furnishes a clean vegetable substitute for butter and lard, especially for cooking purposes. The poorer grades are used for soap-making and other mechanical purposes. In the process of extracting the oil the hulls are removed from the seeds and the kernels are partly cooked, after which the oil is removed by pressure. The cake that remains is ground into cotton-seed meal. This still contains considerable fat and a large amount of other nutriment and is an important food for cattle. Fixed oils differ from volatile oils in not completely evaporating when exposed to the air. In many cases the by-products resulting during the manufacture of the various oils are of considerable commercial importance. Some of these by-products are shown in the cases with the oils. In this connection are shown some vegetable waxes. These occur as exudations upon the surfaces of plants, especially those of leaves and fruits. Wax imparts a bluish-white color or "bloom" to such a surface, as upon pumpkins and grapes. Such a surface is called "glaucous" by the botanist. Another excellent illustration is the white surface upon the fruits of the bay-berry or wax-myrtle. Wax is related to fat. It is insoluble in water and is obtained by melting in hot water and skimming it from the surface. It is largely used in candle-making and also in pharmaceutical preparations.

Resins. Cases 57 and 62.—The cases devoted to resins contain on the one hand a large trunk of the long-leaf pine, in which has been cut a turpentine box, together with a series of specimens of turpentine and rosin, illustrative of the trade-classification of these products, and, on the other hand, a series of resins derived from other species of pine and related trees, and also those from trees representing the mulberry family, the mimosa family, the sumac family, and the myrrh family. An important substance derived from the turpentine of the long-leaf pine and other species of pine trees is pine tar or *pix liquida*. Pine tar may

be regarded as turpentine, modified and rendered impure by partial burning. It is obtained from the same trees that yield turpentine, but the dead wood and stumps are preferred. The wood is stacked and so enclosed by earth as to partly exclude air, and is then fired at the top. As the wood burns above, the heat drives out the liquid tar just below, which runs off into vats and is stored in barrels. The charcoal powder which enters renders it black. A more perfect method is to distil it in suitable retorts. By subsequent distillation of the tar, oil of tar is driven off, naval pitch being left behind. Oil of tar contains, or yields a large number of valuable substances, such as Guaiacol, creosol, naphthalene, toluene, and xylene. In addition to the resins obtained from living kinds of trees, there are fossil resins of different degrees of hardness and color; these enter largely into the manufacture of varnishes. Varnish is a solution of one or more resins in some volatile liquid which, on evaporating, deposits a uniform and continuous layer of the resin upon the surface to which the varnish was applied. Such a coating of varnish, if of good quality, is both hard and tough, hence not easily scratched, insoluble in water and waterproof, capable of taking a high polish, but melting and burning readily. Varnish resins differ in quality and value according to the degree in which the varnish made from them possesses the properties named above. The best is probably anime copal. Not only is it so hard and tough as to stand floor-wear, but it is soluble in so few substances that the spilling of most liquids upon it will not injure it. Some of the trees yielding varnish resins are now almost or quite extinct, and the lumps of resin have lain buried in the soil in a fossil state since the age when these trees were living.

Plant Constituents. Cases 63 to 68.—This exhibit consists of a series of alkaloids, acids, glucosides, amaroids, albuminoids, resinoids, and enzymes. These substances plants store up in their tissues, or in the tissues of one or more organs, and from them they are extracted for use in all branches of the arts, sciences, and industries.

Starches. Case 69.—Starch is largely formed by most plants, as a reserve food supply, from the water taken in through the roots and the carbonic acid gas inhaled from the atmosphere; the chemical combination is effected by the sun's energy, directed by the green coloring matter (chlorophyl). Starch is mostly found in the form of granules, sometimes in small rods, and is easily converted by the plant, or artificially, into glucose, in which form the plant consumes it. In darkness the plant consumes starch previously formed in daylight. Starch is insoluble in water and can therefore be easily washed out from ground plant tissue. The forms of the starch grains are so constant and characteristic in each plant that they afford an excellent method of identifying the latter, even in powder. Starch, as in the case of many other substances, exists in and is consequently derived from the several organs of various plants, for example, the roots of the cassava plant furnish the cassava flour and tapioca, while those of coontie yield coontie flour or Florida-arrowroot which is quite similar to sago, and those of the sweet-potato plant furnish sweet-potato flour. The rootstocks of the common potato plant abound in potato-flour, while those of the arrowroot plant yield arrowroot flour. The stems of some of the sago palms and those of some of the true palms are the sources of sago flour. The fruits, both dry and fleshy, of a great variety of plants, contain starch; for example, those of the several grains, wheat, rye, and corn; while those of the banana yield the less common banana flour. The seeds of some plants are used as a source of starch, as for instance, those of the chocolate plant.

Cork and Paper. Cases 70 and 72. Cork forms the outer portion of the bark of most woody stems. That of one species of oak, *Quercus Suber*, of the Mediterranean region, possesses peculiar properties of toughness, elasticity, and imperviousness to liquids and vapors which makes it useful for bottle stoppers. Many attempts have been made to find substitutes, but none have been found

to possess an equal value. It has many other important uses. After removal from the tree, and the shaving off of its gray outer layer, it is alternately beaten with mallets and heated to close up the natural fissures. Its removal does not injure the tree, since it will split off if not removed.

The cutting of cork requires extremely sharp instruments, operated by machinery running at a high rate of speed. The substance, as we are accustomed to see it, is prepared by means of boiling the cork bark and scraping off the rough outer portion. The crude cork and many manufactured articles are shown in case number 49, and a large jacket of crude cork is exhibited near by, just as it was stripped from the tree.

Wood fiber, especially that obtained from the trunks of the spruce and poplar, enters largely into the manufacture of paper. In cases 48 and 50, the fiber is shown in its crude condition and in the various stages of refinement, as well as the various qualities of paper into the structure of which it enters. Here also are the several stages and substances connected with the production of straw paper.

Sugars. Cases 73 and 74.—Sugars are formed by plants at a stage in the manufacture of carbohydrate foods, and again when the carbohydrate is used by the plant as food, as explained on our label, in the starch case. Although many varieties of sugar are recognized, they all fall into two great classes, cane-sugar and glucose. Cane-sugar occurs mostly in stems and roots, glucose in fruits. Glucose is cheaper than cane-sugar and if pure, is more healthful for human use, but the commercial article is very apt to be impure. Glucose is mostly manufactured from corn. Cane-sugar is mostly manufactured from sugar-cane, sugar beets and sorghum cane. Sugar is a very important plant-product and it is of vast economic value. Sugar-cane (*Saccharum*) is the basis of the world's sugar supply. The juice from the stems of the plant is boiled down and by other processes is made into the principal crude products shown in the cases and later into the commercial grades of sugar.

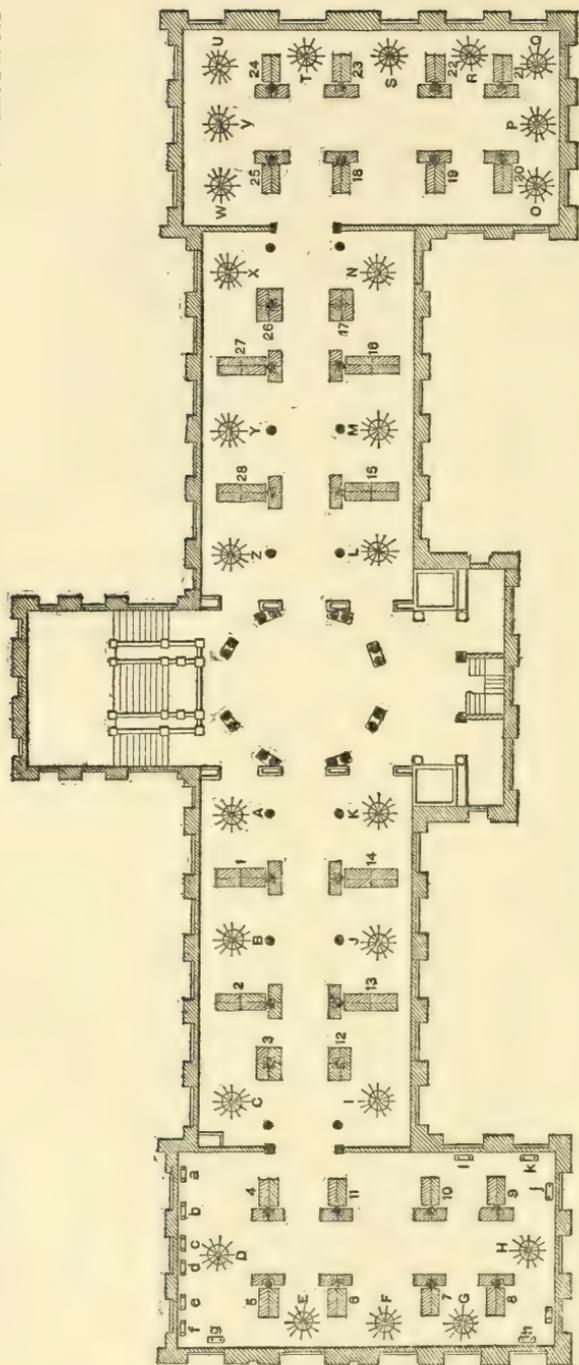
The juices of other plants are also used in making sugar, for example, in temperate regions, the sugar-beet yields an enormous amount, the sap of the maple tree is made into maple-sugar, while in tropical regions the sap of various palms, such as the coconut-palm and the sugar-palm, is made into palm-sugar.

Foods. Cases 75 to 100.—The very important section of vegetable foods occupies the cases on the north side of the west hall, opposite those containing the fibers. Here may be seen the various plants and parts of plants commonly used for food. In a few instances nearly the whole plant is available, as in the mushroom, the morel, and the truffle. Usually, however, certain parts only are nutritious or desirable; a few examples of these are as follows: sweet-potatoes, horseradish, carrots, and beets are roots; onions, potatoes, and Jerusalem-artichokes are underground stems or rootstocks; asparagus and poke-shoots are young stems; lettuce, beet-tops, spinach, and parsley are leaves; cauliflower and calamus-buds are inflorescences; corn, rice, bananas, mulberries, gooseberries, apples, tomatoes, and oranges are fruits; while peanuts, walnuts, hickorynuts, beans, almonds, and chestnuts are seeds.

Drugs. Cases 101 to 118 and 201 to 218.—The east hall is given over to drugs. This, like the department of foods, is large and important. The active principles or medicinal agents are stored up in the tissues of the plant or in the tissues of special organs. The great majority of refined drugs are derived from one or more of the parts of the plant, but in the case of the white-agaric, ergot, Irish-moss, Iceland-moss, wintergreen, sundew, bitter-sweet, penny-royal, boneset, and tansy the whole plant is used.

A few of the crude drugs arranged under the several plant-organs they represent are as follows: sarsaparilla, poke-root, rhubarb, aconite, queen's-root, senega-root, marshmallow, man-in-the-ground, and ipecac are roots; calamus, ginger, colic-root, Canadian snake-root, soapwort, mandrake, American-ipecac, buckbean, and stone-

wort are underground stems or rootstocks; sandalwood and quassia-chips are woods; sassafras-medulla is pith; birch, slippery-elm, sassafras, cinnamon, wild-cherry, horse-chestnut, cascara, linden, and cinchona are barks; laurel, hardhack, cherry-laurel, peach, senna, coca, and eucalyptus are leaves; red-clover flowers, orange-flowers, linden-flowers, heart's-ease, borage-flowers, safflower, marigold-flowers, Roman-chamomile, German-chamomile, and milfoil-flowers are flowers and flower-heads; saw-palmetto, cardamon, cubebs, hops, star-anise, poppy, rose-hips, tamarind, Tonka-bean, and colocynth are fruits; colchicum-seed, grain-of-paradise, betel-nut, mustard, delphinium-seed, almonds, calabar-bean, Barbadoes-nut, castor-oil seed, and henbane-seed are seeds. Refined drugs are well represented, among others, by gum-arabic, a gum collected from shrubs and trees of the genus *Acacia*; the most common source is *Acacia Senegal*, a large shrub or small tree growing throughout north-central and northwestern Africa. Its gum is somewhat inferior to the old-fashioned gum arabic obtained from species of northeastern Africa. The gum, which is chiefly a compound of arabic acid and calcium, exudes through orifices in the bark, resulting from the punctures of insects and in other ways. In some instances the collectors puncture the bark for the purpose of causing the exudation. When hard and dry it is collected and sent to the packing houses. Here it is assorted into grades, according to color and purity, which are sold by number. No. 1 gum arabic is nearly colorless. From gum arabic most of the better grades of mucilage are made. It is largely adulterated, especially with dextrin; such mucilage quickly turns dark. Another well-known refined drug is camphor. This important substance is collected in China and Japan, but mostly in the Island of Formosa, the Japanese government now having control of almost the entire industry. It is distilled from the chipped wood of the roots and lower part of the trunk of large trees, by natives who encamp in the forest during



FLOOR-PLAN, MUSEUM OF SYSTEMATIC BOTANY

- I-28. Synoptic Collection
 - 1-8. Case 1. Slime-moulds
 - Cases 2-16. Sea-weeds
 - Cases 17-36. Fungi
 - 9-11. Cases 37-40. Hepatics
 - Cases 41-48. Mosses
- 12 and 13. Cases 49-55. Ferns and Fern-allies
- 12-28. Cases 56-58. Cone-bearing Plants
- Cases 59-128. Fruit-bearing Plants
- A-Z. Local Flora
- a-k. Microscope Exhibit

the collecting season, protected by a specially organized police force numbering several thousand men. The collectors must sell the crude camphor to the Japanese government, which refines it for the market. The government sells the refined camphor through a single agent, who is required to regulate the price in all parts of the world, to prevent speculative enterprises in it. Crude camphor is a loose, spongy, crystalline mass, saturated with camphor oil. This oil is also an important commercial article.

Woods. Cases 119 and 200.—The east wing is occupied by woods. The exhibits fall under two main divisions, the one consisting of a series of wood-specimens from all parts of the world, and crude wood-products such as pipes, canes, shoes, sandals, utensils, and carbons or charcoals; the other being a synoptic collection illustrating North American dendrology. The wood specimens consist either of blocks of wood, or of sections of trunks with the upper part cut so as to show the long grain of the wood and also the cross grain. In the case of wood-products the crude material and the finished product is shown when possible. The collection of North American dendrology is based on specimens of the wood of all North American trees. To these wood-specimens are added specimens of the twigs, of flowers, of fruits, and of other objects of interest from the various trees.

2. THE MUSEUM OF SYSTEMATIC BOTANY

This occupies the entire second floor of the building and is designed to illustrate by specimens, drawings, and photographs, types of all the natural families of plants, beginning with those of the simplest structure and ending with the most complex. It consists of four series of objects:

- (a) The general synoptic collection.
- (b) A series of microscopes showing selected specimens.
- (c) Illustrations of the local flora.
- (d) Plant photograph exhibit.

(a) *Synoptic Collection.* This is designed to illustrate the plant world. A series of characteristic objects is installed as a basis for illustrating each plant-family. These specimens are accompanied as far as possible by plates, drawings or photographs, while on the shelves are arranged additional objects, such as flowers, fruits, woods, specimens of fossil plants, and models of various organs of plants, all intended further to illustrate the structural characteristics of the different groups. This collection is arranged according to the most natural and thus far most generally satisfactory interpretation of the interrelation of the plant-families; it may be considered as falling into two main series, namely, the flowerless or spore-bearing plants and the flowering or seed-bearing plants.

The flowerless plants fall into three phyla or subkingdoms: (1) the Thallophyta, in which the plant-body is not differentiated into stems and leaves, as represented by the slime-moulds, the bacteria and other micro-organisms, the seaweeds, the fungi, and the lichens (2) the Bryophyta, represented by the mosses and their immediate relatives; and (3) the Pteridophyta, including the ferns and the fern-allies.

The Thallophyta (cases 1 to 36), may be defined as plants without true roots, stems, or leaves; but notwithstanding their simple structure they exhibit an infinite variety of form and color.

The Myxomycetes or slime-moulds (case 1), standing at the bottom of the plant-scale, occupy the first exhibition case placed at the right hand side of the stairway from the main floor. They are thallophytes, having neither chlorophyl nor (in their vegetative condition) a cell-wall. These very simply constituted plants usually grow upon and derive their nourishment from decaying organic substances. They vary greatly in size, some being exceedingly minute, others assuming the form of relatively large irregularly shaped masses spreading in all directions as they grow. Most of the plants are small, and the structure is

very delicate, in fact some are so fragile that a mere breath of air will ruin them.

Following the slime-moulds stand the cases devoted to the algae or seaweeds (cases 2 to 16), which may be briefly defined as thallophytes with chlorophyl, the green coloring matter of plants. The plants of this series are much more variable in form than those of the preceding, and are also much more numerous. Some forms are microscopic, others attain considerable size. The first case of the series is occupied by representatives of the blue-green algae (case 2) and the diatoms. The plants of these two groups are minute, so much so that in most cases the individuals can be well seen only with the aid of a microscope. As one finds them in nature they commonly form slimy or oozy masses which are not particularly attractive to the naked eye, but under a compound microscope they are of very great interest. Following the series just mentioned are the green seaweeds (case 3), the group which includes the plants that are sometimes called the pond-scums, green slimes, green felts, and stoneworts. Some of these are microscopic; however, some of the green seaweeds attain a considerable size and begin to look a little more like what are popularly termed "plants." After the green seaweeds come the brown ones (cases 4 to 8), and here the largest kinds are included. In their tissues is found a brownish pigment which obscures their green coloring matter. To this group belong the widely distributed "gulf-weed" or "sargasso-weed" (*Sargassum*) and the gigantic "great kelp" of the Pacific Ocean, which sometimes attain a length of more than a hundred feet. The seaweeds culminate in the red algae, a group in which the plants show some shade of red, pink, or purple; these (cases 9 to 16) exhibit a marvelous range of form and color. The last group of cases containing this series is given to the group of red algae which are known as the corallines, on account of their outward resemblance to the corals. These plants are thoroughly permeated with lime and are often as hard

and stone-like as any coral, and build up reefs in the tropical oceans much as the corals do.

The next great type of plant life is the fungi (cases 17 to 36). These, like the plants of the preceding group, vary greatly in size and complexity of structure; but, unlike them, they are devoid of chlorophyl, the characteristic green matter which enables other plants to build up complex food for their nourishment, and consequently they are wholly different in their mode of life. Some are parasitic, deriving their nourishment from living plants and causing enormous damage to crops; others are saprophytic, deriving it from the remains of dead organisms; while others are symbiotic, living in such relationship with chlorophyl-bearing (green) plants that they mutually nourish one another, as in the case of mycorhizas. There are five generally recognized series here: First we have the stalked-spored fungi (cases 17 to 28). This series falls into two groups, the one typified by the "rusts" and "smuts" which are commonly parasitic on the leaves and fruits of other plants; the other the great saprophytic group, well known through the mushrooms, bracket-fungi, stink-horns, and puff-balls. Second in the series is the group known as the imperfect fungi (case 29). In this group the spores are borne directly on the threads or "hyphae" which constitute the vegetative portion of the organism. They are often parasitic on the leaves and on the bark of both wild and cultivated plants. Third in this series are the spore-sac fungi (cases 30 and 31). In these plants the spores are borne in delicate membranous sacs, called asci, which in the more complex forms are collected into bodies of various shapes. The plants vary greatly in size and structure and may be either parasitic or saprophytic. To this group belong the yeasts and mildews. To this group also belongs the chestnut-blight fungus. This fungus disease which has been imported into this country has caused the death of all of the American chestnut trees in the immediate vicinity of New York

City and threatens the entire destruction of this valuable tree. Some plants grow above the surface of the ground, as in the case of the morel; while others are subterranean, as in the case of truffles. In case 32 has been installed specimens and illustrations of crown-gall, an abnormal growth which is caused by minute plants known as bacteria. This peculiar growth is commonly known as vegetable cancer on account of its close resemblance to the cancer of the human body. The disease is very destructive to trees and shrubs of various kinds. Next in order are the alga-like fungi; these vary in form from simple masses of protoplasm to simple or branching threads. Here belong many of the moulds and similar forms which grow both on other plants and on animals. The fifth and in many respects the most interesting of all the groups is that consisting of the lichens (cases 33 to 36). The lichens have commonly been considered to form an independent symbiotic group, each lichen being supposed to consist of a fungus and an alga living together, the one nourishing the other, but, according to some of the more recent students of the group, the lichens are simply fungi that live parasitically upon algae. The lichens are quite familiar to most people as plants of more or less leathery texture growing on rocks, on poor soil or on the trunks of trees.

A step forward brings us to the Bryophyta. These are seedless green plants, most of which possess roots, stems, and leaves, but have no vascular tissue (cases 37 to 48). This group is best known through the mosses, which form its largest division. Of somewhat simpler structure are the hepatics or scale-mosses (cases 37 to 40). The stems and leaves of the hepatic plant are sometimes combined into a flat thallus-like body which creeps closely on the ground or other objects and resembles in aspect some of the lichens. The leaves, when present, are usually more delicate in texture than in the true mosses and they do not have a midvein. These differences alone enable one to distinguish a hepatic from its relatives by the unaided eye or at

most by the use of a lens. In addition to these characters, the capsule or the receptacle which bears the spores, or reproductive bodies, usually splits into four valves when full-grown and the spores themselves are accompanied by spiral threads called elaters. The favorite habitat of hepatics is wet places, and mountains continually steeped in clouds yield a surprising variety of forms. Closely related to the hepatics, and commonly included with them, is the group Anthocerototes; these plants may, however, be distinguished by the presence of a central axis or column (columella) in the capsule, and there are several other important structural differences in their tissues.

The mosses (cases 41 to 48) follow the hepatics in order of development and complexity; they differ from them, however, in many respects. The stem and leaves have more differentiated tissues, and the leaves usually have a midvein. The moss capsule generally opens by a lid under which there are commonly appendages to aid in scattering the spores, which in this case are not accompanied by spiral threads as they are in the hepatics. The mosses fall into three primary groups: First the "peat-mosses" (*Sphagnum*), which differ from the rest of the mosses in the development of the tissue-structure of the capsule and in the spores; they grow in swamps and other wet places, and their accumulation forms peat. The "black mosses" (*Andreaea*) differ from both of the other groups in the valvular capsule; they grow on dry rocks. The true mosses vary exceedingly in size and aspect. An examination of the specimens in the exhibition cases will convey to the mind a better idea of this group than may be gained from a description. They grow under all kinds of conditions from dry rocks to deep water. Many of the kinds grow on almost any kind of rock, earth, or bark of trees, while certain ones are more particular as to their habitat. Some will thrive only on limestone, which they often gradually disintegrate and partially preserve in the masses of closely set plants as a calcareous tufa; other species prefer ground

that has recently been burnt over, as species of *Funaria* and *Leptobryum*, while others grow only on the bones of dead animals or in places where animal refuse has accumulated.

Next higher in the plant kingdom is the subkingdom Pteridophyta, or ferns and fern-allies, the seedless plants with roots, stems, leaves, and woody tissue (cases 49 to 55). The ferns as a group perhaps attract the attention of a greater number of people than any other series of plants. Associated with what are usually known as ferns are the fern-allies, for example the "horse-tails" (*Equisetum*), "lycopods" (*Lycopodium*), and "quillworts" (*Isoetes*), but these are usually less conspicuous than the "ferns." Fern-plants differ from all the plants of simpler organization in having vascular (woody) tissue, that is, a system of vessels for conducting sap through the different parts of the plant-body. They exhibit an almost infinite variety of form; their stems may be underground, horizontal on the ground, or erect; the leaves are either simple or compound, and sometimes perform both the work of foliage leaves and that of bearing the spore-cases (ferns), while in other cases some of the leaves have become changed into mere spore-bearing organs (cinnamon-fern).

The "flowering" plants (cases 56 to 128) comprise a single subkingdom, the Spermatophyta, or seed-bearing plants. This extensive group seems to have followed two independent lines of development and consequently the plants fall into two well marked groups, the first being the gymnosperms, cone-bearing plants, or plants in which the seeds are borne exposed in variously shaped cones (cases 56 to 58). This is a comparatively small group, but exhibits great diversity, including plants ranging from straggling shrubs or vines to the largest trees. The leaves, too, vary from structures resembling needles or scales to expanded fern-like structures of considerable variety. In a former geological age these plants were the dominant seed-bearing plants, but now the second group of the sper-

matophytes largely predominates; namely, the angiosperms, covered-seeded plants in which the seed is borne in a seed-case. These plants also existed in the later geological ages, and now form the most important and conspicuous part of the vegetation of the earth. The covered-seeded plants (cases 59 to 128) fall into two divisions, the one in which the embryo has a single leaf, the monocotyledons (cases 59 to 71); the other in which the embryo has two leaves, the dicotyledons (cases 72 to 128).

(b) *Microscope Exhibit.* The exhibition microscopes occupy small stands in the west wing of the second floor. In front of the windows on the right as one enters the wing are shown a few of the simplest and smallest forms of plant life. Under the lenses of the first microscope are representatives of the diatoms—one-celled organisms, some of which have the power of animal-like locomotion; the living substance of each cell is enclosed and protected by a hard transparent glassy wall consisting of two halves, one of which fits into the other like a band-box into its cover. The second microscope shows attractive and varied forms of fossil diatoms from California. Following this are shown "sea mosses," or "seaweeds," as they are commonly known, and closely related minute plants which inhabit fresh water and belong to groups often referred to in popular speech as "pond-scums" or ooze." In the natural unmagnified condition, many plants of this sort seem quite the reverse of attractive, but when placed under a sufficiently powerful microscope many of them reveal a rare beauty. The "sea mosses," or "seaweeds," gradually lose much of their natural beauty of coloration on prolonged exposure to the light, but the prevailing elegance and symmetry of form and structure persist.

Following the plants of the seaweed type are several representatives of the smaller fungi. The first of these specimens illustrates the resting spores of the parasitic fungus that causes the well-known rust of rose leaves. The second shows a vertical section through the cluster-cup

stage of a fungus that draws its nourishment from the living tissues of the leaves of violets. Of the fungi which live upon decaying refuse matter, *Ascobolus* is one of the more interesting among those selected for exhibition. In this, the spores, or propagating cells, are borne in groups of eight within transparent ellipsoidal sacs, and at maturity these sacs, each enclosing eight spores, are ejected with considerable force. Under the next microscope are shown sections through the gills of a common mushroom, illustrating the manner in which its very minute and numerous spores are borne.

Then follow specimens of the liverworts or scale-mosses, plants in which the differentiation of the vegetative body into stem and leaves becomes first clearly evident. One of these, a *Frullania*, has a part of each leaf peculiarly modified so as to form a reservoir for water. By aid of this device, the frullanias and their allies are able to thrive in drier situations than are in favor with most of the order to which they belong. Preparations are exhibited showing also the vegetative structure and methods of reproduction of the true mosses. Especially interesting is the "peristome" of one of the mosses, which is a fringe of peculiar appendages surrounding the mouth of the little urn in which the minute dust-like spores are borne. These appendages move about as a result of changing conditions of moisture and these mechanical movements assist in scattering the spores. A somewhat analogous device is found in connection with the spores of the equisetums or horse-tails, though the appendages in this case are attached to the spores. Near the slide illustrating this feature of the horse-tails is one showing the spores and spore-cases of the common polypody; the spore-case here is provided with a sort of spring, by the action of which the spores are violently ejected, catapult-fashion. Another preparation shows the structure of the stem of the moonwort (*Botrychium*) as it appears in a cross section. Another illustrates the structure of the wood of a young pine stem in cross

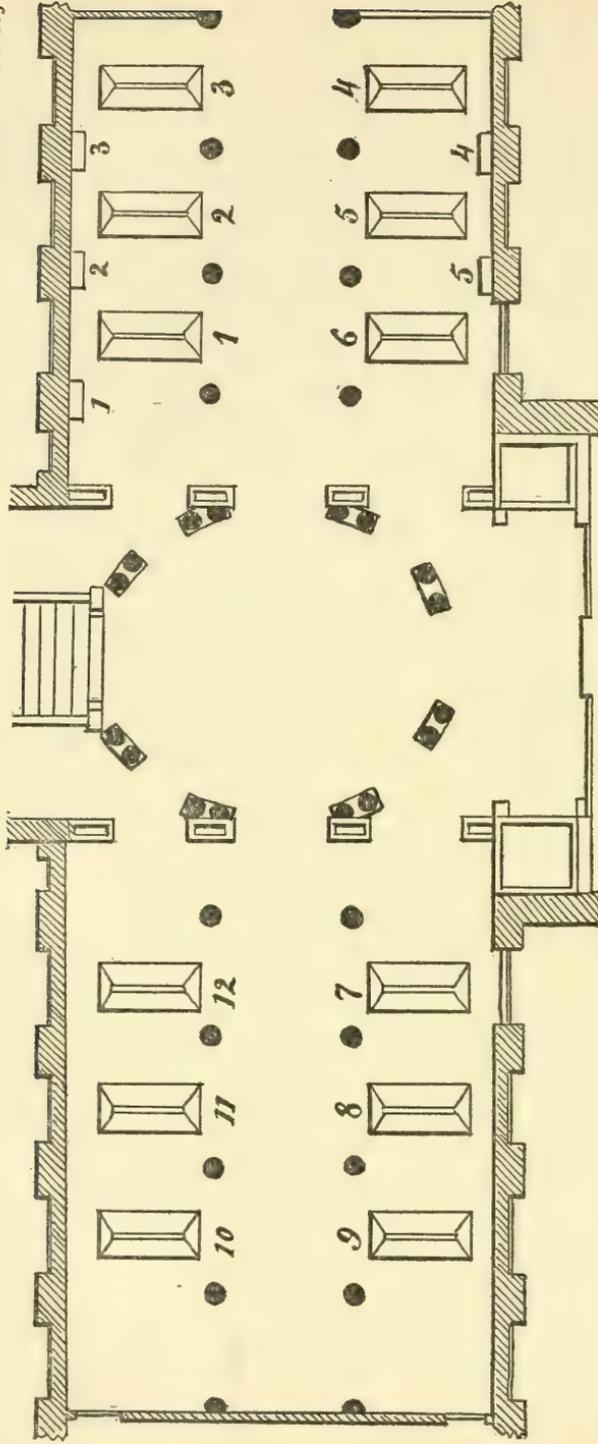
section and brings out clearly the anatomical basis of the annual growth rings. And yet another shows a cross section of the submerged stem of an aquatic plant with its large air spaces and poorly developed strengthening tissues.

(c) *Local Flora*. In this collection it is designed to illustrate every plant-species growing naturally or without cultivation within one hundred miles of New York City. For the most part specimens of the plants themselves are used, but in cases where the structure of the plants renders this method undesirable, or impossible, a photograph or a drawing is substituted for the plant-specimen. This collection is displayed in swinging frames which are placed so as to correspond in a general way to the sequence of the cases of the synoptic collection already described; thus, the first stand is near the first museum case as one enters the west hall from the top of the staircase. All of the plant groups are here represented by those members that occur locally, and the characteristics of the several groups as mentioned under the Synoptic Collection also apply here.

(d) *The Plant Photograph Exhibit*. A series of over 200 enlarged photographs, illustrating plant societies, habit-characters, flower-characters, and fruit-characters of the higher plants, as well as habit and structural characters of some of the larger algae and fungi, are displayed in frames fastened to the walls of the systematic museum. As far as practicable, they have been placed near the cases containing representatives of the species illustrated. The photographs are 11 x 14 inches in size and are mounted in glazed frames, some frames containing 4 and others 6 photographs.

3. THE MUSEUM OF FOSSIL BOTANY

This collection, installed in the basement, is designed to show the successive stages of evolution through which the ancestors of our living flora have passed since the time of



FLOOR PLAN, MUSEUM OF FOSSIL BOTANY

- Floor and wall cases 1. Plants of Eozoic Time, Laurentian Period, and Paleozoic Time, Cambrian, Silurian, Devonian and Carboniferous Periods
- Floor and wall cases 2-4. Plants of Paleozoic Time, Carboniferous Period
- Floor case 5. Plants of Mesozoic Time, Triassic and Jurassic Periods
- Wall case 5. Specimens showing methods of fossilization
- Floor case 6. Plants of Mesozoic Time, Cretaceous Period (Raritan)

- Floor case 7. Plants of Mesozoic Time, Cretaceous Period (Raritan and Cliffwood)
- Floor case 8. Plants of Mesozoic Time, Cretaceous Period (Dakota)
- Floor case 9. Plants of Mesozoic Time, Cretaceous Period (Laramie)
- Floor case 10. Plants of Neozoic Time, Tertiary Period (Eocene)
- Floor case 11. Plants of Neozoic Time, Tertiary Period (Miocene)
- Floor case 12. Plants of Neozoic Time, Tertiary (Miocene and Pliocene) and Quaternary Periods

the first appearance of plant life on the earth, as far as the remains of extinct plants have been preserved. The general arrangement adopted is therefore based upon the sequence of the geological time divisions: Eozoic, Paleozoic, Mesozoic and Neozoic, and their subdivisions into periods; Laurentian, Cambrian, Lower Silurian, Upper Silurian, Devonian, Carboniferous, Triassic, Jurassic, Cretaceous, Tertiary, Quaternary and Modern. This arrangement is therefore geological, but incidentally it is also biological, and follows the same system as that on which the synoptic collection of the museum of systematic botany is arranged, inasmuch as the plants of the earlier periods are low in the scale of life, consisting of thallophytes and pteridophytes and plants of uncertain botanical determination, while those which appear in the successively later periods are of successively higher and more complex types, represented by cycads, conifers and both monocotyledonous and dicotyledonous plants closely related to our living flora.

Each specimen on display, with the exception of the very large ones, is placed upon a separate wooden block, and each one is labeled, giving the generic and specific name; the family, order or class of plants to which it is referred; the geologic period and subdivision in which it belongs, and the locality or region where it was collected. All essential information of a botanical and geological nature in relation to each specimen is, therefore, included in the label. Whenever a figure of any specimen can be obtained this is placed on the same block with the specimen, and pictures of ideal landscapes, showing the extinct vegetation of certain geologic periods, as well as restoration of certain extinct plants, are displayed in their proper cases. The series of exhibits begins in the first cases to the left as one enters the east hall of the basement. The sequence of the specimens in the wall cases corresponds to that of the floor cases.

In floor- and wall-cases Nos. 1 to 4 may be seen representatives of Eozoic and Paleozoic Time: Laurentian,

Cambrian, Lower Silurian, Upper Silurian, Devonian and Carboniferous Periods. In floor- and wall-case No. 1 are specimens of graphite of eozoic age and of anthracite and bituminous coal of carboniferous age, showing the transformation of vegetable matter into the ultimate condition of pure carbon in the form of graphite or "black lead" in the oldest rocks. Other specimens in this case, classed as algae, are of uncertain botanical relationship, as the structure of the primitive plants was not well adapted for preservation as fossils. For example, some organisms appear as mere filamentous strips of graphite in white limestone, without any trace of the original structure remaining, while others may be seen as casts and impressions which closely simulate in general appearance different parts of the seaweeds now existing. In this series of problematic fossils are also included a number of forms at one time definitely classed as plants but now by some assumed to be of animal or inorganic origin; namely, *Scolithus*, which may be caused by worm burrows; *Phytopsis*, which may be a coral; *Plumalina*, which may be a hydroid; *Dendrophycus*, which may be current-markings; and Dictyolites, which are most likely sun-cracks. All of these, however, have at one time or another been definitely regarded as the remains of marine plants and were originally so described and classified.

In these cases and in wall-case No. 2 are also the remains of the earliest fern-plants and their allies (Pteridophyta) of Devonian and Carboniferous age, represented by *Lepidodendron*, *Sigillaria* and *Calamites*, and the early seed-bearing plants, the cone-bearers (Gymnosperms), represented by *Cordaites*, with the fossils under *Trigonocarpon*, *Rhabdocarpon* and other genera.

Floor-cases Nos. 2 and 3 and wall-case No. 3 contain specimens of Carboniferous age, for the most part ferns or fern-like plants, which were originally described as ferns, but which are now placed in a different group, the Cycadofilicales, that is, plants that had characteristics of both

the ferns and the sago-palms, but more closely related to the latter than to the ferns.

Floor- and wall-cases No. 4 are devoted to specimens of Carboniferous plants in the genera *Lepidodendron*, *Sigillaria* and *Stigmaria*, in order to show the variation in the arrangement and shape of the leaf scars and the difference between specimens with the bark preserved and those which have been decorticated.

Floor-case No. 5 contains types of early Mesozoic time: Triassic and Jurassic Periods. The plant remains in this case are mostly sago-palms or cycads, with a few cone-bearers and fern-plants, besides specimens of the so-called "*Glossopteris* flora," a flora of uncertain botanical relationship, which flourished in the transition period between Paleozoic and Mesozoic time, particularly in the southern hemisphere, and may yet be represented by the living South African genus *Stangeria*, a cycad having leaves with pinnately arranged forking veins, similar to ferns.

Floor-case No. 6 encloses plant remains from the rocks of later Mesozoic time: Lower and Middle Cretaceous Period. These specimens represent the first appearance of the higher-seed-bearing plants (Angiosperms), the type which is dominant in the existing flora. The genera are in most instances apparently identical with those now in existence, but the species are extinct. The plants of the Lower Cretaceous consist largely of ferns and cone-bearers, while those of the middle Cretaceous show a preponderance of angiosperms.

Floor-case No. 7 is arranged to show specimens of the Middle Cretaceous flora found within the limits of the City of New York, on Staten Island, or in the immediate vicinity in New Jersey and on Long Island.

Floor-case No. 8 contains specimens from the Middle Cretaceous of the western States. Those from the Dakota Group are exceptionally fine, many of them being perfectly preserved and showing both case and impression of the same leaf as counterparts.

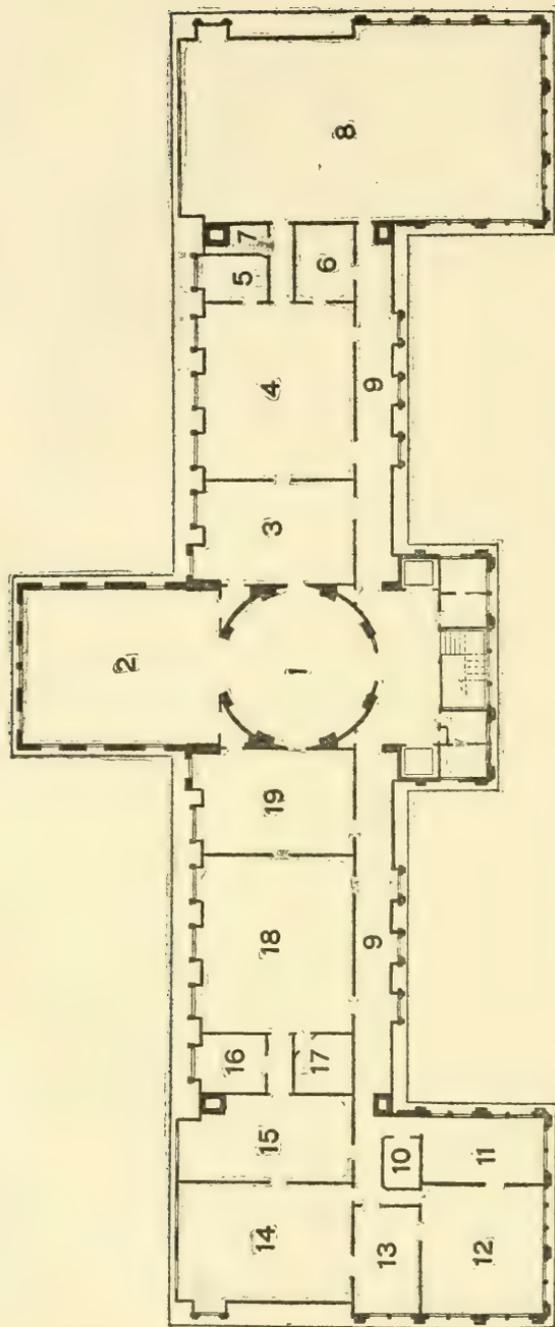
Floor-case No. 9 is devoted to plants of the Upper Cretaceous (Laramie Group), and completes the vegetation of Mesozoic time.

Floor-cases Nos. 10 to 12 and wall-case No. 5 contain plant remains of Neozoic time. Those of the early Tertiary Period (Eocene) are displayed in floor-case No. 10. Those of the later Tertiary (Miocene) and Quaternary Periods in floor-cases Nos. 11 and 12. The specimens in the latter case complete the sequence of plant life on the earth and bring it up to modern times. A number of specimens at one end of the case show the methods of preservation by petrification, incrustation and carbonization, and on the upper shelf is a series of specimens from Quaternary and more recent swamp deposits which show how the conversion of living plants into fossils, a process now going on, has its beginning.

The specimens in wall-case No. 5 further illustrate the characteristics of the plants of the late geological periods and the methods by which the various plant structures have been preserved. A number of specimens of silicified woods show the method of preservation by what is known as petrification, or conversion into stone, in which the woody structure is replaced by mineral matter. Other specimens show preservation by incrustation, in which mosses and the stems of reeds are coated or incrustated by mineral matter deposited from springs; while on the upper shelf on the top of the case are logs and stumps from old swamps and interglacial deposits, in which the wood has been partially carbonized, or converted into lignite, by the slow process of natural distillation. This process represents the beginning of the conversion of vegetable tissue into coal.

LECTURES

Other features of the museum building include the large public lecture hall, with a seating capacity of over seven hundred, which occupies the western end of the basement. It is equipped with an electric projection-lantern, and free



PLAN OF UPPER FLOOR OF MUSEUM BUILDING

- | | | |
|-----------------------------------|----------------------------|-----------------------------|
| 1. Library Reading Room | 7. Storeroom | 14. Herbarium of Fungi |
| 2. Library Stack Room | 8. Main Herbarium | 15. Study |
| 3. Herbarium of Algae | 9. Hall | 16. Study |
| 4. Herbarium of Ferns and Lichens | 10. Photographic Dark Room | 17. Physiological Dark Room |
| 5. Curator's Room | 11. Work Room | 18. Botanical Laboratory |
| 6. Moss Herbarium | 12. Chemical Laboratory | 19. Library Extension |
| | 13. Study | |

public popular lectures covering a wide field of botanical and horticultural subjects are delivered here on Saturday afternoons from spring to autumn; these are fully illustrated by means of a very extensive collection of lantern slides owned by the Garden which is constantly being increased. A noteworthy part of this collection is the series of delicately and accurately colored slides of flowers, fruits, trees and shrubs, by Mrs. Adelaide S. Van Brunt, from photographs made during many years by her late husband, Cornelius Van Brunt.

The Horticultural Society of New York holds several of its monthly meetings at the Garden, using the large lecture hall, and also uses the basement museum hall adjacent for the purpose of exhibitions.

The Torrey Botanical Club holds monthly meetings from October to May, on the afternoon of the last Wednesday of each month, in the museum building, and many of its field meetings on Saturday afternoons throughout the season are held at the Garden.

THE LIBRARY

The library of the Garden is located in the center of the upper floor of the museum building, and is available for consultation, by permission. It has been formed by the Board of Managers in order to provide for the use of students, all the literature of botany, horticulture and related sciences, and is rapidly becoming one of the most complete collections of books and pamphlets in the world dealing with these subjects. It consists of a reading room, circular in shape, and two stack rooms opening off from it. The collection contains over 28,000 bound volumes.

In addition to its own books, the library has on deposit many of the botanical works belonging to Columbia University and the New York Academy of Sciences.

The Cox collection of Darwiniana, named in honor of the late Charles Finney Cox, by whom the collection was made, consists of a complete set of the works of Darwin.

These books occupy a specially constructed cabinet which stands near the center of the reading room.

Manuscript letters of botanists, as well as many portraits of botanists, are also on file.

THE HERBARIUM

The herbarium consists of dried specimens of plants systematically arranged in cases; it occupies the greater portion of several rooms on the upper floor of the museum building, and is available for consultation by permission. It contains prepared specimens of all kinds of plants from all quarters of the globe, and is the most extensive and complete collection of its kind in America. It comprises the Garden herbarium and the Columbia University herbarium. The latter is one of the oldest collections of its kind in the United States, having been begun by Dr. John Torrey soon after the commencement of the last century. After half a century of natural growth several large herbaria were incorporated in it and large sets of special collections were added to it. The Garden herbarium was begun with the inception of the Garden. It has grown rapidly and now far excels the Columbia herbarium in the number of specimens. The rapid growth of the Garden herbarium and its importance is due to the fact that it is built up of approximately thirty different herbaria which represent plants of all groups from all parts of the globe. To this as a basis have been added miscellaneous collections and the first sets of the plants secured by members of the Garden staff while exploring in different parts of the New World and the Old.

The great majority of specimens are mounted on herbarium sheets, but many thousand specimens, such as bulky fungi, fruits, seeds, and other parts of plants not suitable for placing flat on herbarium sheets are contained in cardboard boxes of multiple sizes.

The herbarium now comprises approximately one and one-half million specimens. All groups of the flowerless plants and flowering plants are copiously represented.

THE LABORATORIES

Laboratories and working rooms for research are provided on the upper floor of the museum building, and properly qualified students of botany are permitted to make use of this equipment, under the direction of some member of the staff of the Garden. The equipment is designed to meet the needs of a very broad field of investigation including plant chemistry, pathology, physiology and morphology. An experimental garden and greenhouse at the nurseries are used in connection with the laboratories. A valuable series of old microscopes, illustrating the history and development of that instrument, was presented by the late Mr. Charles F. Cox.

3. The Pinetum

[COLLECTION OF CONE-BEARING TREES]

The collection of cone-bearing trees, technically known as the Pinetum, because the pines are the most abundant of these trees, is planted over a space of about 30 acres in the southwestern part of the grounds, extending from the approach to the elevated railway station southeast to the herbaceous garden, and northeast to the museum building and the borders of the hemlock forest. The species of trees are grouped in genera, which are mostly separated by paths. The planting out of these trees was commenced in 1901; the collection will continually become more complete year by year as additional species are secured; many of these have to be raised from seed, and the process of establishing a collection of conifers thus requires much time.

Commencing at the approach to the elevated railway station we find the Douglas spruce (*Pseudotsuga mucronata*) planted in the space between the traffic road and the park driveway to the left of the path leading to the conservatories; this tree is a native of western North America from the Rocky Mountains to the Pacific Coast and is sometimes known as red fir; in the far northwest it sometimes becomes 180 to 210 feet high, its trunk occasionally as much

as $3\frac{1}{2}$ feet in diameter, but in the Rocky Mountains it is seldom one-half this size, and trees taken from the far northwest do not thrive well on the Atlantic coast, owing to the much greater rainfall which they naturally receive there; the cones of the Douglas spruce are from 2 to 4 inches long, pendant on the branches, their scales rounded and shorter than the bracts which project beyond them.

The hemlock spruces (*Tsuga*) are planted between the approach to the elevated railway station and the power house, and are represented by the Canadian hemlock spruce (*Tsuga canadensis*), the same species which forms the interesting forest on the hills bordering the Bronx River, and indicated on the general plan of the Garden as the hemlock grove. This tree occasionally becomes about 90 feet high, with a trunk up to 12 feet in diameter, and is distributed throughout northeastern North America, extending southward along the mountains to Alabama, northward to Nova Scotia and westward to Minnesota. Its bark is the most important tanning substance in the United States and a great many trees are annually felled to obtain it; its wood furnishes a cheap lumber of little strength and durability. The weeping hemlock (*Tsuga canadensis pendula*) is one of the most beautiful dwarf evergreens. The Carolina hemlock (*Tsuga caroliniana*), from the mountains of southern Virginia to Georgia, may also be seen here, as well as the Japanese hemlock spruce (*Tsuga Tsuga*), to which the name *Tsuga* was first applied. The hairy-twigged Japanese hemlock, *Tsuga diversifolia*, is also here.

In the area to the westward of the conservatories, extending to the west border, and bounded by paths on the north and south, are the firs (*Abies*). These can at once be distinguished from the spruces (*Picea*) by the erect, instead of pendulous, cones, and by the smooth branchlets. The wood of the firs is usually soft and not durable, so it makes poor lumber. Specimens of the balsam fir will be found here; this is widely distributed over northern North America, and from it is obtained Canada balsam or balm of

fir, used in the arts and in medicine. The Japanese silver fir is an attractive plant, with its dark green stiff foliage. Veitch's silver fir, from Japan, and said also to occur on the neighboring coast of Manchuria, is one of the best for ornamental purposes. It was discovered in 1860 on the famous Japanese mountain, Fuji-yama, by Mr. Veitch, for whom it is named. The red fir, from Washington and Oregon, with its blue leaves, borne almost erect and apparently on but one side of the branchlets, makes a conspicuous object. In its native country it sometimes attains a height of 250 feet. Its wood is sometimes used in the interior finishing of buildings. Among other firs here are: the white fir, from western North America, sometimes growing to a height of 200 to 250 feet; the Siberian fir, from northern Europe and Asia, yielding a soft lumber in general use and a bark used in tanning leather; the common silver fir, from Europe; Nordmann's silver fir, from the Caucasus; the Sicilian silver fir, from Asia Minor; and the Nikko silver fir, from Japan.

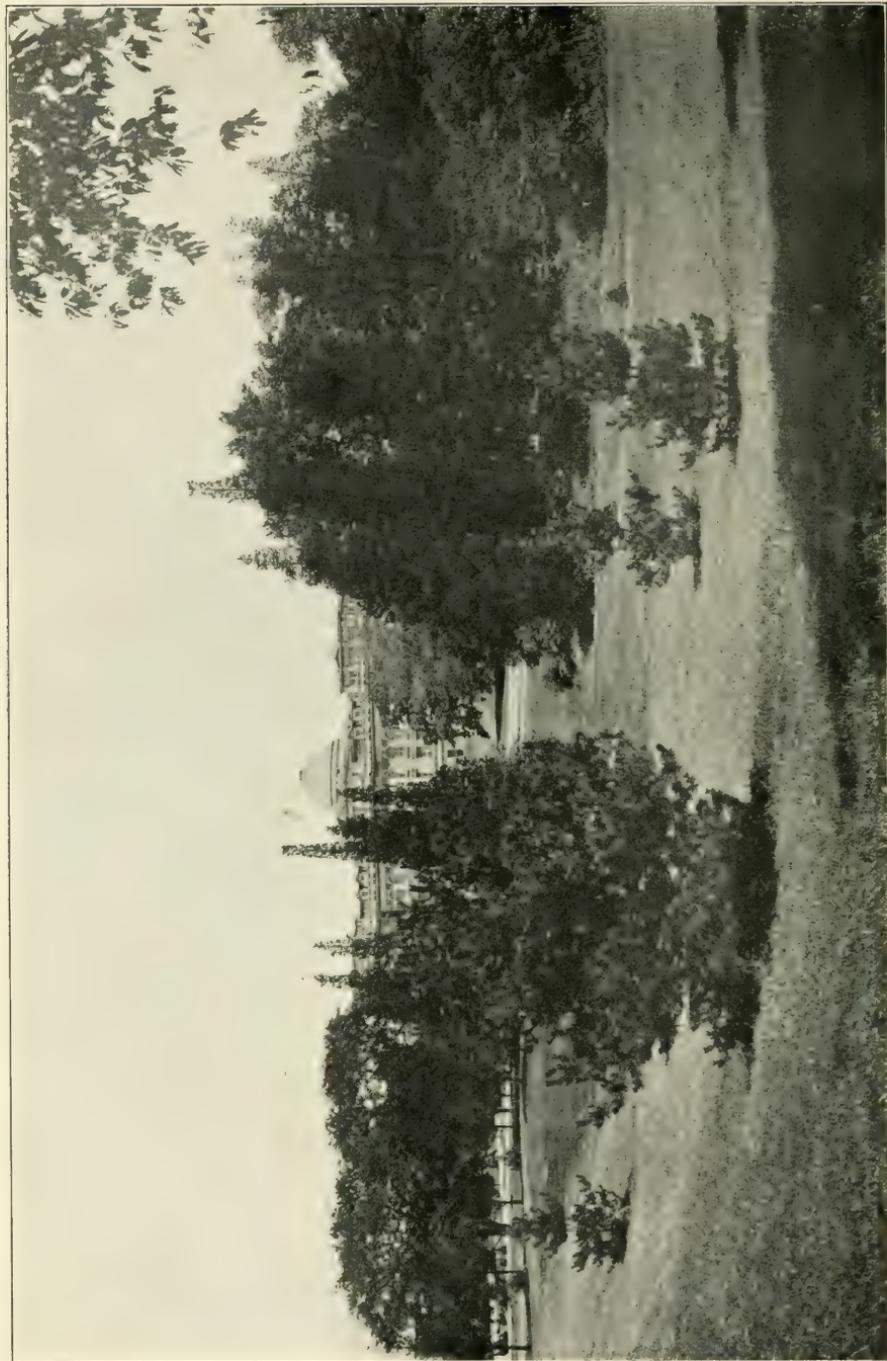
The spruces (*Picea*) are located in the area to the north-east of the firs. Some of the spruces are most valuable timber trees. The oriental spruce, from Asia Minor, is present in several specimens. One of the hardiest spruces for our climate, and a general favorite, is the Colorado spruce. This will be found here in the green form; also variety *glauca*, variety *Kosteri*, the blue color of the young leaves more marked than in *glauca*, and a pendulous form of variety *Kosteri*. It usually grows about 100 feet tall in its native country. The Norway spruce, with a number of horticultural forms, are brought together to the west of the group of golden bells or Forsythia near the Garden station plaza. It is a commonly cultivated tree and furnishes a useful timber, which is known as "white deal" in England, and is largely used in the manufacture of musical instruments. The resinous exudation of this tree is known as Burgundy pitch, which, in combination with other ingredients, is used in Europe to line beer casks.

Other spruces of interest here are the Yesso spruce, the wood of which is much used in Japan; the white, or Engelmann's, spruce, from western North America, the wood of which is largely manufactured into lumber and the bark sometimes used in tanning; the Servian spruce, one of the largest and most valuable timber trees of Europe; and the tiger's-tail spruce, from Japan, introduced about forty years ago, and one of the hardiest Asiatic species in cultivation.

The space allotted to the pines (*Pinus*) embraces the region to the eastward of the spruces and public conservatories, range 1, extending across the road to the herbaceous grounds. Most of the pines are of great economic importance, furnishing large quantities of lumber, turpentine and resin. Most of the white pines will be found on the westerly ridge of the herbaceous grounds and across the road from this to the eastward of the conservatories. Among these is our common white pine, which is perhaps the most valuable of the timber trees of northeastern North America, large quantities of lumber being derived from it. Near this is the Himalayan pine, resembling it, but with longer drooping leaves and the cones borne on long stalks; this sometimes attains a height of 150 feet in its native country, where its lumber is much used for building and other purposes. In this region will also be found the Cembra or Swiss stone pine, of southern Europe and northern Asia; and the Macedonian pine, of southeastern Europe.

In the area to the eastward of the conservatories will be found, among others, the Corsican pine, with a hard, strong wood which is much used; the variegated Scotch pine, with the young leaves variegated; and a number of plants of both the white pine, Himalayan pine and Corsican pine.

In the region to the north of the white pine tract, and on the westerly side of the herbaceous grounds ridge, will be found the Tyrclese mountain pine, from the Tyrolese and Venetian Alps, forming a group of some dozen plants; near



VIEW IN THE PINETUM, THE MUSEUM BUILDING IN THE DISTANCE

this is the Japanese red pine, and several horticultural forms of it, from Japan. Following these to the north are a number of plants of the Jack pine, or Banks' pine, native of northern North America. Its wood is sometimes used for fuel, and was valued by the Indians for the frames of canoes.

In the area to the eastward of the spruces are a number of other pines. The Corean pine, one of the white pines and a native of eastern Asia, is located next to the spruces. Near this is the Table-mountain pine. On the high ground to the eastward of the above is the Scotch pine, the principal timber pine of Europe and Asiatic Russia. On the easterly slope of this higher land and on the lower ground nearby may be found, among others, the red or Canadian pine, from northeastern North America, the wood of which is largely used for building purposes and for masts, piles and spars; the small-flowered pine, another of the white pines and from Japan, where it is frequently used by the Japanese in producing their miniature trees; the Japanese black pine, also from Japan and useful for its wood; the Austrian pine, found native in Austria, Servia and Roumania, and the yellow, or bull, pine, from western North America.

In the triangle located midway between the south gate and the conservatories, are the American cypresses (*Taxodium*), in two species: the cypress, or bald cypress, and the pond cypress. These, like the larches (*Larix*), and a few other coniferous trees, shed their leaves for a portion of the year. They form vast areas, in parts of the southern states, called cypress swamps. Their timber is of economic importance and their bark is rich in tannin. None of the true cypresses (genus *Cupressus*) are hardy with us.

At the northern end of the swale in which the herbaceous grounds are located, and to the westward of the morphologic garden, is the collection of larches (*Larix*) and also the members of the yew family (Taxaceae). The larches are deciduous trees, the wood of which is of great economic

importance. Specimens of the European larch are here, and also of the Japanese larch. The genus *Pseudolarix*, distinguished from the larches in having the scales of the cones deciduous, is represented by its single species, the golden or Chinese larch; this, like the true larches, is a deciduous tree.

The yew family (Taxaceae) is represented by three genera. Of the true yews (*Taxus*) there are: the American yew, or ground hemlock; the English yew and several of its horticultural varieties, the wood of which was highly prized in ancient times for the manufacture of bows; and the Japanese yew. The last is by far the best for this climate, standing well the dry summers and cold winters; there is a dwarf form of this known as variety *nana*, which is an especially desirable evergreen for decorative planting. The cluster-flowered yew (*Cephalotaxus*) is represented by the Japanese species and one other from Corea. The Japanese Torreya (*Tumion nuciferum*) represents this genus. Another species, *Tumion taxifolium*, of Florida, is not hardy in our climate; small plants of it will be found in house 12, conservatory range 1. Still other representatives of the yew family are in houses 12 and 13 of conservatory range 1.

To the north of the economic garden will be found specimens of the umbrella pine, not a true pine, however, but belonging to the genus *Sciadopitys*, a native of Japan. Another tree here is the Japanese cedar, *Cryptomeria japonica*, with several horticultural varieties. This will stand our winter climate only in sheltered situations such as this; the forms of the variety *Lobbii* are more hardy and are therefore better suited to this climate. There is also here a small specimen of the big tree of California, *Sequoia Washingtoniana*. This climate is most uncongenial to this noble plant which in its native country, the western slopes of the Sierra Nevadas, attains a height sometimes of over 300 feet.

On the westerly corner of the conservatory terrace and in

the immediate vicinity are located the retinisporas, which are so commonly cultivated as decorative plants. There are many horticultural forms here represented, but they are all variations of two Japanese trees: the Sawara cypress (*Chamaecyparis pisifera*); and the Hinoki cypress (*Chamaecyparis obtusa*). The latter species is frequently used by the Japanese in their dwarfing process. The names borne by the various horticultural forms have been suggested by some peculiarity in coloring or in manner of growth. North American species of the genus *Chamaecyparis* will be found in the low ground along the south walk, not far from the south gate.

On the easterly corner of the conservatory terrace, opposite the retinisporas, is a part of the juniper, or red cedar (*Juniperus*), collection. The remaining and larger portion of this collection will be found on the easterly end of the area lying between the driveway and the traffic-road south of the conservatories. In these two areas will be found many species and varieties of these plants. The common juniper, of north temperate regions, is one of these; also the Irish juniper, a form of this, of compact and strict habit. The red cedar, so common in a wild state in the grounds of the Garden, finds representatives in many horticultural forms. The savin juniper, of Europe and northern Asia, and its American representative, the prostrate or Waukegan juniper, of northern North America, are both neat low-growing sorts. The Chinese juniper, and its striking form, of columnar habit, known as variety *pyramidalis*, are each present in a number of specimens. There are still other varieties of the Chinese juniper represented here, including *Pfitzeriana*, one of the best dwarf conifers.

At the westerly end of this area is the arbor vitae group (*Thuja*). The species of this genus produce a durable wood which is of especial value where there is contact with the soil. The Japanese arbor-vitae is represented by several specimens. The common arbor-vitae, or white cedar, from northeastern North America, is fully represented, not

only by the typical form, but by many horticultural varieties, some of them very decorative. The wood of this tree is valued for fence posts, railway ties, etc., and from its young branches fluid extracts and tinctures are made which are used in medicine. The Chinese arbor vitae, from China and Japan, has a number of specimens representing it and some of its horticultural forms.

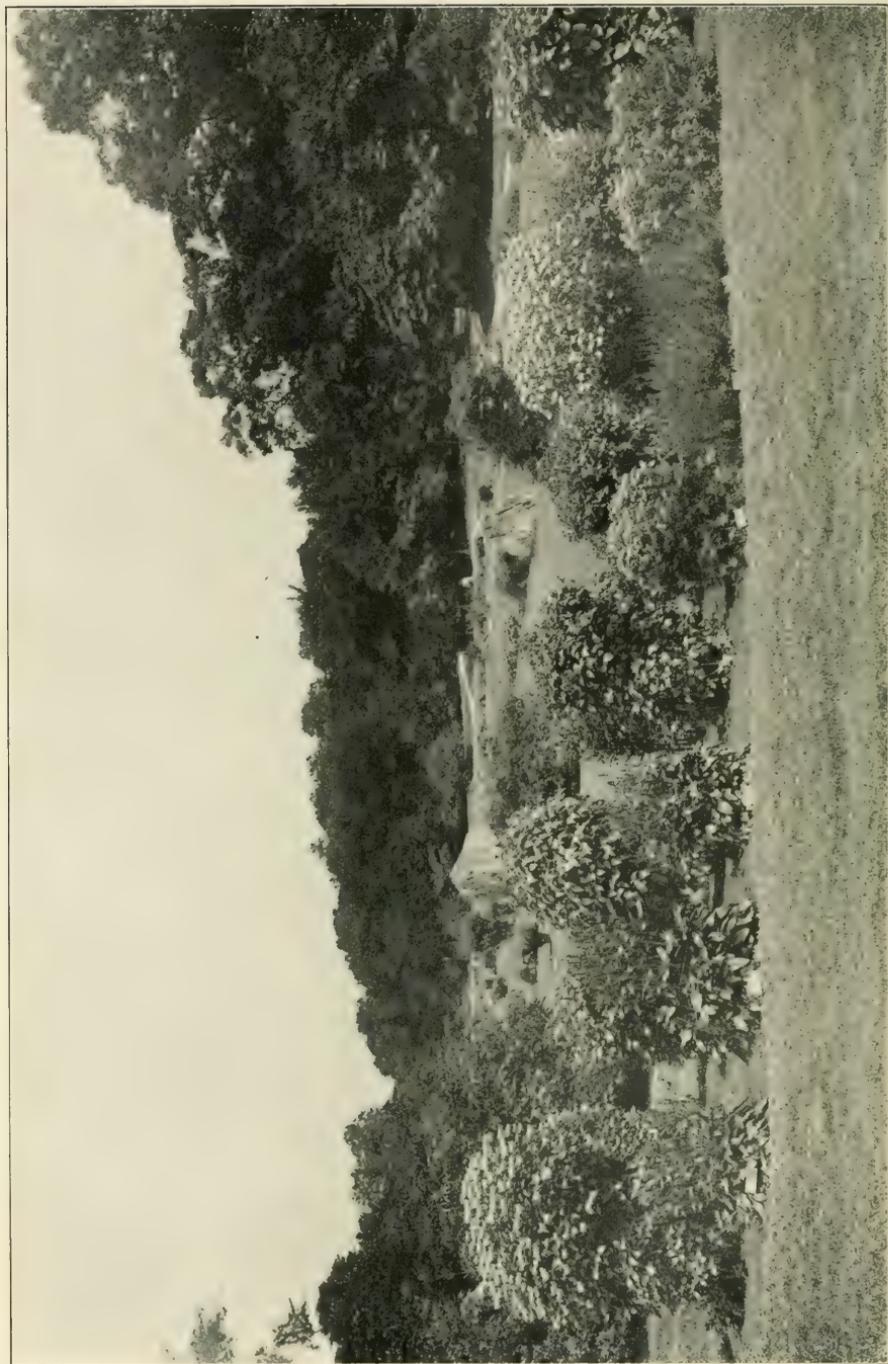
The maiden-hair tree family is represented by a single species, the maiden-hair tree, several specimens of which may be found on the southern portion of the westerly ridge of the herbaceous grounds. This interesting tree, with its fan-shaped leaves, is a remarkable relic of a type of vegetation which was common and widely distributed in tertiary geological time, but is now restricted to eastern temperate Asia in this one species, *Ginkgo biloba*.

4. The Herbaceous Garden

The collection of hardy herbaceous plants is situated in a valley southeast of the public conservatories, and between the main driveway and the western border of the woods fringing the hemlock grove. This valley is about 1500 feet long and averages about 300 feet wide. A small stream runs through the valley from north to south and is here and there broadened out into pools. The collections are arranged in three series: (a) The systematic plantation; (b) the morphological garden; (c) the economic garden; the viticetum, or collection of vines, is planted at an arbor just east of the northern part of the valley.

(a) SYSTEMATIC PLANTATION

This is located in that portion of the valley south of the driveway crossing it, and here the plants are grouped by natural families in botanical relationship. At the southern end are the seedless plants, represented by the ferns and their allies; east of the brook are the families of seed-bearing plants belonging to the large endogenous division, or those with parallel-veined leaves and with one seed-leaf (monocot-



VIEW IN THE HERBACEOUS GARDEN

yledons). To the west of the brook are the families belonging to the exogenous division of plants, or those in which the leaves are usually net-veined and which have two seed-leaves (dicotyledons); this latter group embraces the larger part of the plants in the collection. Along the brook, or in it, may be found many aquatic plants, representing in some cases families which are exclusively water-lovers, while in other cases they are aquatic representatives of families occurring in the immediate vicinity in the beds. In this plantation, the family groups are arranged substantially in a sequence beginning with those of simpler organization and proceeding to the most complex.

The series commences in the southern corner of the valley at the foot-path entrance, where the hardy ferns and their allies may be found, including species from all parts of the north temperate zone. Among these may be mentioned the ostrich fern, the cinnamon fern, Clayton's fern, the royal fern, the brake or bracken, and a number of species of the shield-ferns and of the spleen-worts. Some of the aquatic representatives of the ferns and their allies may be found in the pond nearby.

In this pond may also be found the following aquatic endogenous families: the cat-tail family, the bur-reed family, the pond-weed family, the arrow-grass family, and the tape-grass family. At the junction of the brook with this pond is the water-plantain family, including, besides the water-plantain, several species of arrow-head (*Sagittaria*). A little beyond, in the brook, may be found the water-poppy family, represented by the water-poppy, a showy plant common in tropical regions.

Following to the north comes the large group of the grasses and grass-like plants, those whose flowers, mostly very small, are subtended by chaffy scales or glumes. This is represented by the grasses and the sedges, several beds being devoted to each of these families. Some of the more familiar grasses are: timothy, Kentucky blue-grass, reed canary-grass, orchard grass, red-top and tall fescue-

grass, all used in making hay. Other grasses of interest are: sweet vernal-grass, exhaling a pleasant odor when bruised; the Japanese plume-grass, in several forms, very ornamental; the ribbon-grass, a variegated form of the reed canary-grass, and also ornamental; and species of many other genera.

The sedges are represented mainly by the large genus *Carex*, of which there are many species, native in the United States, growing in swamps, meadows and woodlands. Fraser's sedge (*Cymophyllus Fraseri*), is a striking plant from the southeastern United States, at one time one of the rarest of plants, but rediscovered in recent years in large quantities in the mountains of North Carolina. The tussock sedge, common in our swamps in early spring, the cat-tail sedge, Gray's sedge and the fox sedge, are others belonging to the genus *Carex*. There are also representatives of bullrushes and other sedges.

Following the sedges is the arum family, having as representative plants, familiar to many, the skunk cabbage, the green arrow-arum, the green dragon, the jack-in-the-pulpit, and the sweet flag. In the brook opposite to this family may be found the somewhat related duckweed family; the duckweeds (*Lemna*) are very common, these tiny plants sometimes occurring in such numbers as to cover the surface of ponds and slowly moving streams. Coming now to the spiderwort family, we have represented mainly the spiderworts and day-flowers. In a small pool and along its eastern edge is placed the pickerel-weed family. Here may be found a large clump of the pickerel-weed (*Pontederia*) which is common in swamps and along streams in the vicinity of New York; here may also be found the water-hyacinth, which has become such a pest in some of the rivers of Florida and the West Indies, and the closely related blue water-hyacinth, of more straggling habit, also of tropical origin, planted out in summer.

The rush family occurs next in the sequence, represented, among others, by such familiar plants as the common bog-

rush, the slender rush, and the common wood-rush. Following this come the members of the bunch-flower family, with several species of bellworts, the turkey-beard, the Japanese toad-lily, the fly poison, and others. Closely related to this is the lily family; one of the beds given over to this family is devoted to the true lilies (*Lilium*) in several forms; another is set aside for the onions and their relatives, of which there are many interesting forms, some of them of decorative value; while another bed is given to a miscellaneous collection of plants belonging to this family, among which may be mentioned the day or plantain lilies, the yellow day lilies and the lemon lilies, the true asphodel or king's sword, the grape-hyacinth and Adam's needle. Other close relatives of the lilies belong to the lily-of-the-valley family; here may be found many familiar plants, among them being the lily-of-the-valley (*Convallaria*), the wild spikenard, the common asparagus, of such wide use as a vegetable in the early part of the summer, and several species of the Solomon's-seal, both from the Old World and the New.

The amaryllis family is shown by a number of species of daffodils and narcissus. In the iris family, which comes next, many species are represented. Most familiar among these are: the common blue flag of our swamps, the yellow flag of Europe, the German iris, the Siberian iris, the Japanese iris and the blackberry lily. For the canna family reference is made to the plantations at the Garden fountain at the approach to the museum building and to the conservatories, and for orchids to the conservatories.

Crossing the brook now by the path paralleling the driveway, we come to the beginning of the sequence of the large series of plants with net-veined leaves and with two seed-leaves (dicotyledons). This series begins with the lizard's-tail family, represented here in the brook by the lizard's-tail (*Saururus*), a common plant of our brooks and river borders in the eastern United States. To the nettle family one bed is at present given, located near a group of magnolia trees,

where may be found, among other kinds: the slender nettle, of North America; the stinging nettle, native in Europe and Asia, but introduced into this country; and the wood nettle, also a North American plant; all of these secrete an oil through the hairs covering the stem and leaves, this oil being irritating to the skin, especially in the stinging nettle. In the immediate neighborhood and to the right is the birthwort family, represented by several species of wild ginger (*Asarum*), among them the common one of this region, the short-lobed wild ginger, the root of which is of medicinal value; another is Shuttleworth's wild ginger, of the southeastern United States. To the buckwheat family there are at present devoted three beds, forming a group to the left of the nettle family. The docks (*Rumex*) are shown in many forms, as are the knotweeds (*Polygonum*); the most showy of these are the Japanese and Sakhalin knotweeds, the latter a plant of considerable economic importance, being used as a fodder plant, and is a native of the Sakhalin Island; to this family also belong rhubarb, or pie-plant, and buckwheat. Next to this and near the brook is the goose-foot family, with several species, one of which, the lamb's-quarters (*Chenopodium*), is native of Europe and Asia, but found as a common weed in waste places and along roadsides in this country; its young shoots are sometimes used as a vegetable. Closely related to this, and just south of it, is the amaranth family, represented by several species of the pigweed, many of them among the commonest weeds of our roadsides and waste places. Forming a series to the right of this are: the whitlow-wort, four-o'clock, pokeweed, carpetweed and purslane families. In the whitlow-wort family are gnawel or German knotweed, a common weed of fields and waste places, and the forked chickweed. In the four-o'clock family may be found the common four-o'clock of our gardens, a native of tropical America, its flowers opening only on cloudy days or late in the afternoon on clear days, whence its name; and the umbrellaworts, from North America. In this vicinity is the Madeira-vine

family, to which belongs the genus *Basella*; here represented. The pokeweed family is represented by the common poke or garget (*Phytolacca*), native of the eastern part of North America, a plant of medicinal value and poisonous, but its young shoots when first appearing above the ground are sometimes used as "greens." In the carpetweed family are the carpetweed, from which the family derives its name, a native of the United States and Mexico, but a common weed in this vicinity; and representatives of the south African fig-marigolds (*Mesembryanthemum*), many of them very showy; they are not hardy in this latitude and must be planted out every spring. In the purslane family, among others, may be found the sunplant or common portulaca of the gardens, a native of South America; the small-flowered talinum, from the central United States; and the common purslane or pusly, a pernicious weed in many sections of the country, and often used for "greens" or as a salad.

Then comes the chickweed family, with sandworts, chickweeds and related plants. The pink family follows, where many kinds of pinks, catchflies, and gypsophils may be found. In the first pool, formed by the widening of the brook, is the water-lily family; the large yellow pond lily or spatterdock, a native of eastern North America, may be seen here, as may also its relative, the red-disked pond lily, from northeastern North America; the sweet-scented water-lily, and its variety, the pink, or Cape Cod, water-lily, also find a place here; the water-shield or water-target is also a member of this family and a native of North America. The tanks in the court of the public conservatories contain a great many additional kinds. The hornwort family likewise occupies a position in this pool. The aquatic members of the crowfoot family are grown here, the terrestrial forms being placed in four beds to the westward; one of these beds is given up entirely to the peonies (*Paeonia*), of which there are a number of interesting and handsome forms, and in the other beds may be found lark-

spurs, columbines, buttercups, meadow-rues, anemones, liver-leaf, and many other relatives; aconite, or monk's-hood, of great medicinal value, also belongs to this family.

The barberry family, which is represented by a single bed on the ridge to the right of the crowfoot family, contains, among others, the blue-cohosh and the may-apple or mandrake (*Podophyllum*), natives of North America; the twin-leaf, a native of the northeastern United States; and of Japanese plants, the red epimedium. In the poppy family may be found the oriental poppy, a native of Asia Minor and Persia, and here may be seen also the cordate *Macleaya*, from Japan, and the Mexican poppy, a native of Mexico and found as a weed in many tropical and warm temperate regions. In the fumitory family are the bleeding-hearts (*Bicuculla*), represented by the wild bleeding-heart from the eastern United States. The mustard family, which comes next in the sequence, occupies two beds. To this family belong the candy-tufts, represented here by the evergreen candy-tuft, from southern Europe and Asia Minor, and the alpine rock-cress, from Europe and North America, one of the showiest flowers in early spring, its mantle of pure white flowers making it a conspicuous object; there are many other species represented in this group. The caper family has as representatives the showy pedicellaria, a native of the Old World, and the clammy weed (*Polanisia*), from northern North America. The white and yellow cut-leaved mignonettes (*Reseda*) represent the mignonette family. Across the path to the right, on the ridge and partly surrounding a rocky knoll, is the bed devoted to the orpine or stonecrop family, where there may be found many of the stonecrops (*Sedum*), among the more showy and attractive being: the great purple stonecrop, the great stonecrop, the white stonecrop, and the mossy stonecrop, all natives of Europe and northern Asia; the wild stonecrop from our own country; the Siberian stonecrop and the poplar-leaved stonecrop, both from Siberia; and a Japanese species, Siebold's stonecrop; also

belonging to this family are the houseleeks (*Sempervivum*), of which there are many representatives, all from the Old World, however, as these plants are not indigenous to the New World. Many other species of this family, not hardy in this latitude, may be found in the conservatories. Across the path from the orpine family may be found the three beds devoted to the saxifrage family. The heart-leaved saxifrage, with its large, thick leaves, from Siberia, is one of the showiest plants here, sending up its large masses of pink flowers early in the spring, so early sometimes that they are nipped by the frost. Among other plants here may be mentioned: the alum-root, from the eastern United States; the two-leaved bishop's-cap, from the northern United States; the Japanese plant, *Rodgersia*; and the shield-leaf saxifrage, from the western United States. Menzies' saxifrage, from western North America, is interesting from the fact that in late summer and fall it produces small plants at the base of the leaf-blades.

To the herbaceous members of the rose family are allotted five beds, located to the left of the saxifrage family. Many species of cinquefoils and agrimonies may be found here; of the strawberry (*Fragaria*) there are several species represented; the lady's-mantle, from north temperate regions, the various species of avens, the goat's-beard, the burnets and many others, are of decorative value or of interest for other reasons. The roses, blackberries and raspberries, also members of this family, are shrubs, and may be found at the fruticetum. The mimosa family has relatively few representatives in temperate regions, most of its numerous members being confined to warm temperate regions and to the tropics; many of these may be found in the conservatories. To the senna family belong the sennas or cassias, a showy representative being the American senna a native of North America; this family being also largely of warm temperate and tropical distribution, many other species may be found in the conservatories. To the right of the mimosa family may be found the bed devoted to the

pea family; to this some of our most valued economic plants belong, such as the pea, the bean and the clover; to the pea family belong also the baptisias, the bush-clovers, the vetches, the tick-trefoils and many other familiar plants.

Next in the order of sequence is the geranium family, to which belong the geraniums or crane's-bills; the plants so often cultivated in the house under the name of geraniums, but which are not hardy out of doors in our climate, are really not what they are called, but are truly pelargoniums, a closely-related group of plants belonging to the same family; our common wild geranium or crane's-bill may be found, among other plants here. A little farther on, near the brook, may be found the bed devoted to the wood-sorrel family, often called sour-grass by children; several species are shown here. Just to the left of the geranium family is the flax family, to which belongs the flax plant (*Linum*), from the fiber contained in the stem of which linen is made. Beyond this is the bed for the rue family; to this belong the common rue, of southern Europe, and the fraxinella; this family also includes the oranges and lemons, specimens of which may be found in the conservatories, and a very great number of tropical trees and shrubs. To the right of this is a small bed devoted to the milkwort family. The spurge family is in a bed just to the left of the flax family; the flowering spurge, from the eastern United States, and the cypress spurge, from Europe, but sometimes found wild in this country as an escaped plant, are both here. Along the edge of the brook, and opposite the spurge family, may be seen the water-starwort family, to which belong a number of small aquatic plants. About opposite this, and at the base of the rocky ridge to the right, are two representatives of the box family, in the trailing pachysandra, from North America, and its Japanese relative, the terminal pachysandra; the true box (*Buxus*) is a shrub or small tree, native of Europe, and several races of it may be found at the fruticetum. A little to the right of the wood-sorrel family is the jewel-weed

family, to which belong the common balsam of the gardens, and the plant so common along our brooks and other wet places, and known as jewel-weed, or touch-me-not. A little beyond this are three beds of the mallow family; the hollyhocks belong here, as do the mallows; the crimson-eye mallow and the swamp-rose mallow, both from North America, are showy representatives of this family; and the marsh mallow, a native of Europe and the Orient, is also shown; its root is used in the manufacture of a mucilage and for medicinal purposes.

To the right of the mallows is the bed given over to the St. John's-wort family. The rock-rose family comes next, a little further on; here belong the rock-roses of Europe and our own frost-weeds. To the right of this is the violet family; a collection of our native species, together with some from foreign lands, is here brought together and many of these may be recognized as old friends. Near the violet bed is one devoted to the loasa family. Up on the ridge to the right, across the walk, may be found the cactus family; relatively few of these are hardy in this climate, so the larger part of the cactus collection must be sought in the conservatories. Here may be found, however, several representatives of the prickly pears (*Opuntia*), including the eastern prickly pear, common in this part of the country which is frequently found on the rocky ridges in the vicinity of New York and occurs wild on some ledges within the Garden reservation. Down near the brook, and not far from the mallow family, is the loosestrife family, represented by the purple loosestrife, a native of Europe, but introduced in many places in this country; among others belonging to this family is the swamp loosestrife, or willow-herb (*Decodon*), a clump of which may be found along the brook opposite to the loosestrife bed. Near this, on the edge of the brook, is located the meadow beauty, one of the prettiest little flowers of our meadows; it belongs to the meadow beauty family, few species of which occur in coal regions; it is largely represented in warm temperate

and tropical regions, and many other species may be found in the conservatories. But a short distance from the violet family is the evening-primrose family; here may be found a number of the evening primroses (*Oenothera*), with their showy yellow flowers, noteworthy as the plants mainly experimented with by Professors DeVries and MacDougal in their studies on the origin of species. Along the brook, not far from the loosestrife family, is the water-milfoil family, represented by the Chilean water-milfoil or parrot's-feather, forming a beautiful mass of feathery green on the surface of the water. Returning now to the ridge, a little beyond the violet family, we find the bed allotted to the ginseng family; here are the Indian-root, from eastern North America, and the heart-leaved aralia from Japan. To this family also belongs the ginseng plant, the root of which is so much prized by the Chinese as a medicine. Down the slope from this group may be found two beds given over to the carrot family, which includes many economic plants, such as the carrot, parsnip, celery and caraway; lovage, a common European plant, is shown, and the rattlesnake-master, from the eastern United States; the wild carrot and the golden meadow parsnip also belong here.

To the primrose family, located at the base of the ridge a little beyond the carrot family, belong the primroses (*Primula*), many of which are natives of Europe; here we find the common European primrose, the cowslip and others; the moneywort, a native of Europe, but introduced into many places in this country, sends its long creeping stem all over the bed—this is sometimes known as creeping Charlie; the fringed loosestrife, from North America, is also here, as is the clethra-like loosestrife, from Japan, with its racemes of white flowers. Between the two beds devoted to the carrot family, and a little beyond, is the plumbago family, to which belongs the common thrift of Europe; there are several other thrifts here also, as well as the statices or sea-lavenders, in several species. The bed allotted to the

gentian family may be found a little beyond the plumbago family; various gentians are represented, among them the blind gentian, a native of the United States. In the brook, just beyond the little stone bridge, may be found the buck-bean family; here are shown the water-snowflake, common in tropical regions, and the water-lily floating heart, native in Europe and northern Asia.

Just beyond the left-hand bed devoted to the carrot family is the dogbane family; the willow-leaved amsonia, from the central and southeastern United States, and the broad-leaved amsonia, from the central and eastern United States, are conspicuous objects here. Beyond this are two beds of the milkweed family and among its representatives are the common milkweed of our roadsides, the hairy milkweed and the swamp milkweed; the swallowworts also belong here and are illustrated by several species. In the morning-glory family, located to the right of the above, are the small bind-weed, of northern Europe and Asia, sometimes a troublesome weed in this country, and the bush morning-glory from the western United States. Following the milkweeds is the phlox family; interesting plants here are the Jacob's-ladder (*Polemonium*), of Europe, with its masses of blue flowers; the hairy phlox, of North America; Brittons' phlox, a relative of the common ground phlox, from the southeastern United States; the ground phlox and its white-flowered form, both natives of the eastern United States; and forms of the garden phlox, also from the southeastern United States. In the shade, the natural habitat of many of these plants, is the water-leaf family, at the base of a large rock on the ridge; there are the purple, the broad-leaved and the Virginia water-leaf (*Hydrophyllum*).

Further along and at the base of the ridge is the borage family; the tuberous comfrey, the rough comfrey and the common comfrey, all natives of Europe, are represented. In the vervain family, in a small bed to the left, may be found: the wedge-leaved fog-fruit (*Lippia*), from the wes-

tern United States and Mexico and the vervains. We now come in the sequence to the mint family, to which are devoted six beds; among the true mints may be found here the creeping whorled mint, the curled mint and the spear-mint, all from the Old World. Many familiar plants may be seen in these beds, and among them are: the false dragon-head, of the United States; motherwort, common in Europe and widely distributed as a weed in this country along roadsides and in waste places; the horse-balm, of North America, common in the east in woods; Oswego tea, and other bergamots, natives of North America; the betony and hyssop, of Europe; the hedge-nettles, from both the Old World and the New; the common sage of the Mediterranean region, highly prized by the housewife, and other sages; catnip, a native of Europe, but widely distributed as a weed in this country; Gill-over-the-ground, or ground ivy, also a European plant, but extensively spread as a weed in this country; and the dittany, of North America.

The potato family may be found a little to the left and just beyond the phlox family. Here may be seen the common jimson, or Jamestown, weed, the seeds of which are poisonous, a native of tropical regions, but a common weed along our roadsides; the nightshade, a European plant, but commonly distributed as an introduction in many parts of this country, also with poisonous fruit, tobacco plants and solanums; it is to this family that the potato, tomato and egg-plant belong. A little beyond and to the left of the mints are the two beds allotted to the figwort family; of interest here are: the beard-tongues, of which there are several species; the speedwells (*Veronica*), among them the long-leaved speedwell and the gentian speedwell; the fox-gloves (*Digitalis*), from one of which, the purple fox-glove, the valuable medicine digitalin is derived; Lyon's snake-head from the southern states; culver's-root, from the southeastern United States; and several figworts. Just beyond this may be found the

unicorn-plant family, represented by the unicorn-plant. A little beyond is the globularia family, presented by a single species of globularia. To the right is the acanthus family; not many of these plants are hardy in this latitude, but in the conservatories many representatives may be found, as the family is largely confined to tropical and warm temperate areas; in this bed may be seen the hairy ruellia, from the southeastern United States. In this neighborhood may also be seen the lopseed family, represented by the lopseed, a native of eastern North America.

To the right of the acanthus family is the single bed devoted to the plantain family; several species, such as Ruge's plantain and rib-grass, are pernicious weeds in this neighborhood, often disfiguring an otherwise even lawn. Just beyond the mints may be found the two beds of the madder family; to this belongs the dainty little bluets or innocence, which sometimes give a blue sheen to sterile, sandy places, so abundant is it in some localities; it is quite common in eastern North America; several species of bedstraw (*Galium*) may also be found here, while many other plants belonging to this family are grown at the conservatories, among them the coffee tree. A little beyond is the single bed of the honeysuckle family, represented by the feverworts; this family being largely composed of woody plants, many other species, including the true honeysuckles, may be found in the fruticetum and in the viticetum. To the left is the valerian family with a single bed; here may be found the valerian, a common European plant.

Just beyond the plantain family is the teasel family. It is to this that the teasel plant belongs, used in olden times for raising the nap on woolen cloth. Several species of cephalaria may be found here. Next in sequence is the gourd family, to which belong such common fruits as the cucumber, muskmelon, watermelon and pumpkin. The bell-flower family is a little further on and to the left of the teasel family; the Carpathian and Host's bell-flowers, both

natives of Europe, are pretty representatives here; the creeping bell-flower, or Canterbury bells, also a native of Europe, may be found here in several forms; the Japanese bell-flower and its white variety are also here, their large showy flowers making them quite conspicuous. A little further on and to the left is the lobelia family; the cardinal flower and the great lobelia, both natives of North America, make showy objects; the former is particularly striking in its rich masses of cardinal-red flowers.

To the right of the teasel family is the chicory family. The common lettuce (*Lactuca*), so much used in salads, belongs here; many of the plants are extremely weedy by nature, and this is particularly true of the hawkweeds, a genus richly represented in the Old World, several species of which are shown here; the oyster plant is also a member of this family.

To the left of this may be found the ragweed family. All the species here are of a weedy nature. The ragweed, the giant ragweed and the common clot-blur find representation here. Terminating the sequence comes the very large thistle family, represented by many species from all parts of the world; there are nine beds at present given over to these plants; the sunflowers, coneflowers, thistles, asters, fleabanes, yarrows, golden-rods, tansies, sneezeweeds, burdocks, artemisias and wormwoods, cat's-foot, tick-seeds, elecampane, boneset, chrysanthemums, colt's-foot and many others are shown; the Jerusalem artichoke, one of the sun-flowers, a native of eastern North America, bears edible tubers.

HERBACEOUS GARDEN PERGOLA

A small, hexagonal, concrete pergola stands in a triangle formed by three paths in the forest edge on the eastern side of this plantation.

(b) MORPHOLOGICAL GARDEN

This is located to the north of the systematic collection, the two collections being separated by the driveway which

crosses the valley. It is designed to illustrate here with typical examples the organs and other features of plants, including leaf-forms and the various modifications of their margins, their venation and insertion on the stem; also the various kinds of stems, methods of propagation, flower-clusters and fruits, leaf-movements, parasites, desert plants and seed-dispersal. Looking north on this collection, the first bed to the right of the brook contains plants illustrating simple leaf-forms. Immediately following this on the same side of the brook are the plants representing the various forms of compound leaves, or those in which there is a distinct jointing of the leaflets to the leaf-axis. Farther along the brook, in the pool, may be found various forms of aquatic roots, stems and leaves; and a little beyond this to the right is the bed containing plants illustrating forms of propagation.

The remaining plots of this collection are located on the left hand or westerly side of the brook. The first of these to the right is devoted to leaf-venation, and the one to the left to leaf-margins, the former illustrating the character of the veins and nerves, and the latter the tothing or lobing of the margins. Beyond this to the right is the group of plants showing the manner of insertion of the leaves on the stem; and to the left of this are specimens illustrating the various ways in which plants may form a mosaic covering on the ground. A little beyond are the examples of stem-forms; one bed is devoted to show the smaller kinds, while for the larger examples, illustrating tree-twinning, root-climbing and tendril-climbing stems, specimens have been placed to the left of this bed.

A little beyond the pool may be found the bed illustrating flower-clusters, and still further on that devoted to parasitic plants, or those deriving their nourishment from the living tissues of other plants. To the left of this and farther up the hill is the group of plants showing leaf-positions. Beyond and a little to the right are plants which are at home in desert regions, and the various means of accom-

modating themselves to their natural surroundings are shown. Further on to the right is the bed devoted to fruit-forms; and to the left of this, one showing various forms of seed-dispersal; those with the surface of the fruits covered with some sticky substance or curved appendages or hooked hairs or spines require the intervention of some animal for their distribution, while those with wings or with hairs attached to the seed are spread through the agency of the wind. To the right of the above are plants representing a species and a variety, and to the left of this is a bed containing plants showing species and hybrids. Another bed in this vicinity illustrates mutations.

(c) ECONOMIC GARDEN

The collections illustrating food plants and those producing substances directly useful to man in the arts, sciences and industries are planted at the northern end of the long glade containing the herbaceous collections just described. The collection is arranged in two series divided by a central grass walk. The beds on each side are numbered consecutively, the number being indicated on a wooden stake in the center. A general sign is placed in each of the beds, denoting what its contents are intended to represent, and in front of each plant is a smaller label giving individual information.

On the east side of a broad central grass path and the brook are located plants used for medicine, those employed as condiments or relishes, and a number of plants from which the fiber is used in the manufacture of various fabrics. The medicinal plants which grow in wet or moist situations may be found on the easterly side of the brook. Along the westerly border is also a collection of medicinal shrubs and trees.

On the west side of the grass path and brook are the food plants. Here may be found many of the common fruits and vegetables. Along the gravel path is a collection of shrubs and trees, containing some of the more common plants producing edible nuts and fruits.

In the eastern series, bed no. 1, located at the northern end, contains plants used as condiments and relishes; here, among others, are peppermint, spearmint, mustard, lovage, lavender, savory, caraway, dill, coriander, basil, marjoram, anise, balm, sage, tarragon, and horse-radish. Beds 2, 3, 4, 6, and 7 contain drug plants. In beds 2, 4, and 6 it is the roots and rootstocks which are employed; such drugs as valerian, Indian physic, convallaria, sanguinaria, podophyllum or mandrake, inula, belladonna, pleurisy-root, rhubarb, cimicifuga, arum, tussilago or coltsfoot, and caulophyllum are here. In bed 3 among the commonly known drugs are catnip, tansy, horehound, and stramonium, the leaves of which furnish the active principles. In bed 7 are plants from the herbage, seeds or flowers of which drugs are manufactured; hops, tussilago or coltsfoot, rue, tobacco, castor-oil, digitalis and dulcamara are some of these. Bed 5 contains plants from which fibers are obtained, such as cotton, flax, used in the manufacture of linen, hemp, and broom-corn, from the inflorescences of which brooms are made. In the adjoining woodland border of shrubs and trees are the prickly ash, barberry, witch hazel, cramp-bark, rhamnus, frangula, euonymus, red-root, shrub yellow-root, and hydrangea. Along the east side of the brook will be found calamus and magnolia.

In the western series, devoted to food plants, in bed no. 1, located at the north end of the first line of beds, are plants the bulbs of which are useful for food; among these are onions, garlic, chives, and leeks. In the adjoining bed 10, the first of the second line, are those furnishing tubers for food, such as the sweet-potato, Irish potato, and Jerusalem artichoke. In bed 18, the first in the third line, are plants with fleshy roots, such as celeriac, oyster-plant, radishes, turnips, carrots, and beets. In beds 2 and 3 it is the leaves which are edible; familiar examples are cabbage, kale, lettuce, Brussel's-sprouts, collards, chicory, Chinese mustard, fetticus, endives, and spinach. In bed 4 are plants, the herbage of which is used; examples here are French

spinach or orach, and rocket salad or roquette. It is the stems and leaf-stalks of the plants in bed 11 which are edible; here are asparagus, rhubarb, sea kale, kohlrabi, cardoon, and celery. In bed 5 are cauliflower and broccoli, the flowers being the edible portions.

Many plants furnish food in the shape of fruits. A fruit is developed from the flower, thus differing from a vegetable which is the edible portion of some part of a plant other than the fruit. Beds 6 to 8, 12 to 16, and 19 to 27 contain plants which furnish edible fruits. These divide themselves generally into two kinds, those in which the fruit is more or less fleshy, such as berries, pumpkins and beans, and those in which the seeds only furnish the food value, such as wheat, barley and other grains. In bed 6 are the egg-plant and okra. In bed 8 will be found peas, beans, and fennugreek; in bed 12 the various kinds of tomatoes; in bed 13 the different sorts of peppers; in bed 14 strawberries; beds 19 to 26 contain each a single kind, as follows: crookneck squash, pumpkin, musk melon, citron, water melon, Hubbard squash, English marrow, and cucumber.

In the group containing the grains are the four common cereals, wheat, rye, oats and barley, all in bed 7. In bed 15 are the different kinds of sweet corn. In bed 16 are the field corns, both flint and dent, and popcorn. In bed 27 are buckwheat, sorghum, and rape, among others.

Beds 9 and 17 contain fodder plants. Bed 9 has fodder plants other than grasses, such as alfalfa, red, white and crimson clovers, winter vetch, summer vetch, yellow lupine, blue lupine, and Florida beggarweed. In bed 17 are fodder plants of the grass family, such as teosinte, Johnson grass, field corn, timothy, Kentucky blue-grass, red-top, and pearl millet. In bed 28 is the sugar-cane plant, from the juice of which sugar, one of the most important articles of food, is made.

In the border of woody plants along the gravel walk are such familiar fruits as the hazel-nut, black, red and white currants, gooseberry, blackberry, black-cap, elderberry,

chinquapin, barberry, huckleberry, and highbush blueberry. Along the west side of the brook will be found rice, which furnishes the principle article of food for millions of people, especially in the tropics of the Old World; the cranberry plant; taro, also an important article of food in the tropics, largely taking the place there of the potato in temperate climates; and water-cress.

VITICETUM

The area devoted to the plantation of hardy vines is above the easterly side of the economic garden, where a rough arbor has been constructed for them to climb upon. The arrangement begins at the southerly end of the arbor, on the left hand side, with the smilax family, to which belong the green-briers or cat-briers. The yam family is placed immediately opposite to the right, followed by the mulberry family on the same side. The birthwort family, with the dutchman's-pipe as a representative, follows the smilax family on the left, and opposite to this is placed the buckwheat family, to which belong the climbing bindweeds and brunnichia. On the left hand side, and beyond the birchwort family, is the akebia family, where one may find the five-leaved akebia, a native of Japan. Following this on the same side is the moonseed family, to which belongs the Canada moonseed. On the opposite side of the arbor is the hydrangea family. Following this, also on both sides of the arbor, is the pea family, including species of the peas and wistarias. Further on, occupying both sides, is the staff-tree family, where may be found the climbing bitter-sweet and other vines of this family. Succeeding this comes the grape family, to which belong the grapes, the Virginia creeper and the Japanese ivy. On the right, beyond the grape family, is the actinidia family, represented by the toothed actinidia. Then comes the trumpet-creeper family, of which the trumpet-creeper, a native of the southeastern United States, is a member. This family in turn is followed by

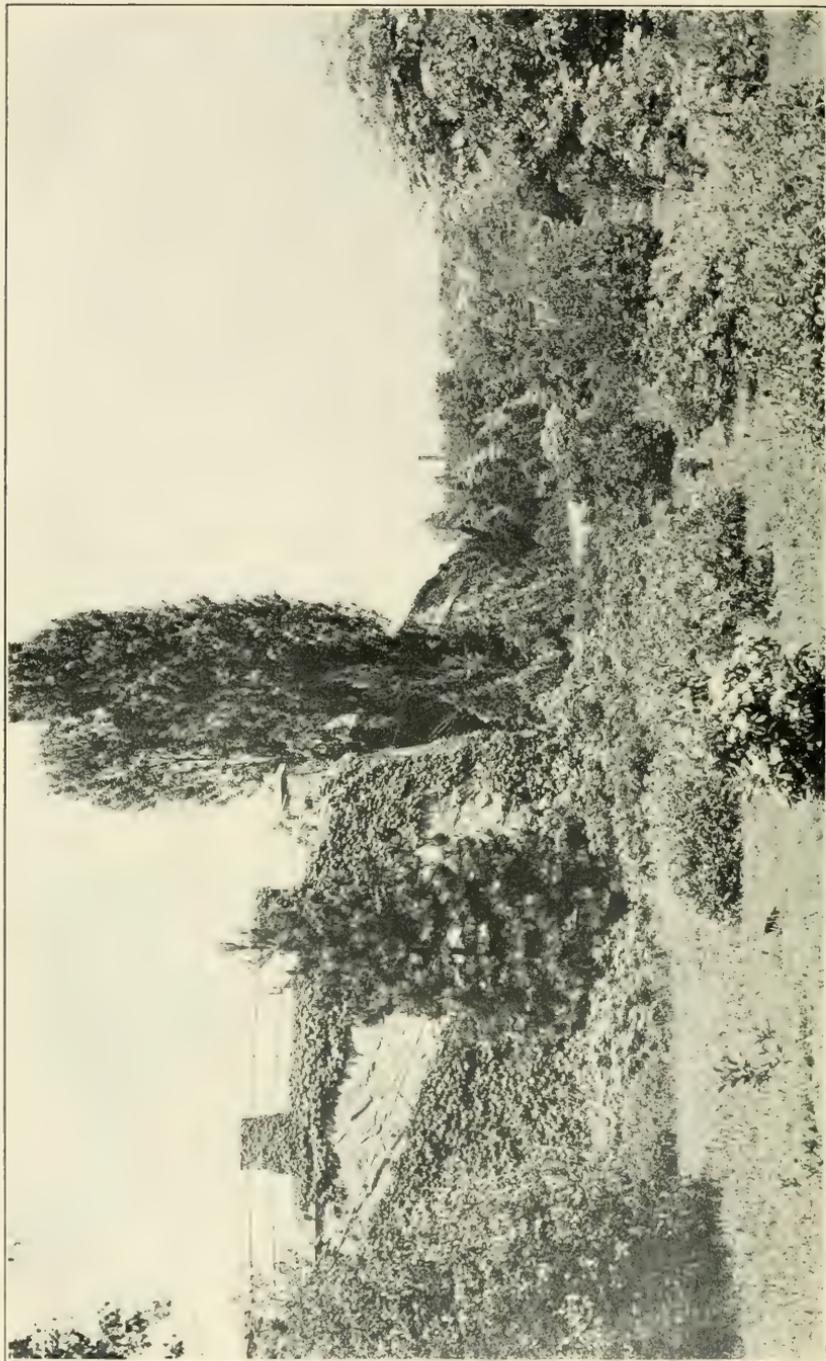
the honeysuckle family, represented here by several species of honeysuckle and woodbine.

5. The Fruticetum

[COLLECTION OF SHRUBS]

This plantation, occupying about 16 acres, is located to the northward of the lakes in the rear of the museum building, and is confined to the area lying between the lakes, the railroad, the woodland on the east, and the north meadows. In this collection are brought together specimens of hardy woody plants which are shrubs, that is, plants with woody stems which branch from the ground and have no single main stem. The arrangement here parallels that in the herbaceous grounds and in the other systematic collections. The sequence begins on the southerly side near the long stone bridge which crosses the Bronx River, and proceeds on both sides of the path running to the north along the edge of the woods, returning southward on both sides of the path paralleling the main north and south driveway, to the plum family, on the bank overlooking the water garden. It then crosses to the senna family directly opposite and overlooking the westerly lake, proceeding northward from there across the transverse driveway, and following the line of the path paralleling to the westward the main north and south driveway. The sequence then continues to the westward along the north path, again extending southward at the Woodlawn Road entrance, continuing on both sides of the westerly path and terminating with the thistle family at the westerly end of the lake near the railroad border. The families will be referred to below in this sequence. Woody vines are grown at the viticetum.

The pine family, represented by some of the low-growing junipers and pines, begins the sequence to the southward of the approach to the long bridge. The next is the willow family, beginning across the road from the pine family;



WOODLAWN ROAD ENTRANCE, FRUITICETUM

this group is located on both sides of the path and comprises many forms from various parts of the world; the family is largely an inhabitant of temperate regions, so many species can be grown here. The bayberry family occurs across the driveway from the willows, occupying a position on the bank overlooking the water garden. Here may be found the sweet-fern, a native of eastern North America; the sweet gale, at home in north temperate regions; and the waxberry or bayberry, common in eastern North America; the berries of the latter have a covering of wax, which was separated by throwing the berries into hot water, when the wax melted and rose to the surface, where it was skimmed off; it is still used to some extent in making candles. The monotypic corkwood family is represented by the corkwood (*Leitneria*) of the southern United States, which has proven to be hardy here at the foot of the terrace, its catkins flowering early in the spring. The birch family follows the willows on the east side of the path; here are the hazel-nuts, the alders and the shrubby birches; the common hazel-nut and the beaked hazel-nut, both from North America, also the common hazel-nut or filbert of Europe, and others; the smooth alder, common along streams and in swamps, is also here. Following the birch family on the same side of the path comes the beech family; here may be found the shrubby oaks and the chinquapin of the southeastern United States. On the same side of the path, a little farther along, is the elm family, represented by the dwarf elms; most of the members of this family are trees and may therefore be found in the arboretum. Immediately following this is the mulberry family, represented here by specimens of the Tartarian mulberry.

The crowfoot family occupies a space just to the north of the willows west of the path, and is represented by the moutan or tree peony, from China, and the shrub yellow-root (*Xanthorrhiza*), from the eastern United States; its roots are yellow, and at one time were employed as a dye;

there are many herbaceous members of this family at the herbaceous grounds. The barberry family is a little farther north on the same side of the path; many species of barberries and mahonias occur here. Among the barberries may be mentioned: the common European barberry, the ripe fruit of which is sometimes made into preserves, and the unripe ones pickled as a substitute for capers—its bark is used as a dye and for tanning leather; Thunberg's barberry, from Japan, a desirable plant for small hedges and for the borders of walks; the neat barberry, from the Himalayan region, which colors a beautiful red in the fall; and the large-toothed barberry, from Nepal; the mahonias are represented by the erect Oregon grape, from northwestern North America; and the Japanese mahonia. The magnolia family occurs a little back from the path, between the crowfoot and barberry families; there are here several species of shrubby magnolias. The strawberry-shrub family is located on the point dividing the paths, opposite the mulberries already referred to; here may be found several species of the strawberry-shrub, including the hairy one which has the fragrant flowers scented like the strawberry, the fragrant *Chimonanthus*, from Japan, is a member of this family, and is known to the natives there as karamume. A short distance to the north of the strawberry-shrub family is the laurel family, represented by the spice-bush (*Benzoin*), a native of northeastern North America; as the different kinds of flowers, staminate and pistillate, are borne on different plants, only those having pistillate flowers bear the bright red berries in the summer and autumn. In the lower land below, to the east of the path, is the Virginia willow family, with shrubs of the Virginia willow, a native of the southeastern United States. Across the path from this is the hydrangea family; here may be found the syringas, the deutzias and the hydrangeas, several species of each; the mock orange (*Philadelphus*), a native of Europe, indicates its presence by the rich fragrance of its flowers; the slender deutzia, from

Japan, bears its long slender clusters of white flowers in great profusion; the large-flowered hydrangea, a Japanese-plant, bears a profusion of large bunches of white flowers, which in the late summer and autumn change to a beautiful rose color; the oak-leaved hydrangea is perhaps the oddest member of this genus; it is native from Georgia and Florida to Mississippi. Following the hydrangea family comes the gooseberry family, and to this belong the currants and gooseberries; one of the showiest is the long-flowered golden currant, from western North America; its rich yellow flowers give forth a delicious spicy fragrance. The witch-hazel family is located to the north of the north path and on the point opposite; here is the common witch-hazel, of eastern North America, from which the extract of witch-hazel, or Pond's extract, is made, the Japanese witch-hazel, and also a Chinese representative of this genus; the spiked corylopsis, a Japanese shrub, belongs here, as do the fothergillas of the southeastern United States.

The rose family occupies a large area, beginning just north of the gooseberries and currants and extending westward to the main north and south driveway, and southward along that as far as the first transverse path; here belong the spiraeas, of which there are many forms, the blackberries, the raspberries, the roses and others. Among the spiraeas, the steeple-bush or hard-hack and the willow-leaved meadow-sweet, or quaker-lady, are common as wild plants in this latitude. Other interesting forms are Thunberg's spiraea, from Japan, and other Japanese spiraeas. Among other plants of interest in the group which contains the spiraeas are the Chinese pearl-bush, a native of northern China, with its profusion of white flowers in early summer; the Japanese rose, from Japan, not a true rose, however, with bright yellow flowers; another shrub from Japan, known to the natives of that country as *siro yama buki*, bears large white flowers resembling in appearance those of the mock orange; two other Japanese shrubs, members of the same genus, and

known to the natives there as kago ma utsugi and yama doosin, respectively, the former an exceptionally graceful and attractive plant; *Neviusia*, an extremely local plant, known in a wild state only in Alabama; and the nine-bark, of eastern North America. To the southward of the spiraea group comes the collection of blackberries and raspberries (*Rubus*) represented by many kinds; two of the showiest are the Japanese wineberry and the purple flowering-raspberry, the latter common in rocky woods in this part of the country. Farther to the south is the group of the true roses; many kinds may be found here, including the sweet-brier, the dog-rose, or wild brier, and the red-leaved rose, all natives of Europe; the low or pasture rose of eastern North America; and the odd-looking Watson's rose, a native of Japan. Numerous herbaceous species of the rose family are grown at the herbaceous grounds.

Following this is the apple family; to this belong the apples and pears, many of which, being trees, may be found in the arboretum. Of a shrubby habit, and therefore members of this collection, are many of the hawthorns or thorn-apples, the quinces, the rose-boxes, the choke-berries, the service-berry and the shad-bush. Southward across the driveway from these, and overlooking the easterly lake, is the collection illustrating the plum family, to which belong the plums, cherries, apricots and peaches. As many of the species of this family are trees they may be found at the arboretum. Among those represented here are the western sand cherry, of northwestern North America; the three-lobed peach, a native of China, in its double-flowered form; the dwarf peach, from Europe; and the Russian almond, of Russia and western Asia.

Crossing the driveway to the west, the sequence is again taken up on the ground overlooking the west lake, with the senna family, represented by the Asiatic Judas-tree, of China and Japan, and the American Judas-tree of the eastern United States; in spring, before the appearance of the leaves, these are profusely covered with pink or pur-

plish flowers. Across the transverse driveway to the north, and directly on the opposite side, may be found the pea family. Here are various species of the pea-tree: the pigmy pea-tree, from the Himalayan region; the Cham-lagu pea-tree, from China; the common pea-tree and the small-leaved pea-tree, both from Siberia. The white broom, the common broom and the dense-flowered broom all of Europe, have representatives here; of these, the common broom, in Spain and France attains the size of a small tree, and its wood is highly prized for veneering and cabinet work; its branches are extensively employed for making brooms, whence its common name. Other plants of interest are the false indigo and the bristly locust and Kelsey's locust, all from the southeastern United States; the woody bladder-senna, from Europe and the Orient; and the scorpion senna, from southern Europe. Immediately beyond is the rue family, illustrated by the shrubby trefoil (*Ptelea trifoliata*) of the eastern United States; the prickly ash, from the northeastern United States, and Bunge's prickly ash, from China, and the anise pepper tree, of the same genus, from China and Japan; and the trifoliolate orange, from Japan, which has been used as one of the parents in the recent hybridization experiments by the U. S. Department of Agriculture in its effort to produce a more hardy orange; the lemon and forms of the orange may be found in the conservatories, together with other woody members of this family. The tanners'-tree family comes next with a single representative from Japan. Following this is the box family, represented by a number of forms of the box-tree, from Europe, Asia and Japan; the wood of the box-tree is highly prized for wood-engraving, on account of its hardness and close fine grain, and it takes a fine polish. A few steps further on is the sumac family, to which belongs the common poison ivy, so frequent in and around New York City; here are the fragrant sumac, the mountain sumac and the smooth or scarlet sumac, all from the eastern United States; Osbeck's sumac is a stately shrub from

China. The European and the American smoke-trees (*Cotinus*) are relatives of the sumacs; the former is sometimes called the wig-tree, on account of the flower-clusters which become white and feathery in fruit; a dye is obtained from it which is called young fustic.

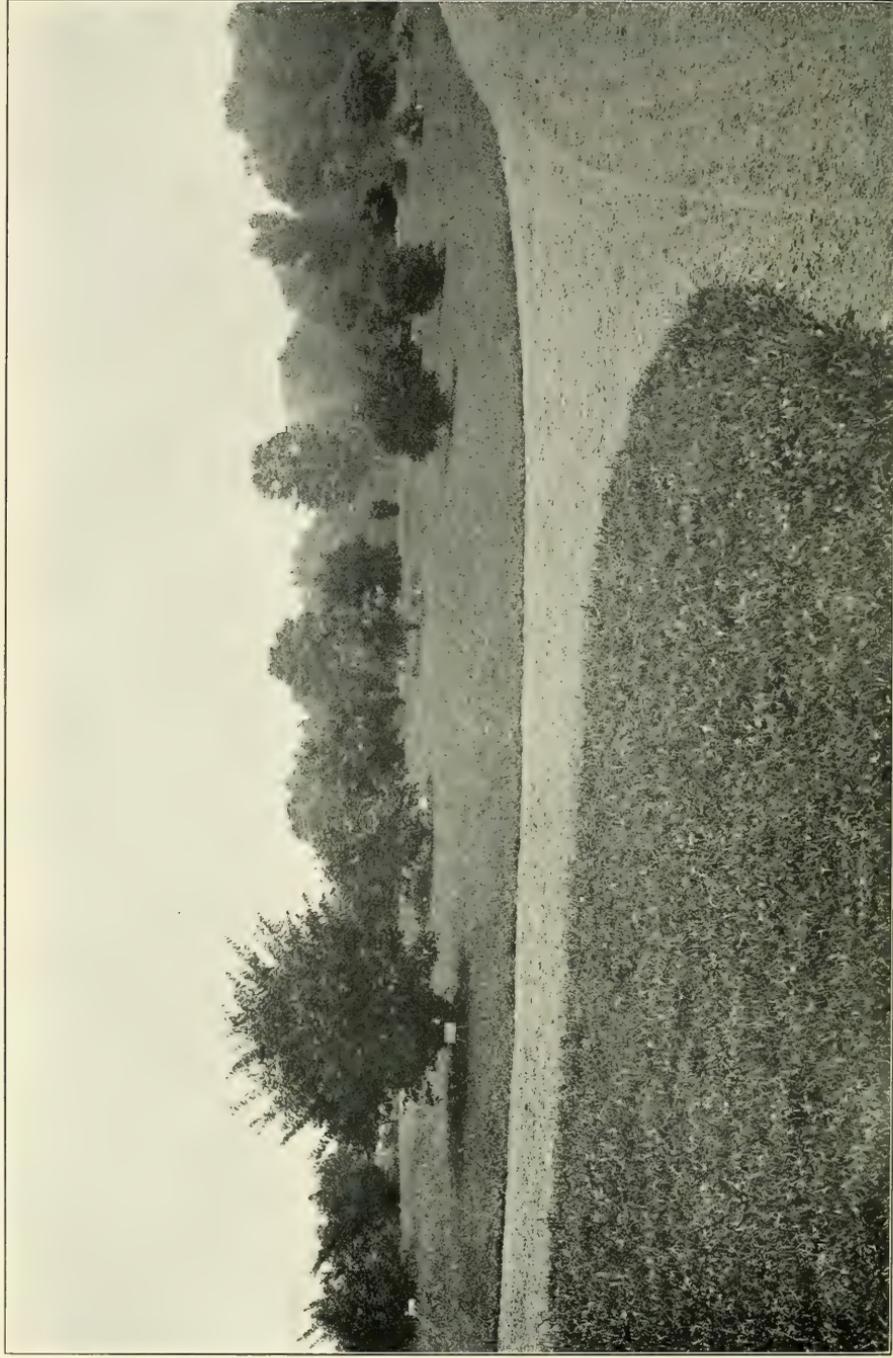
Crossing the transverse path to the triangle, the holly family is on the nearest point, shown by the serrate holly and the crenate holly, both from Japan, and the American holly; the European holly is grown in the conservatories. The Virginia winter-berry, of the eastern United States, bears its bright red berries far into the winter. On the opposite corner of the triangle is the staff-tree family, illustrated by many forms of *Euonymus*; the European staff-tree, the burning-bush of the eastern United States, the winged spindle-tree of eastern Asia and Bunge's spindle-tree of the Amur region are shown. *Pachistima Myrsinites*, from the northwestern United States, is also represented. Crossing the path to the north of the triangle we come to the maple family; most of the maples are trees, so they must be looked for in the arboretum, but here are specimens of the Ginnala maple, from northern China and Japan. Immediately beyond this is the bladder-nut family, represented by species of the bladder-nut (*Staphylea*), both from the New and the Old World. Following the path to the west, we come to the buckeye family, represented here by the small-flowered buckeye, from the southeastern United States; many of the buckeyes and horse-chestnuts are trees, and are grown in the arboretum. Following this is the soapberry family, with the genus *Xanthoceras*, a native of China, as a representative. At some distance from the path to the left is the buckthorn family; the most familiar plant here is the New Jersey tea, or red root, of eastern North America; its leaves were formerly used as a substitute for tea; the jujube-tree, an inhabitant of the Mediterranean region and temperate Asia, is of this family, its edible fruit oval in shape and about the size of a plum, with an acid taste when fresh; the

Dahurian buckthorn, growing wild from central Asia to the Amur region, and the purging buckthorn of Europe, the berries of which are medicinal, are here; from the juice of the ripe fresh berries of the purging buckthorn, mixed with alum, is made the pigment, known as sap-green or bladder green, used by water-color artists. Close to this is the linden family, represented by the genus *Grewia*. The mallow family, further along the path, is represented by specimens of the rose-of-Sharon (*Hibiscus syriacus*), from western Asia, and often found escaped from cultivation in the eastern United States; many herbaceous representatives of this family may be found at the herbaceous grounds. Near the mallow family is the tea family, represented by the mountain *Stuartia*, from the southeastern United States; other members of the tea family, including the tea plant and the common camellia, may be found in the conservatories. Also near the mallows may be found the St. John's-wort shrubs (*Hypericum*), with their showy yellow flowers. Farther on, where the path bends to the left, is the tamarix family, represented by several species of tamarix, Old World plants. Next comes the mezereon family, having as a representative the leather-wood or moose-wood (*Dirca*), of the eastern parts of North America; the name leather-wood refers to the very tough inner bark; the bark is a violent emetic; the daphnes are of this family, and here will be found the garland-flower, the spurge flax, and the Chinese daphne.

Some distance from the path and opposite the Woodlawn Road entrance, is the oleaster family, including several species of oleaster, the buffalo berry and the sea-buckthorn, a native of Europe, the berries of which are acrid and poisonous; the berries of several of the species of oleaster are edible; the buffalo berry, of northwestern North America, is largely eaten by the Indians of that region; the berries of the oriental oleaster, known as Trebizond dates, are made into cakes by the Arabs, after having been dried. Plants of the ginseng family form a group opposite the

same entrance, some of these being quite tropical in aspect; the Japanese angelica-tree, from Japan, is one of these, and another is Maximowicz's acanthopanax, also from Japan; the variegated Chinese angelica-tree, a native of China, is quite ornamental. Beyond this group, and on both sides of the transverse path, is the dogwood family, shown by many species of dogwood or cornel (*Cornus*), from both the Old World and the New; the red-osier dogwood, the kinnikinnik and the paniced dogwood are American representatives; the officinal dogwood comes from Japan and is known there as sandzaki; the dogberry, gater-tree, or hound's-tree, is from Europe and western Asia; its wood is hard and is sometimes made into butchers' skewers and tooth-picks; in France, an oil used for burning and in soap-making is extracted from the black berries. *Benthamia Kousa*, the Japanese flowering dogwood, from China and Japan, is shown in a number of specimens; this is related to our native flowering dogwood, *Cynoxylon floridum*.

Across the path from the dogwoods, at the foot of the steps, may be found the white-alder family. Here are the Japanese sweet-pepper bush and the North American sweet-pepper bushes or white-alders, their fragrant white flowers appearing in August. The heath family is next, represented by many forms of azaleas and rhododendrons; the Japanese *Pieris* is a pretty plant, and another of a related genus, from the southeastern United States, is called mountain fetter-bush; the stagger-bush, of the southeastern United States, is also here. Following the path to the south, we come next to the huckleberries and to the shrubs of the storax family. On the other side of the path is the olive family, which covers a large area, extending along the path for a considerable distance; the olive-tree is the type of this family, and specimens may be found at the conservatories; in the fruticetum are several forms of the golden-bell (*Forsythia*), from China; a number of the privets, including the California privet, so much used for



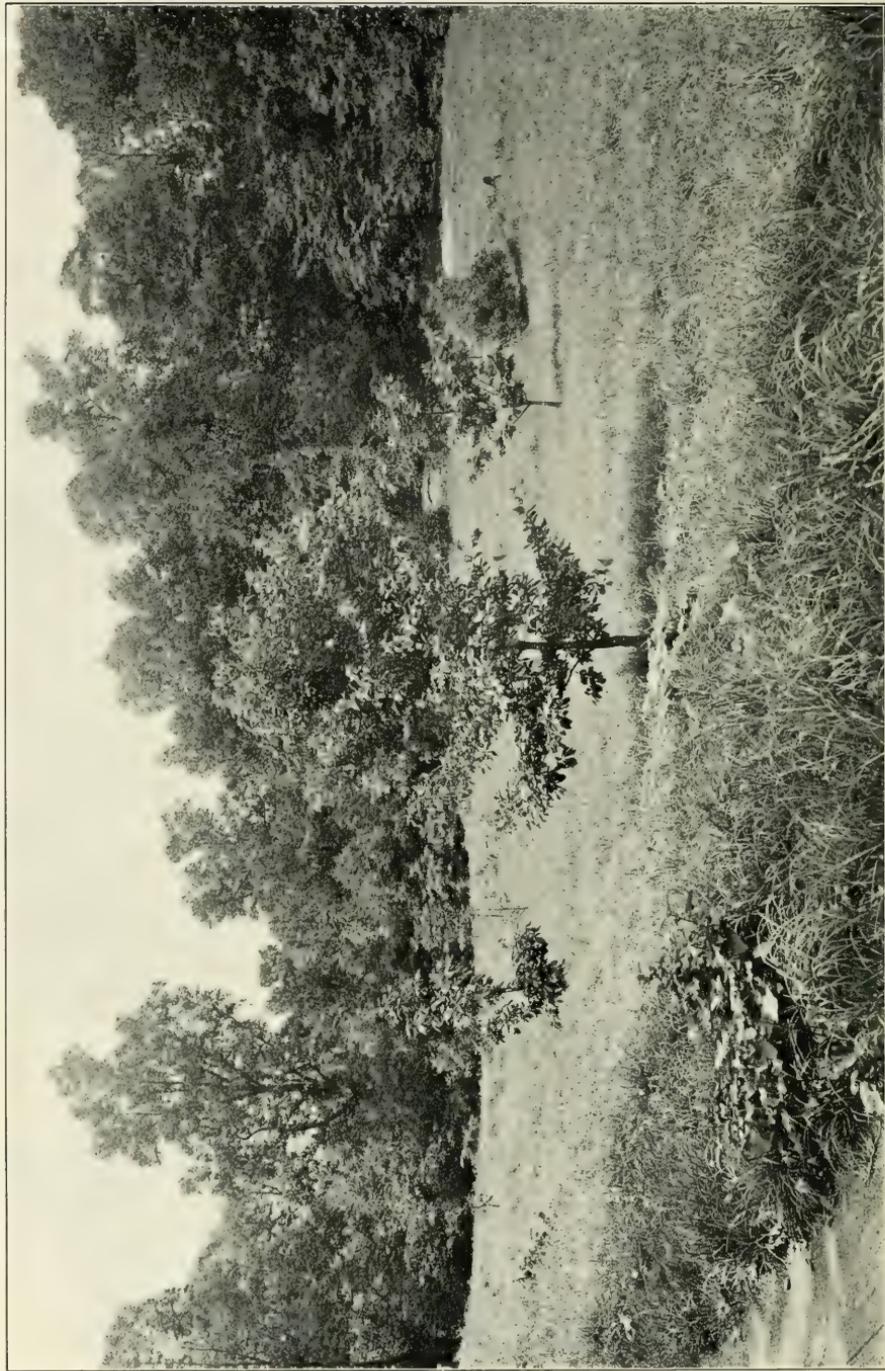
VIEW IN THE FRUITICETUM, OR SHRUB COLLECTION

hedges; a variety of lilacs (*Syringa*), including the Rouen lilac, from China, the Pekin lilac, from southern China, the Himalayan lilac and the common lilac, a native of eastern Europe, so frequently cultivated in gardens, and the *Forestieras*. To the right of the path and following the storax family is the logania family, with species of *Buddleia*, including the showy variable buddleia, from China. Following this is the vervain family, and some of these shrubs are especially attractive in fruit, among them being the purple callicarpa, from China, and the Japanese callicarpa; most attractive is the late-flowering clerodendron, a Chinese plant, whose flowers have a delicious spicy fragrance, much like that of the sweet-pepper bush; the sepals are a beautiful rose color, while the corolla is creamy white; it blooms late in the summer or early fall, when flowers of shrubs are few.

We next come to the potato family, shown here by the matrimony vine, a native of Europe, but often found growing wild, its purple flowers followed by bright red berries; most of the hardy representatives of this family are herbs, so must be sought for in the herbaceous grounds, while many of the woody species, and some of the herbs, are tender, and may be found in the conservatories. The figwort family is shown in a single representative from the northwestern United States, *Pentstemon Scouleri*; many other representatives of this family are in the herbaceous grounds and the conservatories. The succeeding group is the honeysuckle family, to which is allotted a large area, there being many hardy kinds; the viburnums are represented by many species, both from the Old World and the New, such as the cranberry-tree, from north temperate regions, ornamental by its masses of bright red fruit; the dwarf cranberry-tree, an exceedingly compact form, very dense in its growth; the Chinese viburnum, from China and Japan; Siebold's viburnum, from Japan; the Japanese snowball, from China and Japan; the wayfaring tree, from Europe and Asia; and the woolly viburnum, from China and

Japan; among American forms may be mentioned the arrow-wood, Canby's arrow-wood, the black haw or sloe, the withe-rod, and the larger withe-rod with its large bunches of showy fruit. The group of the honeysuckles occupies a position across the path from the viburnums, and here may be found, among others, the fragrant honeysuckle, from China, one of the first to send forth its blossoms richly laden with perfume; Morrow's honeysuckle, from Japan, covered with coral-red fruit in late summer and fall; Standish's honeysuckle, from China; the narrow-leaved Albert honeysuckle, from Turkestan; the blue fly-honeysuckle, from north temperate regions; and the golden-veined honeysuckle, from China and Japan, with the veins richly marked with yellow, or sometimes the whole leaf yellow. Across the transverse path to the south, and overlooking the lake, may be found the weigelas, *Symphoricarpos* and the diervillas; the weigelas are illustrated by many showy forms, flowering in early summer; the showiest *Symphoricarpos* is the snowberry, native of northern North America, laden in autumn with its ivory-white fruit, making it most attractive; the diervillas are represented by two or three species, including the bush honeysuckle, a native of northern North America. The elder-berries (*Sambucus*) are also represented by two or three species. The hybrid abelia will also be found here; its fragrant flowers are borne in great profusion during late summer and early fall; the sepals are deep red-brown and the corolla is white, flushed with rose, making a pleasing combination.

Following the viburnums comes the thistle family. Few of the woody species of this family are hardy in this latitude, but large numbers of the herbaceous species may be found at the herbaceous grounds. As representatives in the fruticetum, we have the groundsel-bush or pencil-tree (*Baccharis*), a native of the southeastern United States, bearing in the fall a profusion of white fruit, making it a most attractive object; and some of the shrubby wormwoods (*Artemisia*) of the Old World.



VIEW IN THE DECIDUOUS ARBORETUM

Salicetum.—The area occupied by this plantation is between the main driveway and the Bronx River, north of the fruticetum, and comprises several acres. Here are brought together moisture-loving willows (*Salix*) and poplars (*Populus*) as a collection apart, many species grown here not being represented in the arboretum and fruticetum. In the corner of the salicetum, next to the driveway, is a group of willows, consisting, in part, of the red-stemmed yellow willow, of horticultural origin, and the Ural purple willow. To the east of this may be found the golden, or yellow willow, of common occurrence in eastern North America, and Bashford's willow, a native of France. Along the west bank of the Bronx River may be found the cottonwood, or Carolina poplar, found wild in eastern North America; and a row of the weeping willow, a native of Asia. At the northern end of the area devoted to this plantation are to be found, among others, the purple willow, a native of Europe; and the black willow, of North America. Many other species are represented in this collection.

6. The Deciduous Arboretum

This plantation extends over much of the garden area east of the Bronx River. The sequence of plant families begins at the southeast corner of the grounds and continues northward to the northern boundary, occupying the easterly ridge and the low grounds adjacent thereto. Here hardy trees are brought together, trees being regarded as woody plants which have a single main stem arising from the ground and not branching until some distance above it. The groups will be referred to in the order of their sequence.

The first is the willow family which occupies the land near the south border, where a collection of willows and poplars may be found. Of these Simon's poplar, from China, is of rapid growth and upright habit, and more graceful than the cottonwood or Carolina poplar; the American aspen, a native of northern North America, the wood of which is largely manufactured into pulp

for the making of paper; in northern British America it is the principal fuel of the Indians, as it burns freely when green and without sparks; the inner bark, which is sweet, is often used by them as a food in early spring. This tree has been of great service in re-foresting large tracts which have been denuded by fire; the long hairy appendages to the seeds enable the wind to carry them far and wide, and as they germinate quickly and the young seedlings grow rapidly in exposed situations, it is admirably adapted to the above purpose, quickly furnishing a covering for the land until more desirable trees may get a foothold. The white or silver-leaf poplar, of Europe and Asia, and Bolle's poplar, a variety of this with lobed leaves and quite ornamental, are here. Another ornamental tree and one frequently used where quick growth is desired, is the eastern cottonwood, or Carolina poplar, common in eastern North America. There also is the Lombardy, or Italian poplar, from Europe and Asia, with its tall spire-like growth. Among the willows are the white willow, from Europe, and the weeping willow, native of Asia, a tree commonly planted for ornamental purposes, and sometimes known as Napoleon's willow. An additional area to the south, east of the long lake, is now being developed for the willow family and the walnut family.

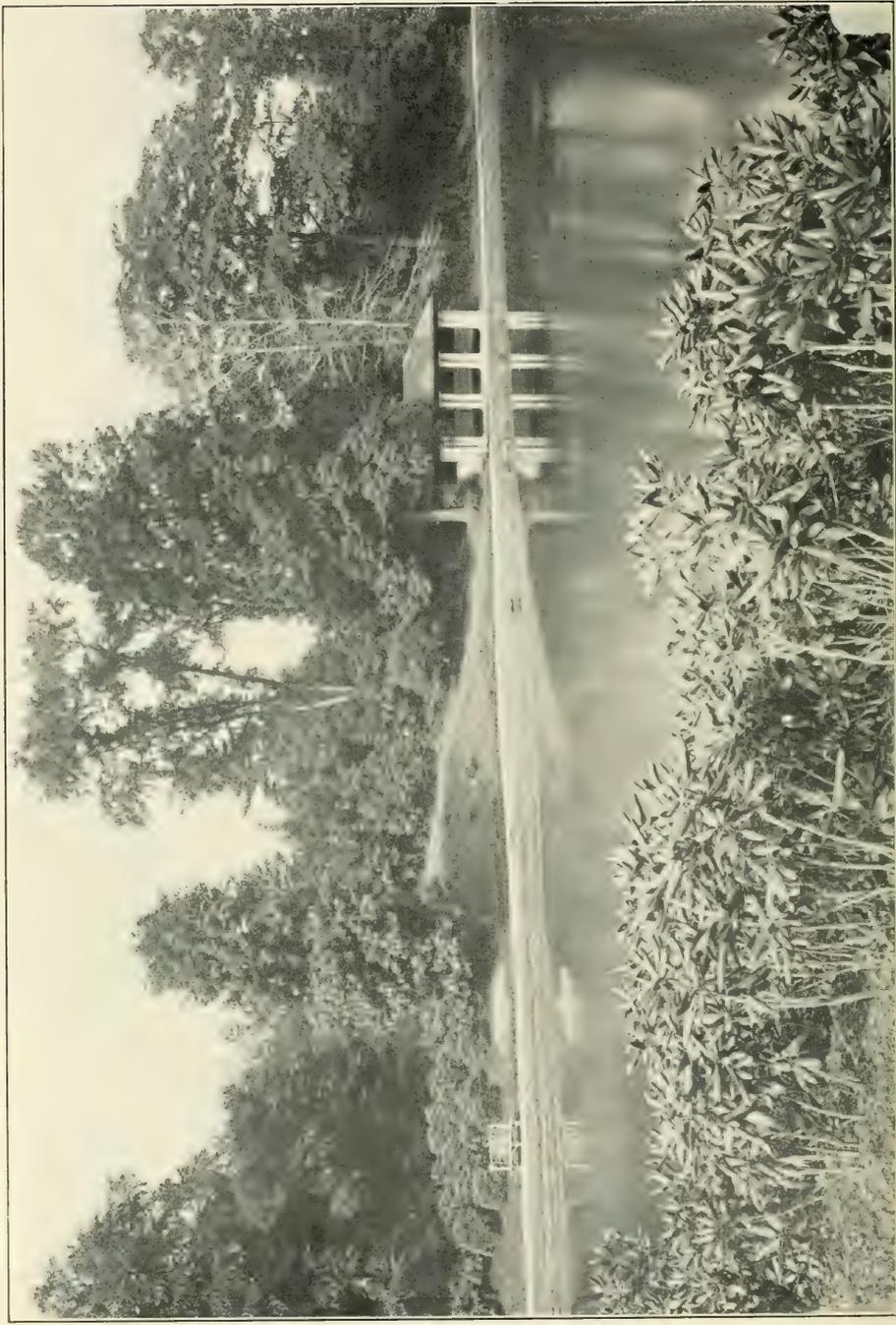
The walnuts and their relatives may be found in the region to the north of the willow family and south of the path. The narrow-winged wing-nut, from China, is here. Of the walnuts (*Juglans*), the English Walnut, native from southeastern Europe to China, produces a most desirable nut, often called Madeira nut; the Romans introduced it into Italy, and from that place as a center its cultivation has spread in all directions, both in the Old World and the New; the nuts form a common article of food in southern Europe; in Europe and northern India an oil, called walnut-oil, used as a substitute for olive-oil, is obtained by subjecting the seed-leaves to pressure. The black walnut and the butternut are both wild elsewhere in the Garden,

and the former is also represented here by small trees. The pecan-nut (*Hicoria Pecan*), wild in the south central United States, is another nut of popular favor, as is also the big shag-bark, or king-nut, of the eastern United States. The water hickory, of the southeastern United States, and the bitter-nut or swamp hickory, of eastern North America, are both represented, while the common shag-bark hickory and the pig-nut grow elsewhere in the grounds.

The birch family is located along the driveway, west and south of the stable, where birches, alders and hornbeams are planted; the European hornbeam is represented. The American hornbeam is common in Bronx Park, and the hop-hornbeam is occasional. Those desiring to study the birches (*Betula*) will find several species available; one of these is the yellow birch which grows wild in eastern North America, and is one of our most valuable timber trees; the wood, on account of its closeness of grain, strength and hardness, is suitable for many purposes. Another is the paper, or canoe, birch, of frequent occurrence in northern North America: the wood of this is preferred to that of any other tree for the manufacture of spools, and is also used in the manufacture of shoe-lasts and pegs; the Indians also make use of its wood in the manufacture of sledges, and from its tough bark they also make canoes and baskets. The river or red birch may be seen here; it is frequent along streams and lakes in the eastern parts of the United States; its wood is used in the manufacture of furniture. The black, or sweet birch is in the collection and this and the poplar-leaved birch are wild elsewhere in the Garden. There is also the European white birch and some of its varieties, and the Alleghany birch and others. The alders are present in several species: the dye alder, of Japan, which becomes a large tree; the Japanese alder, also of Japan; the speckled, or hoary, alder, of north temperate regions; and the European tree alder.

The area devoted to the beech family lies to the westward of that assigned to the birch family; the oaks, the

chestnuts and the beeches belong here. The oaks (*Quercus*) are represented by many species. One of these is the pinnatifid-leaved oak, from Japan, with its odd leaves cut into long linear lobes; it is said to be a form of the toothed oak of Japan. Near by is the rock chestnut oak, of eastern North America; its wood is strong and durable, especially when in contact with the soil, and is therefore of great value for railroad ties and fence posts, and its bark is largely used for tanning. The mossy-cup, or bur oak, also of eastern North America, may be found here; this was discovered by the botanist Michaux in 1795, and is a valuable timber tree, its wood largely used for boat-building, for the manufacture of carriages and agricultural implements, for the interior finish of houses, and, on account of its durability in contact with the soil, for railroad ties. The red oak and the swamp white oak are natives of eastern North America; the latter is also a good timber tree, its wood being used for cabinet work and in various kinds of construction. The Japanese silkworm oak forms a part of this collection; its leaves are much like those of the chestnut, and might easily be mistaken for them; it is often planted in Japan in the silk districts, as its leaves are available as food for the silkworms, whence its name; the Japanese make charcoal from its wood, and from the bark they extract a black dye. The post, or iron oak is a native of the eastern United States. Here may be seen also the sessile-flowered English oak, a native of Europe and western Asia. The large-toothed oak, of Japan, a valued timber tree there, is represented near by; as is also the gland-bearing oak, another Japanese species. The shingle, or laurel oak, of the central parts of the United States, is not of much commercial value, as its wood checks badly in drying; it is sometimes used in making clapboards and shingles. Schneck's red oak comes from the south central parts of the United States. The Turkey oak, of south-eastern Europe and western Asia, is valued in that region on account of its bark which is used in tanning leather.



UPPER LAKE AND LAKESIDE SHELTER

Several hybrid oaks form interesting parts of the collection. The swamp oak, the scarlet oak, the black oak and the white oak are to be seen in large wild specimens elsewhere in the grounds.

The chestnuts (*Castanea*) are represented by the Japanese chestnut, of China and Japan. The American chestnut was in former years common about the grounds, some of the trees being large and of great age. The chestnut blight has destroyed or necessitated the destruction of all of these trees. The beeches (*Fagus*) are located in the north part of the swale at the west side of the oak family reservation. The European beech and its purple-leaved variety may both be found here in small, recently planted trees; there are large specimens of the purple-leaved and weeping varieties of this south of the mansion. Small trees of the American beech are also here, but large wild specimens may be found along the driveways and paths in the vicinity; the wood of the beech takes a high polish and is largely used for furniture, while the nuts are edible. The uses of the European beech are about the same as those of the American.

The elm family, to which belong the elms, the hackberries, or sugarberries and the water-elms, is located on the ridge to the north of the stable. Among the elms (*Ulmus*) to be found here is the Scotch, or Wych elm, a native of Europe and Siberia; the late-flowering elm, growing wild from Tennessee to Alabama; the cork, or rock elm, of northeastern North America; the Chinese elm, of northern China and Japan; and the winged elm, or wahoo, of the southeastern United States. The American elm and the slippery elm are wild in the grounds. The hackberries (*Celtis*) represented are the Georgia hackberry, the dog hackberry, and Small's hackberry, of the southeastern United States; and the American nettle-tree, or sugarberry, of eastern North America. The water-elms are illustrated by the pointed water-elm, a native of Japan. The mulberry family is represented by the osage orange

(*Toxylon*), trees of which may be found to the south of the driveway from the long bridge; it is a native of the central parts of the United States; and by the Russian, red and white mulberries. The cercis-leaf family has for a representative the cercis-leaf, of Japan, located just to the south of the row of large tulip trees east of the Bronx River.

The magnolia collection is planted on the west and south sides of the swale between the two ridges. Fraser's magnolia is one of those to be seen here; it is a native of the mountain woods from Virginia to Florida and Mississippi. The cucumber tree, the white-leaved Japanese magnolia, the umbrella tree, and a number of hybrid forms are other magnolias to be looked for here. Large specimens of the umbrella tree and of the large-leaved umbrella tree will be found at the north end of the herbaceous grounds, on the west side; and still other species at the fruticetum. The tulip-tree is shown by a row of fine wild specimens just to the south of the long bridge over the Bronx River, the largest trees within the grounds of the Garden. This tree is native of the eastern United States and yields a valuable lumber known as yellow poplar or white-wood; the Indians formerly made their canoes from this wood. Four parallel rows of this tree form part of the approach to the museum building. Related to the magnolias is the custard apple family, represented by two specimens of the North American papaw, which will be found at the herbaceous grounds on the west side, near the north end; this is a native of the eastern part of the country, from Ontario and New York to Michigan, Nebraska, Florida and Texas. The laurel family is represented by the sassafras, many trees of which may be found wild in various parts of the Garden. The sweet gum (*Liquidambar*), also wild in the grounds, represents the witch-hazel family.

The plane-trees are to be found just to the west of the elms. Here are specimens of the American plane-tree; it is a native of the eastern United States. On a knoll nearby is a large specimen, native to the grounds, of this



THE MANSION

tree, which is also known as the button-wood and button-ball, and there are many other wild trees along the Bronx River. Specimens of the oriental plane, a native from southeastern Europe to India, will also be found here. This is largely planted as a shade tree in Europe, and is often used in this country for the same purpose. The wood of the American plane, or button-wood, is largely used in the manufacture of boxes for tobacco, for furniture, and for the interior finishing of houses.

The apple family and the plum family are located to the north of the driveway leading to the long bridge. In the apple family may be found some of the tree hawthorns and thorns, including the Washington thorn, a native of the southeastern United States. Following to the west are some of the true apples (*Malus*), among them the Siberian crab-apple, a native of eastern Asia; the cherry-leaved crab-apple, presumably a natural hybrid, originally from Siberia; the American crab-apple, from the eastern United States, the western crab-apple, and Soulard's crab-apple, from the central United States. In the plum family, among others, may be found the rose-bud cherry, a Japanese plant, and a highly decorative species; the ordinary sweet cherry, originally from Europe and western Asia, a delicious fruit, of which there are many horticultural forms.

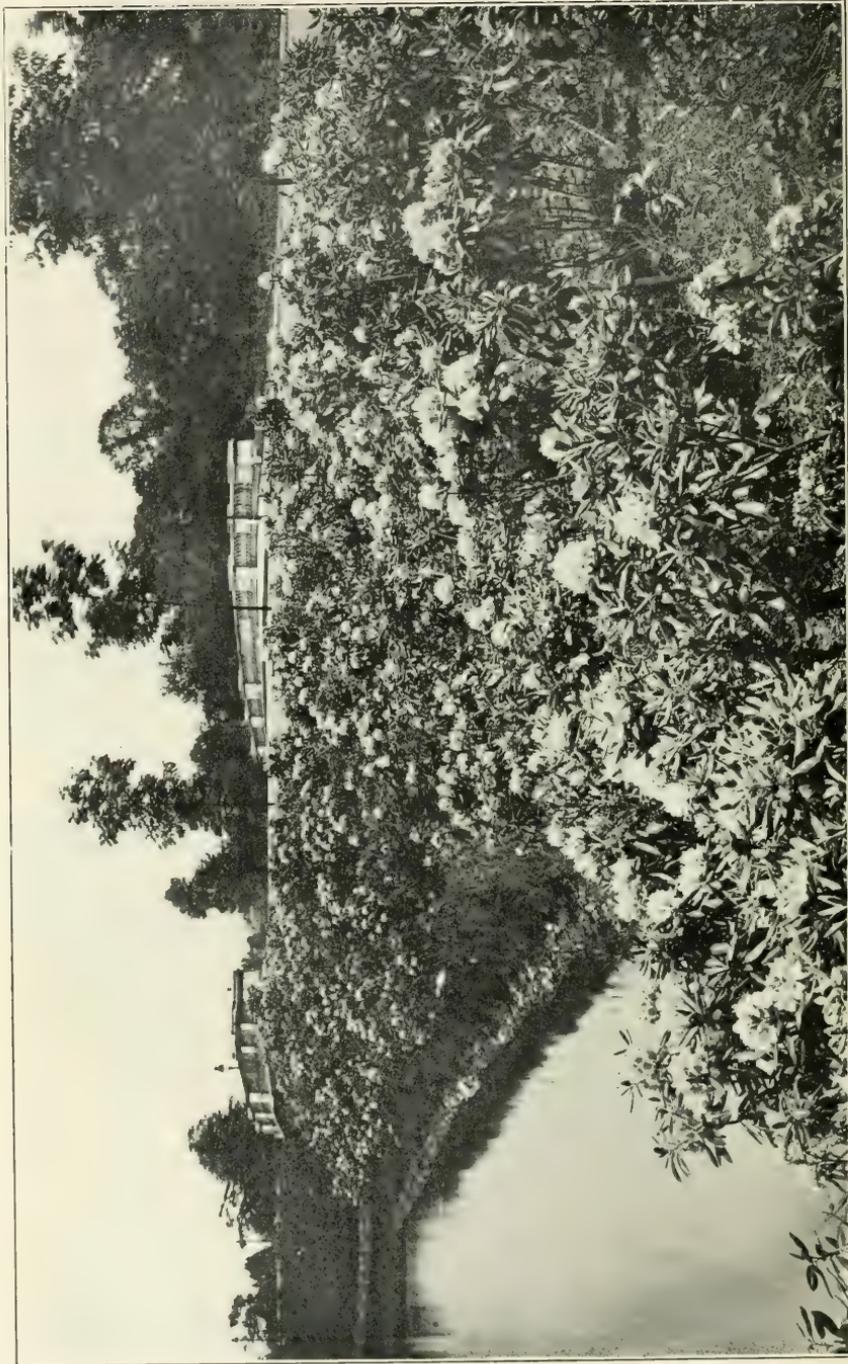
Along the path in the little swale running to the west is a collection of the Japanese flowering cherries which are so highly admired by the Japanese, and this admiration is shared by all who see these specimens at the height of their loveliness which here is about the last week in April or the first in May. There are about one hundred trees in the collection, the blossoms from single to double, and the colors ranging from white to the deepest rose, and one with the blossoms a yellowish green, quite in contrast with the remainder. There is also in this collection a group, occupying the point dividing the paths, of the Japanese weeping cherry; this blossoms two or three weeks earlier than the others; its long drooping branches, clothed with delicate

pink blossoms make of it a graceful and charming object.

Near the eastern end of the long bridge are trees illustrating the senna family, located south of the bridge approach, and the pea family, the true family and the mahogany family on the north side. One of those in the senna family is the honey-locust or three-horned acacia (*Gleditsia*), a native of the southeastern United States; its durability when in contact with the ground makes its wood of especial value for fence posts, for which purpose it is largely used; from China and Japan comes the Japanese locust, also represented here. Another of this family is the Kentucky coffee-tree, in several large and small specimens. One of the representatives of the pea family, from the Amur region, is the Amur yellow-wood (*Maackia*). Another is the locust-tree (*Robinia*), a native of the southeastern United States, but extensively naturalized elsewhere; its wood is hard and close-grained, and is very durable when in contact with ground or with water, so the high value in which it is held for fence posts and for ship-building may be readily understood. The rue family has for representatives the Japanese cork-tree (*Phellodendron*), from Japan, and the Asiatic or Sachalin cork-tree, from northeastern Asia. The mahogany-tree family has a single species represented, the Chinese bastard-cedar, a native of China; the mahogany tree itself, and other representatives of the family, will be found at the conservatories.

On the ridge to the northeast of the apple family, and to the west of conservatory range No. 2, are trees of the ailanthus family, represented by the *Ailanthus*, or tree-of-heaven, a native of China, but extensively naturalized in the eastern parts of the United States, where in some places it has become a nuisance, both on account of its ill-smelling staminate flowers and its habit of freely suckering from the roots.

On the ridge to the west of conservatory range No. 2 are representatives of the maple family. The maples (*Acer*) are represented by a number of species. Perhaps the most im-



RHODODENDRON BANKS, LAKE BRIDGE

portant of these is the sugar, or rock maple, a native of eastern North America, and the principal tree yielding maple sugar and syrup. The sap is usually collected from late in February to early in April; trees from twenty to thirty years old are considered the most productive, and a tree will usually yield in a season from four to six pounds of sugar, some giving less and others much more. This tree is often planted for shade along streets and in parks, its beautiful coloring in the fall enhancing its value for this purpose. Its wood is largely used for making furniture, in ship-building, for tool-handles and for shoe-lasts and pegs. From the southeastern United States comes the white-barked maple, also in the collection. Another tree here is the red maple, ranging throughout eastern North America; its wood is now used in large quantities for the manufacture of furniture of various kinds, for gun-stocks, etc. The striped, or goose-foot maple, sometimes known also as moosewood, of northeastern North America, is a pretty decorative species, especially attractive on account of the beautiful marking of its bark. The box-elder, or ash-leaved maple, native of eastern North America, represents another type with compound leaves. Three Old World representatives are the common European maple, of Europe and western Asia, the sycamore maple, from Europe and the Orient, and the Norway maple, with a number of varieties, also from Europe and the Orient. The sycamore maple is a valuable timber tree in Europe; its wood is used in the manufacture of musical instruments, spoons and other household utensils. Farther north on this ridge may be seen young trees of *Koelreuteria*, the varnish tree, native of China.

In the buckeye family, planted north of conservatory range 2, is the common horse-chestnut (*Aesculus*); for a long time the native country of this tree was unknown, and its home was ascribed by different authors to various lands; it has been pretty well established now that it is indigenous to the mountains of Greece. Another tree here

is the fetid, or Ohio buckeye, of the central United States; its wood, as well as that of some of the other kinds of buckeye, is manufactured into artificial limbs, for which purpose it is highly esteemed; it is also used for wooden-ware and paper pulp. To the north of the buckeye family is the linden family. The American linden, or basswood, found over the eastern parts of North America, is here; it produces a large amount of lumber under the name of whitewood, which is used in the manufacture of wooden-ware, furniture and carriage bodies; it is also largely used in the manufacture of paper pulp. Another species is the white, or silver linden of eastern Europe, and a third, the common European linden.

Next in the sequence comes the ginseng family, represented by several species of aralia, while others will be found at the fruticetum; many other species of this family may be found at the conservatories. West of these is the ebony family, represented by the persimmon or date-plum (*Diospyros*), a native of the southeastern United States; its wood is preferred for the manufacture of shuttles; its fruit contains tannin, which gives it its astringent properties; this fruit, when fully ripe, is eaten in large quantities in the southern states, and is also offered for sale in the markets of the north. Larger trees will be found along the driveway east of the museum.

Further down the hill, west of the persimmon group, is a collection of the flowering dogwood, *Cynoxylon floridum*, both the form with white flower bracts and that with red; the white-flowered kind is common in the woodlands.

Beyond the ginseng family, on the western slope of the hill, is the olive family, represented by many species of the ashes (*Fraxinus*), some of which are useful for timber. The common European ash is to be seen, and among the North American representatives are the green ash; the Texas ash, restricted to that state; the Biltmore ash, from Pennsylvania to Georgia; the white ash and the red ash are com-



WATERFALL IN THE HEMLOCK FOREST

mon. Following to the north is the figwort family, represented by *Paulownia*, a native of Japan. Terminating the sequence is the trumpet-creeper family, represented by species of *Catalpa*; among these is the Indian bean, a native of woods in the Gulf States, and Kaempfer's catalpa, from China.

7. Flower Gardens

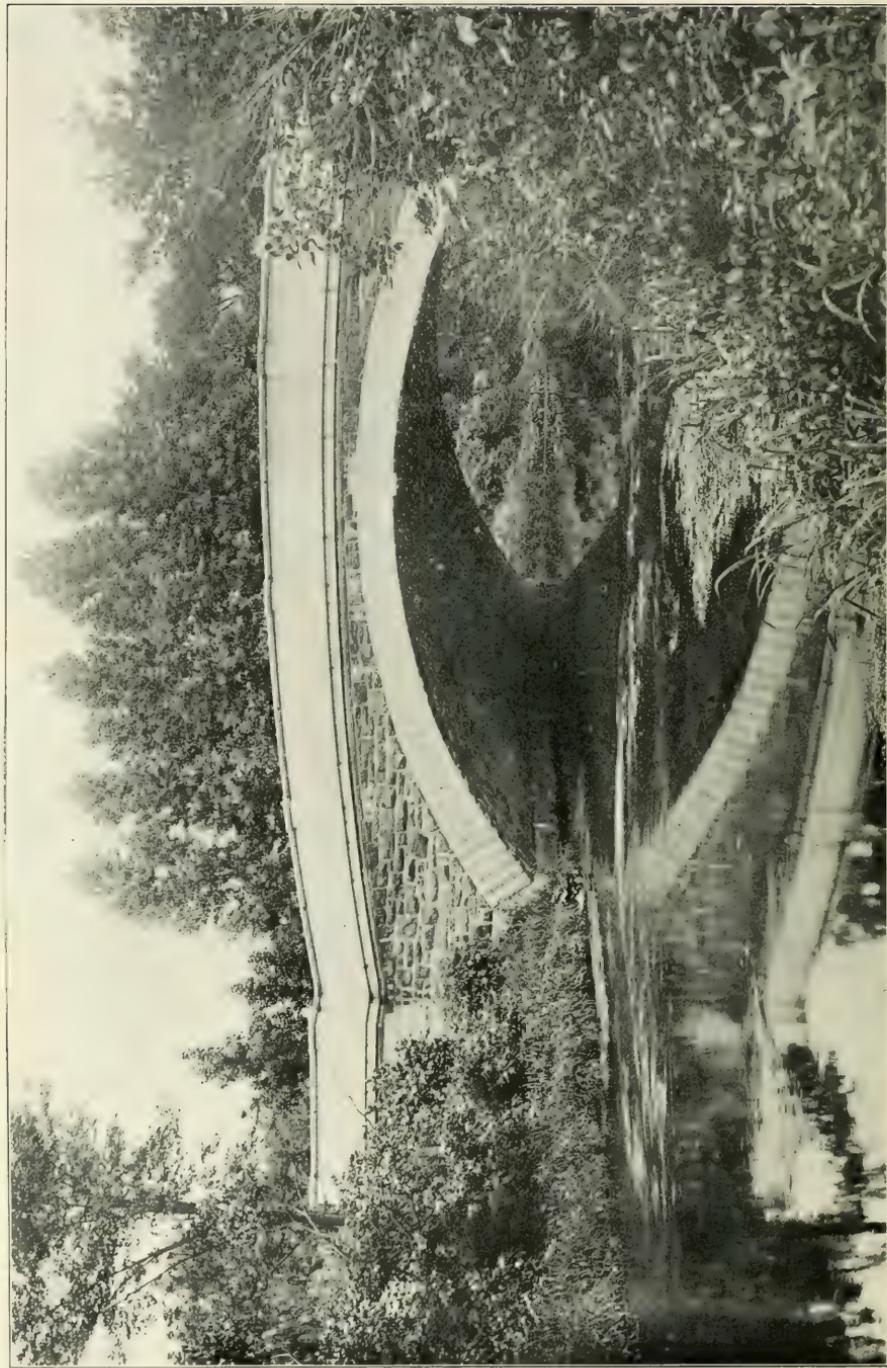
Collections of herbaceous plants, useful for horticulture, will be found along the west border from near the Mosholu bridge to the Elevated Railway approach; along the path leading from this approach to conservatory range I and in the beds in the vicinity of this range; at the iris garden; and at the water garden. Something of decorative value is always to be found in these collections, from the appearance of the early flowering bulbs and other harbingers of spring to the arrival of the chrysanthemums in the fall. The plants are plainly labeled, so that the collections may be intelligently studied. If one is interested in establishing a home garden, notes may be made here of such plants as appeal to the individual, and any color scheme for any period may be thus arranged for. It is not the purpose in these collections to develop any special color scheme, but to bring to the attention of the public as many different kinds as possible of herbaceous plants which may be used in the developing of individual ideas. Many other kinds of herbaceous plants which may be used for decorative purposes may be seen at the herbaceous garden.

The flower beds at conservatory range I are on the north side in two series numbered from west to east. One series is of seven beds, and the other is at the base of the terrace on which the conservatory stands, paralleling it on three sides. In these beds and in those on both sides of the path from the Elevated Railway approach to the conservatories are grown many kinds of bulbs, such as snowdrops, glory-of-the-snow, squills, spring crocuses, early tulips, cottage tulips, Darwin tulips, daffodils, poet's narcissus, snowflakes, lilies and fall crocuses. All bulbs have a resting period,

their foliage disappearing at this time, leaving bare spots in the flower garden. To avoid this, annuals, or greenhouse plants raised from cuttings, are provided. These are sown or planted in time to follow the bulbs, thus giving a succession of flowers for the summer and fall. In addition to the bulbs there are many other kinds of herbaceous perennials here.

Bed no. 11, located at the foot of the east terrace, is devoted to roses. This collection was established in the spring of 1913. The bed is about 250 feet long and 8 feet wide. There are over 400 bushes, representing about 140 kinds, including hybrid perpetuals, hybrid teas, teas, baby rambles, moss-roses and others. The two rear rows contain hybrid perpetuals, and a few other kinds, the two front rows comprising hybrid teas and teas.

The iris garden at the southwest corner of the grounds was established in the spring of 1916. In front of a background of conifers and deciduous shrubs is a border 10 feet wide. The rear portion of this border, with an occasional approach to the front in places, is given over to irises, which may be had in flower, by proper selection of kinds, from early spring to the early part of July. The first to bloom are some of the dwarf forms, such as *Iris pumila* and *I. cristata*. Then come those of the rhizomatous type, with creeping rootstocks, such as *Iris germanica*, *I. pallida*, *I. sambucina*, and many others. These are followed by the Siberian irises, and these in turn by the Japanese irises, of which there are many beautiful color forms. If irises alone are used, a garden of this kind is devoid of flowers after the middle of July, and there are but few irises which appear early in the spring. To avoid this difficulty it is best to plant with the irises spring flowering bulbs, which will give an abundance of color at that time of the year, following these, as they go out of flower, with annuals, which will carry the flowering period through the summer and into the fall. The persistent foliage of the irises, often of a gray green, offers a suitable background for many annuals.



NORTH BRIDGE

The water garden is situated northeast of the museum building between the lake bridge and the Bronx River. An attractive display of hardy water-lilies, many of them Marliac hybrids, may be seen here from June until autumn; while the borders of the lake are planted with a variety of water-loving herbaceous plants and shrubs.

LAKESIDE SHELTER

A concrete shelter-house stands by the path on the southwestern side of the upper lake, which lies just west of the water garden. The southern and eastern banks of this lake are decorated with masses of rhododendrons, mountain laurel, and other shrubs and trees.

8. The Mansion

This large stone house, situated on the high eastern bank of the Bronx River above the waterfall, came to the use of the Garden with the tract of about 140 acres added by the city to the reservation in 1915. At that time it was much out of repair, but considerable work has since been done upon it. The basement is used for shops for storage; the Bronx Society of Arts and Sciences has occupied a part of the building for several years, having museum collections on both the first and second floors as well as the use of a room for its Secretary; the Horticultural Society of New York has been given office room on the second floor; some of the laboratories of the Garden are located here; and part of the first floor has been fitted up for board rooms.

9. Decorative Hardy Collections

Many collections of this nature will be found in various parts of the grounds. They consist of trees and shrubs, both deciduous and evergreen, and of herbaceous plants.

Along the driveways and paths will be found many kinds of deciduous trees, and in the arboretum many other kinds may be studied.

Groups of deciduous shrubs will also be found in many places along the roads and paths, and in the fruticetum, where these are arranged in families, the decorative groups are in close proximity to the families to which they belong. In the fruticetum will also be found a number of evergreen shrubs. Other places where the decorative value of shrubs may be studied are: along the west border, from the Woodlawn Bridge south to the approach to the elevated railroad, and at the foot of and paralleling this approach; along the south border; and in the beds in the vicinity of conservatory range 1. Evergreen shrubs, or small trees which may be used in the same manner as shrubs, are divided into two groups, those with broad leaves, such as the rhododendron, known as broad-leaved evergreens, and those with narrow leaves, sometimes like needles, such as pines, hemlocks, spruces, firs, and yews, known under the general term of coniferous evergreens. The rhododendron is one of the most popular of the broad-leaved evergreens. Collections of rhododendrons may be seen on the east and south banks of the upper lake, just behind the museum building; at the west end of the Boulder Bridge; in front of the fountain at the museum building; and on the north side of conservatory range 1. One of the best broad-leaved evergreens for this latitude is the Japanese holly, *Ilex crenata*, fine examples of which may be found at the foot of the approach to the museum building, and others in some of the beds in the vicinity of conservatory range 1 and at the mansion.

Coniferous evergreens, as individual specimens, may best be studied in the pinetum. Groups of these plants, used in a decorative way, may be found at the foot of the Woodlawn Bridge approach; at the fountain in front of the museum building; at the foot of the museum approach; at the west end of the Long Bridge; and in the beds at the foot of the terrace at conservatory range 1, and in the other beds to the north of the same range. As examples of the mixed planting of deciduous shrubs and of various ever-



BOULDER BRIDGE

greens, beds nos. 1 to 7 at conservatory range 1 and the border screen of the Iris garden may be cited as examples.

10. The Hemlock Forest

The forest of Canadian hemlock spruce along the Bronx River, within the portion of Bronx Park set apart for the New York Botanical Garden, is one of the most noteworthy natural features of the Borough of The Bronx, and has been characterized by a distinguished citizen as "the most precious natural possession of the city of New York."

This forest exists in the northern part of Bronx Park on the banks of the river and their contiguous hills; its greater area is on the western side of the stream, but it occupies a considerable space on the eastern side above the mansion and below the boulder bridge. The area west of the river extends from just above this bridge down stream to a point nearly opposite the old Lorillard snuff mill, and is the part commonly designated "Hemlock Grove." Its total length along the river is approximately 3,000 feet; its greatest width, 900 feet, is at a point on the river about 700 feet above the waterfall at the mansion. The total area occupied by the trees on both sides of the river is between thirty-five and forty acres.

While this area is mostly covered by the hemlock spruces, and although they form its predominant vegetation, other trees are by no means lacking; beech, ash, sweet birch, red maple, hickories, oaks, dogwood, tulip-tree and other trees occur, and their foliage protects the hemlocks from the sun in summer to a very considerable extent; there are no coniferous trees other than the hemlock, however, within the forest proper. The shade is too dense for the existence of much low vegetation, and this is also unable to grow at all vigorously in the soil formed largely of the decaying resinous hemlock leaves; it is only in open places left by the occasional uprooting of a tree or trees by gales that we see any considerable number of shrubs or herbaceous plants, their seeds brought into the forest by wind or by birds. In

fact, the floor of the forest is characteristically devoid of vegetation, a feature shown by other forests of hemlock situated further north. The contrast in passing from the hemlock woods to the contiguous hardwood area which borders them to the west and north, toward the museum building and the herbaceous grounds, is at once apparent, for here we see a luxuriant growth of shrubs and of herbs, including many of our most interesting wild flowers.

11. The Gorge of the Bronx River

The gorge of the Bronx River extends from the boulder bridge at the north end of the hemlock forest southward for about a mile, nearly to Pelham Avenue, and is a most beautiful and picturesque natural feature, besides being of great geological significance. Its depth from the summits of the hills on both sides averages nearly 75 feet, and its sides below the foot-bridge at the mansion are nearly vertical rock faces. The hills on both sides are heavily wooded with hemlock spruces and other trees. In the upper part of the gorge the Bronx flows slowly, being held back by the dam forming the water-fall at the mansion, and the elevation of its surface is only a few inches higher at the boulder bridge, than it is at the fall; after plunging over the dam, however, the river runs in its unobstructed natural channel with all the appearance of a mountain stream, which at high water is exceedingly beautiful.

12. North Meadows and River Woods

The Bronx River enters the northern end of the Garden from Williamsbridge and flows as a slow stream southward to the water-fall at the mansion, its surface being nearly level throughout this distance. It is spanned just inside the northern boundary of the Garden by a concrete-steel arched bridge with granite copings, which carries the main park driveway across it near the Newell Avenue entrance. The entire northern end of the Garden is formed of the flood plain of the Bronx River, consisting largely of grassy



BRONX RIVER ABOVE THE LINNAEAN BRIDGE

meadows and marshes which at average flow of the stream are several feet above its surface, but which at flood time are occasionally submerged for short periods, the whole valley being a very interesting illustration of the behavior of a small stream with a large water-shed at and about its sources. Considerable areas of the marshy land have already been reclaimed by filling, and by the lowering of the dam forming the water-fall at the mansion; the general plan contemplates a much further reduction in the amount of marshy ground, and a further lowering and deepening of the river by dredging, in order to take off freshets with greater rapidity. A part of this flood plain is occupied by the plantations of willows and poplars already described, and these will be considerably extended, but large areas of meadow will be left in their natural condition.

South of these open meadows, the valley of the river is much narrower and is occupied by several acres of characteristic river woods, containing a considerable variety of native trees and shrubs, extending south as far as the long driveway bridge near the northern end of the hemlock forest.

13. Deciduous Woodlands

The natural deciduous woodlands of the reservation are, collectively, over 40 acres in area, mostly in the central and southern portions of the tract, where they occupy rocky ridges and some of the valleys between these ridges. Along the Bronx River, from the boulder bridge north to the north meadows, are several acres of river woods, subject to overflow at freshet periods. The woodlands contain many species of native trees and a much greater number of kinds of native shrubs and herbaceous plants; the undergrowth is, locally, very dense. They are typical illustrations of forests of our part of the country, and are treated and protected as such. Dead and decrepit trees are removed and dead branches pruned off from time to time; where necessary, young trees are planted to replace those cut out; the woods are patrolled to guard against forest fires. All

available firewood obtained is burned in the heating plants of the smaller buildings, and the use of coal is thus reduced. In order to keep these woodland tracts as typical illustrations of eastern United States forests, no extraneous plants have been brought into them, except in one small area on a bank just east of the fruticetum, where many herbaceous woodland species not native of the region have been planted.

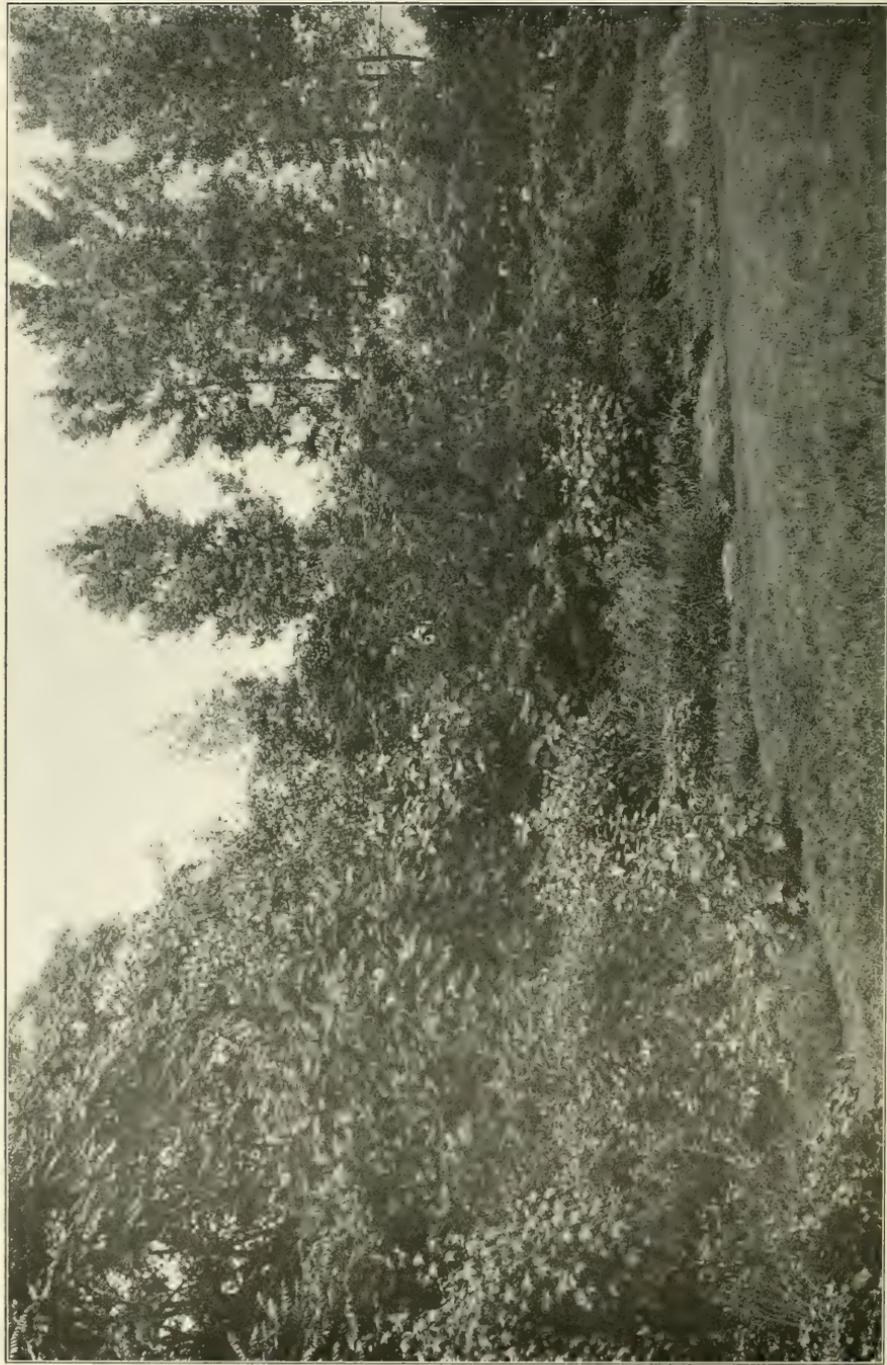
14. Park Features

The whole plan of the development of the Garden has been designed in such a manner as to include all the features of a public park, and it has been carried out in close cooperation with successive park commissioners and engineers of the Borough of the Bronx. The grounds are open to the public every day in the year without any charge whatever. An elaborate series of driveways provides several miles of Telford-Macadam roads, most of which are now constructed with suitable entrances at ten points as follows:

1. Mosholu Parkway. 2. Bedford Park Avenue. 3. Southern Boulevard. 4. Iris Garden. 5. Linnaean Bridge. 6. Mansion Approach. 7. Arboretum entrance (not yet completed). 8. Allerton Avenue. 9. Bronx River Parkway. 10. Woodlawn Road.

Paths located so as to lead to all the principal features are included in the plan, with an aggregate length of over fifteen miles and approximately three-fourths of this system has already been built, and there are several miles of forest trails.

All the roads and paths have been located so as to do no damage to the natural features of the grounds, particular care having been taken to save all possible standing trees and to avoid disturbing natural slopes except in the immediate neighborhood of the large buildings, where considerable grading has been necessary, but even here the study has been to adjust the new surfaces so that they shall merge imperceptibly into the original ones. Ornamental masonry retaining walls, made necessary by the grades of the roadways, have been built at the Mosholu Parkway



A PART OF THE BORDER SCREEN

entrance, at the Woodlawn road entrance, and at the approach to the Elevated Railway station, and vines have been planted at the bases of these walls which partly clothe them with foliage. The Bronx Boulevard, bounding the Garden to the east, is supported along part of its length by a high rubble stone retaining wall.

The plan of the driveway and path systems called for the construction of six bridges; three of these, first, the lake bridge, crossing the valley of the lakes near the museum building; second, the long bridge, which carries the driveway across the valley of the Bronx River north of the hemlock forest; and, third, the upper bridge which crosses the Bronx River at the northern end of the Garden, have been carried out in masonry arches from designs by Mr. John R. Brinley, landscape engineer of the Garden. A unique boulder foot-bridge of five arches, just at the northern end of the hemlock forest was built from designs by the same engineer. The concrete-steel bridge spanning the gorge of the Bronx below the waterfall was built by the Park Department; and the sixth bridge in the plan is a foot-bridge, temporarily built of wood, ultimately designed in concrete, crossing the Bronx River in the north meadows.

The bridge dedicated to Linnaeus, which carries the Pelham Parkway across the Bronx, is appropriately located between the Botanical Garden and the Zoological Park.

The park treatment further contemplates the planting of shade trees where these are needed along the driveways, and much of this has been done, a great many kinds of trees having been used, and many shrub plantations have been set out, especially at roadway and path intersections, utilizing considerable numbers of the same kinds of shrubs at different points.

The drainage of the grounds has been carried out in accordance with a well-studied original plan, which provides outlets for the surface drainage for the most part either into the lakes or into the river, only a small portion of it being taken into the sewers; only a small portion of the drainage system still remains to be built.

The water supply has also been constructed in accordance with the general plan and the system has been extended from year to year as the development of the grounds proceeded.

The general planting plan includes provision for partially surrounding the grounds, except at entrances, with border screens. This planting has already been accomplished along the western and northern boundaries, and partly along the southern and eastern boundaries. These screens are composed of a very great variety of trees and shrubs, variously grouped, and average about fifty feet in width.

A feature of this border screen is an old-fashioned flower border, composed of herbaceous plants in large variety, which extends from the 200th Street, or Bedford Park Avenue, entrance northward to the New York Central Railway Station and thence to the Mosholu Parkway entrance, and there is a similar plantation at the Elevated Railway station; here herbaceous perennials are massed in front of a belt of flowering shrubs which in turn are backed by the trees of the border screen, and so selected that some of them are in bloom throughout the season. Among the plants used in this old-fashioned flower border are daffodils, crocuses, irises, phloxes, paeonies, rose mallows, sun-flowers, cone-flowers, coreopsis, columbines and many others.

Docentry

In order to provide a method for viewing the collections under guidance, an aid leaves the front door of the Museum Building every week-day afternoon at 3 o'clock, to escort all who may wish to accompany him. The routes are as follows:

Monday: Hemlock Forest, Mansion, and Herbaceous Garden. Tuesday: Pinetum. Wednesday: Fruticetum and North Meadows. Thursday: Deciduous Arboretum, Nurseries and Propagating Houses, and Public Conservatories, Range 2. Friday: Public Conservatories, Range 1. Saturday: Museums.



DOCENTRY

Rules

1. The picking of flowers, leaves, fruits, nuts, or the breaking of branches of any plants, either wild or cultivated, the uprooting of plants of any kind, the defacing of trees, and the carrying of flowers, fruits or plants into or from the grounds of the Garden, are prohibited, except by written permission of the Director-in-Chief of the Garden.

2. Leaving or depositing paper, boxes, glass or rubbish of any kind within the grounds of the Garden is forbidden.

3. Dogs are not allowed within the limits of the Garden except in leash.

4. It is forbidden to take fish from within the Garden, or to molest in any way squirrels, birds, snakes, frogs, toads, turtles or any other wild animals.

5. Throwing stones or other missiles, playing ball, football, tennis, or other game is prohibited.

6. It is forbidden to offer for sale food, candy, newspapers, books, tobacco, beverages, flowers or any other objects, without written permission from the Director-in-Chief and the Commissioner of Parks for the Borough of the Bronx.

7. Boating or rafting on the ponds, lakes and streams is forbidden.

8. Trucking, or the driving of business wagons of any kind, is forbidden on the roads of the Garden, except on those designated for such purposes.

9. It is forbidden to accept or solicit passengers for any cab, carriage, or other conveyance, at any point within the grounds of the Garden without written permission from the Director-in-Chief of the Garden and the Commissioner of Parks for the Borough of the Bronx.

10. Visitors are not allowed within the Garden after eleven o'clock at night nor before six o'clock in the morning except upon driveways and paths designated for their use between those hours.

The Garden is also protected by all city ordinances referring to the Park System.

EXPLANATION OF MAP

- | | |
|-----------------------------------|--------------------------------------|
| 1. Public Conservatories, Range 1 | 30. Woodlawn Road Entrance |
| 2. Water-lily Tanks | 31. Salicetum |
| 3. Elevated Railway Station | 32. North Bridge |
| 4. Power House No. 1 | 33. Bronx River |
| 5. Bedford Park Entrance | 34. River Woodlands |
| 6. Botanical Garden Station | 35. North Meadows |
| 7. Mosholu Parkway Entrance | 36. Bronx River Parkway Entrance |
| 8. Museum Building | 37. Deciduous Arboretum |
| 9. Pinetum | 38. Power House No. 2 |
| 10. Flower Gardens | 39. Public Conservatories, Range 2 |
| 11. Southern Boulevard Entrance | 40. Allerton Avenue Entrance |
| 12. Herbaceous Garden | 41. Stable |
| 13. Pergola | 42. Propagating Houses |
| 14. Morphological Garden | 43. Nursery and Experimental Gardens |
| 15. Economic Garden | 44. Arboretum Entrance |
| 16. Viticetum | 45. Long Lake |
| 17. Deciduous Woodlands | 46. Rose Garden |
| 18. Hemlock Forest | 47. Mansion |
| 19. Gorge of the Bronx River | 48. Park Department Barn |
| 20. Gorge Bridge | 49. Park Department Band Stand |
| 21. Waterfall | 50. Park Department Shop |
| 22. Boulder Bridge | 51. Park Department Greenhouses |
| 23. Long Bridge | 52. Picnic Grounds |
| 24. Lower Lake | 53. Mansion Entrance |
| 25. Water Garden | 54. Linnaean Bridge |
| 26. Lake Bridge | 55. Linnaean Bridge Entrance |
| 27. Upper Lake | 56. Iris Garden Entrance |
| 28. Lakeside Shelter-house | 57. Iris Garden |
| 29. Fruticetum | 58. White Pine Plantation |

GENERAL PLAN

OF

THE NEW YORK BOTANICAL GARDEN

1916



New York Botanical Garden Library



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