New York Botanical Garden

Bronx Park

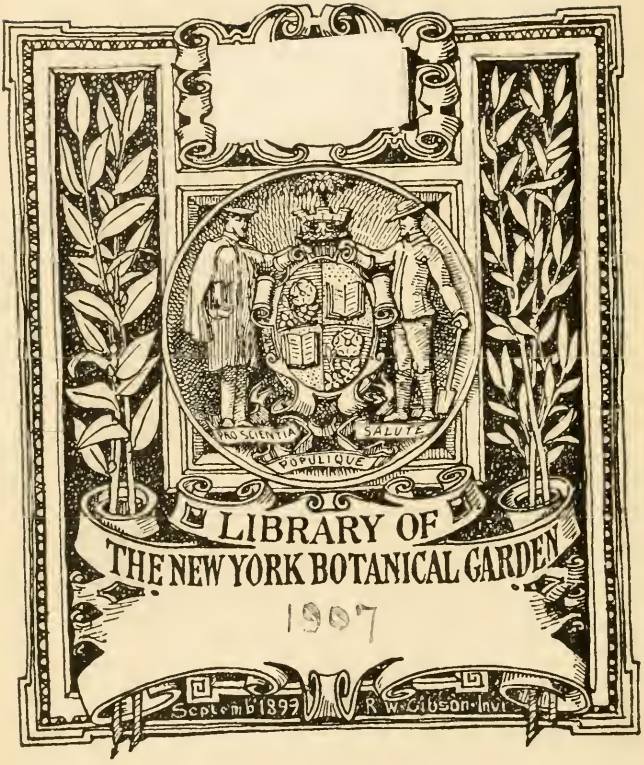
Descriptive Guide

to the

Grounds, Buildings and Collections

NEW YORK
January, 1907

Price, 25 Cents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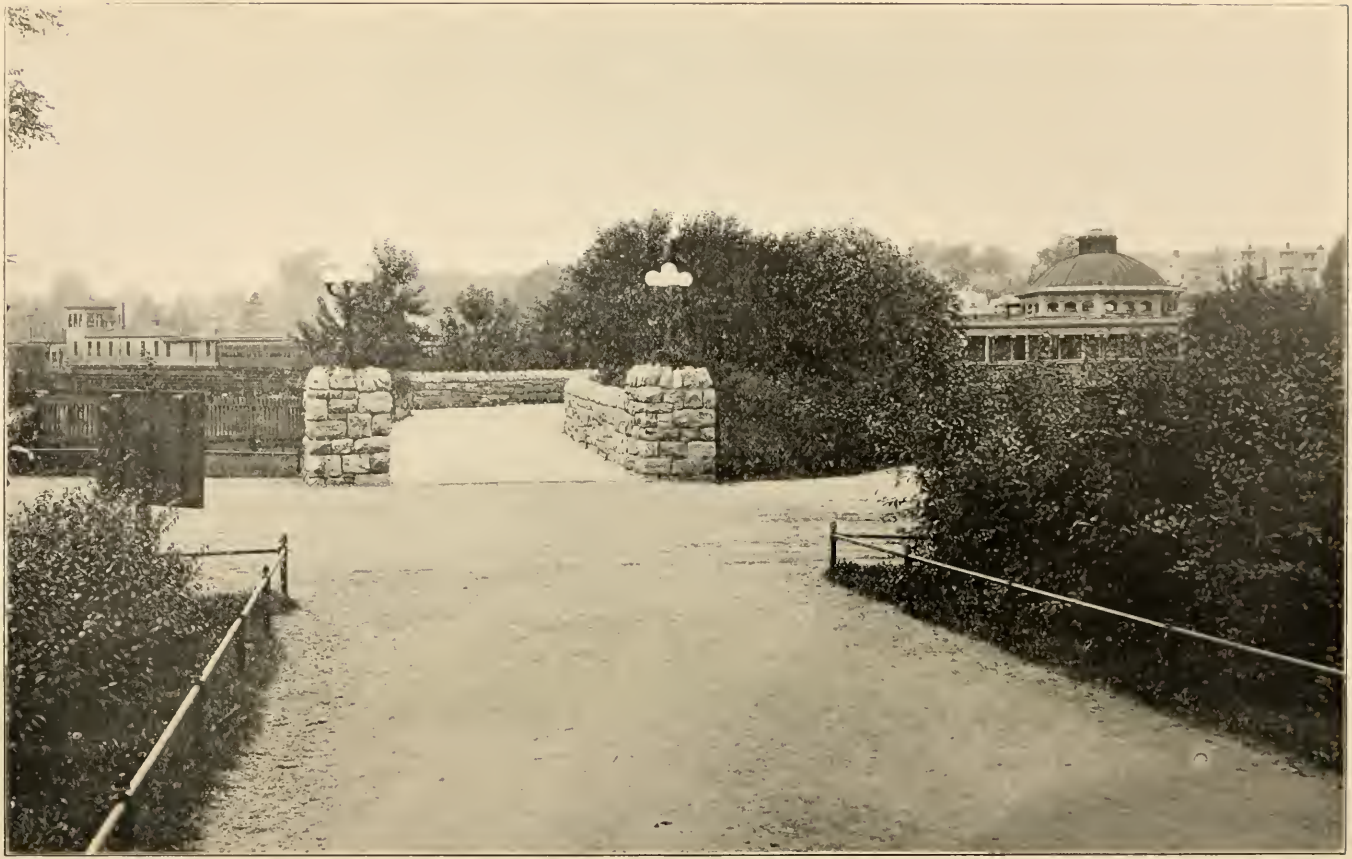

APPROACH TO ELEVATED RAILWAY STATION

NEW YORK BOTANICAL GARDEN

BRONX PARK

Descriptive Guide

TO THE

Grounds, Buildings and Collections

Reprinted from the
BULLETIN OF THE NEW YORK BOTANICAL GARDEN, No. 16,
with an index added

NEW YORK
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DESCRIPTIVE GUIDE TO THE GROUNDS, BUILDINGS AND COLLECTIONS

Location

The New York Botanical Garden is situated in the northern end of Bronx Park, the reservation including about 250 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 Bronx Park 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 Kingsbridge Road, and on Tremont Avenue, and also with the line to Yonkers.

5. By trolley line 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.

6. 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 Bleecker Street 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.

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

The general plan of development includes:

1. The largest conservatories in America, for the cultivation of plants of tropical regions, located near the entrance at the elevated railway station. A second very large greenhouse is planned for construction near the Bleecker Street entrance on the eastern side of the Garden.

2. The largest botanical museum in the world, located near the Bronx Park 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, which is being brought together on the hills and slopes on all sides of the great greenhouse, and in the space between that house and the museum building.

NEW YORK CENTRAL RAILROAD STATION

4. The herbaceous grounds, situated in a valley east of the great greenhouse 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 being 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 the entire eastern side of the grounds from south to north.

In addition to these artificial features, the following natural features are of special interest:

7. The hemlock grove, a forest 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.

8. The gorge of the Bronx River, extending south from the waterfall at the Lorillard Mansion, along the edge of the hemlock grove to the southern boundary of the Garden.

9. 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.

1. The Conservatories

This great glass-house 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 those native in the southern United States there are noteworthy specimens of the palmetto (*Sabal Palmetto*), and of two Florida thatch-palms (*Thrinax*). The characteristic fan-palm of the California desert, *Neowashingtonia robusta*, is illustrated by two fine plants. 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 is now 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. Central and South American palms are illustrated by the delicate *Cocos Weddelliana* from Brazil, by the silvertop palm (*Coccothrinax argentea*), 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, by the very broad-leaved *Phoenicophorium sechellarum*, native of the Seychelles Islands, and by numerous other large species from the Pacific islands. Related to the palms and shown by numerous specimens in this house No. 1, we find a number of species of the cyclanthus family, the most conspicuous being the Panama hat plant (*Carludovica palmata*), from the young leaves of which the costly Panama hats are made. The sago palms, or cycads, are illustrated here by large specimens of *Cycas revoluta* from Japan, by *Cycas circinalis* from the Molucca Islands, by *Cycas media* from Australia, by the small coonties from Florida, and by the Kafir bread (*Encephalartos*), two species from Africa; the stems and trunks of plants of this family contain much starch, which is extracted, in the countries where they grow, by crushing and

washing, and passes into commerce under the name of sago starch. 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 Asia its stems are put to a great variety of uses in construction, for water pipes and for various utensils.

House No. 2 contains specimens of the aroids, on the middle bench, represented by a large number of different species. 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 (*Richardia 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 taras. Plants of the same family, too large for exhibition in this house No. 2, will be found at the western side of house No. 4. The side benches of this house are occupied by plants of the pineapple family. These are mostly plants which live on the trunks and branches of trees in tropical forests, and are therefore called epiphytes, signifying plants growing up on 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. Hanging from the rafters on both sides of this house will be found baskets containing the East Indian pitcher-plants, *Nepenthes;* these 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 glutinous 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.

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 caribaca* from the sandy coasts of southern Florida and 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 southern bench; this name maguey is also applied in parts of the West Indies to species of *Agave*, which will be found in house No. 6.

Numerous representatives of the lily family, especially of the genus *Dracaena*, will be found on the south bench, and these are much used for ornamental planting in the tropics; here also are plants of the genus *Sansevieria*, the bow-string hemps of Africa; a valuable tough fiber is derived from their leaves; larger plants of the lily family will be found in the adjoining house No. 4, a corner of this house being given over to tall dracaenas and their relatives.

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.

Here also will be found several species of the genus *Costus* and of other genera of the ginger family, and some tropical species of the *Iris* family and of the banana family, but most of these are in the adjoining house, No. 4, growing too tall to be accommodated in house No. 3.

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 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*. The fourth genus of the banana family, *Heliconia*, is also represented by several species, called wild plantains, natives of tropical America.

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 *pines* in the tropics, while the remainder of the name was suggested by the spiral arrangement of the leaves.

At the west end of this house will be found large specimens of the aroid family already referred to in describing house No. 2, 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*, the latter a native of Mexico, producing an edible fruit with the odor of pineapple.

A large tree of the common rubber plant, much grown in parlors, will 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 fruit in bunches near the base of the tree, but

this fruit is not edible. Chocolate trees (*Theobroma Cacao*) native of tropical America, may be found near the western 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 illustrated by a tall tree in the middle of this house; its fruit, esteemed as an aid to digestion, is borne just under the crown of leaves.

Several interesting tall vines climb on the pillars of this house, 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 *Alamanda* of Brazil, with its showy large yellow flowers, climbs to the roof.

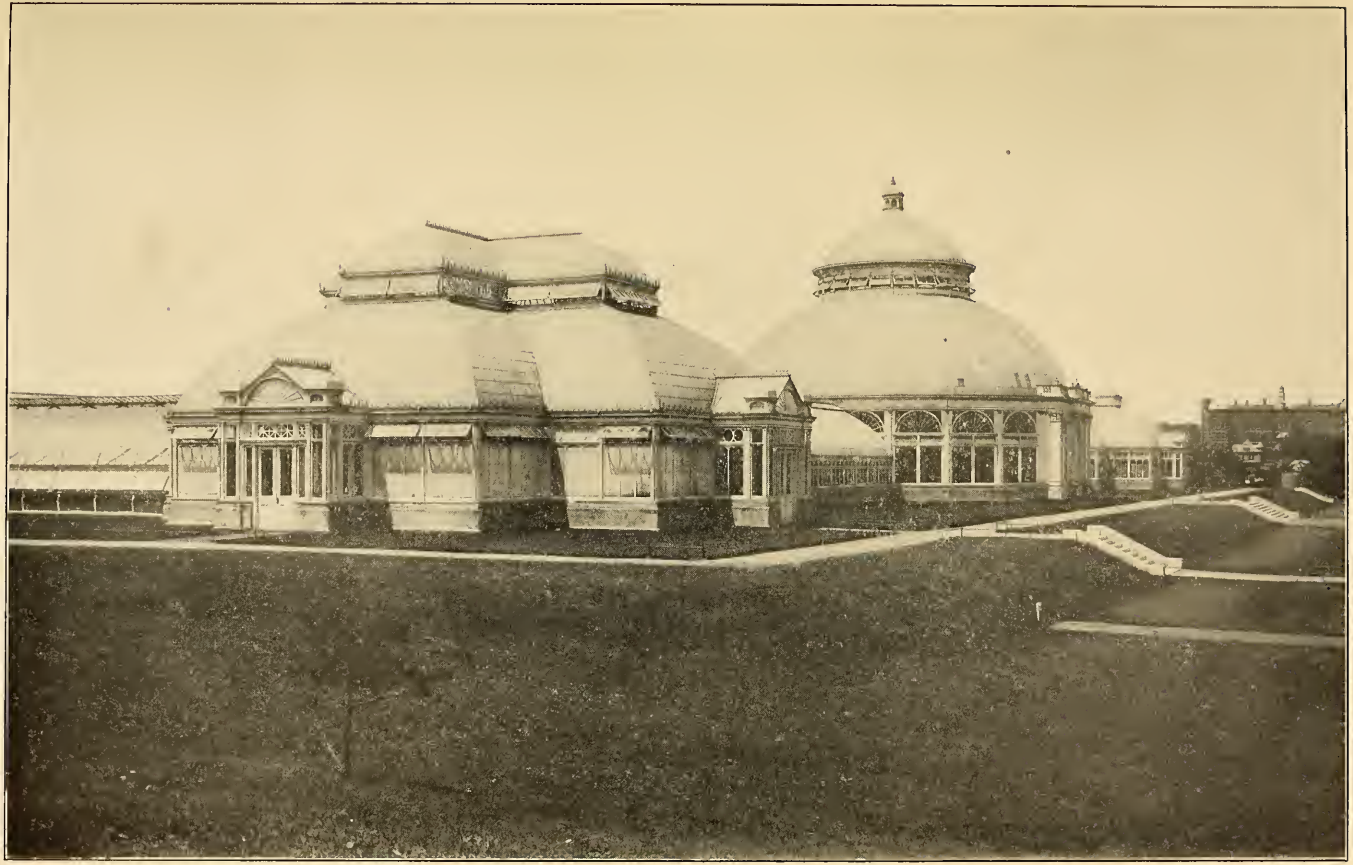
House No. 5. The plants in this house are from desert regions. Especial attention is called to their fleshy stems or leaves which serve as storage organs for a water supply to carry them over periods of drought. On the right hand bench, as one enters from No. 4, are found mainly plants from southern Africa: the carrion flowers (*Stapelia*), relatives of our common milkweed of the roadsides; *Aloe*, *Gasteria*, *Haworthia*, and other South African representatives of the lily family.

The central bench is entirely devoted to the cactus family, which, with few exceptions, is American. Nearly all these plants are devoid of leaves, these organs, when present, being 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. 7, 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* some species have the stems angled, and sometimes bearing roots, while in others 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 apex. A plant of economic interest here is *Nopalea coccinellifera* upon which the cochineal insect breeds; it is from these insects that the dye cochineal is obtained.

On the remaining side bench is the stone-crop family represented by many 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. Many of the stone-crops are hardy plants and a collection of these will be found at the herbaceous grounds. Only a few cactuses are hardy.

House No. 6. This is also a desert house. On the two corner benches to the right, as one enters from No. 5, is a collection of century plants (*Agave*), a large genus known only from the New World; other and larger plants of this same genus will 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 this, and 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. A curious desert plant among the century plants on the side bench is called by the natives of Mexico, its native



THE CONSERVATORIES

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 lily family will be found in the central portion of this house. This comprises members of the genera *Aloe*, *Yucca* and *Dasylirion*. A group of cacti will also be found here, the most imposing figure of which is the giant cereus, *Cereus giganteus*, known as "suwarro" 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 they represent perhaps 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. A number of other large and rare cacti secured by a Garden expedition of 1906 have recently been added to this collection. On the remaining corner benches will be found the fig marigolds, from southern Africa, desert members of the pineapple family, and representatives of the spurge family.

House No. 3. Many families are shown here, the representatives of which are tropical. The members of the mimosa and senna families, largely represented in this house, are curious in their sleep movements; as daylight wanes the leaves begin to droop and the leaflets to fold up. Belonging to the senna family may be mentioned: the logwood tree (*Haematoxylon campechianum*), widely distributed throughout tropical America; the copaiba tree (*Copaiva officinalis*), one of the trees from which copaiba is obtained; and the tamarind tree (*Tamarindus indica*), valuable for its fruit. In the mimosa family the humble or sensitive plant (*Mimosa pudica*), whose leaves fold at the least touch, is of peculiar interest. The mahogany tree (*Swietenia Mahagoni*), and the cocaine plant (*Erythroxylon Coca*), from South America, are important economic plants. In the custard-apple family are

the cherimoyer (*Anona Cherimolia*), and the sour sop (*Anona muricata*). The mammee-apple is another tropical fruit, belonging to the gamboge family. The spurge family is represented in several curious forms, many of them much resembling members of the cactus family; while others bear large leaves, as is the case in the chenille plant, or Philippine medusa (*Acalypha hispida*); belonging to this family also is the plant bearing physic or Barbados nuts (*Jatropha Curcas*). The showy genus *Codiaeum*, commonly known as crotons, also belongs to the spurge family. Members of the cactus family, represented by several genera, especially of kinds growing naturally on trees in tropical forests, will be found near the spurge family. Decorative members of the ginseng family are also in this house.

House No. 8. As in house No. 7, the plants assembled here are of miscellaneous interest. The madder family is present in showy forms of ixoras, hoffmannias and rondeletias. There are striking forms of the potato family; also attractive representatives of the gesnerias, in the African or Usambara violet, and several forms of the genus *Trichosporum*, excellent basket plants. On the north side bench will be found a collection of begonias in many forms, ranging from the large-leaved *Begonia nelumbifolia*, of the West Indies, to the small-leaved *B. foliosa*, from Colombia, and the dainty little *B. rotundifolia*, known only from the island of Haiti, and for many years lost to science. The showy foliage forms of *Begonia Rex* are present in great variety. Among the more noteworthy economic plants are the ramie plant (*Bochmeria nivea*), a native of China, from the fiber of which the so-called grass-cloth is woven; and the bread-fruit tree (*Artocarpus incisa*), originally from the islands of the Pacific and introduced into the West Indies in the latter part of the eighteenth century.

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, a member of the aroid family; the floating fern; and some odd little plants related to the ferns, members of the genus *Salvinia*.

House No. 10. This house is devoted to ferns and their relatives from tropical countries. The species from temperate regions will be found in house No. 12. The collections are here arranged in botanical sequence, and thus closely related families and genera are brought into juxtaposition, enabling one to make a comparative study of these plants; on the north side bench will be found, among others, some of the climbing ferns (*Lygodium*), the cliff brakes, and a large group of the maidenhair ferns, embracing many forms, some of them of exceeding beauty; on the south side bench will be found the brakes (*Pteris*) and their relatives, and the large group of the genus *Selaginella*, relatives of the ferns. On the central bench are many of the polypodies, including a group of the golden polypody; many shield ferns; several species of the genus *Nephrolepis*, to which the Boston fern belongs; and a collection of davallias, some of which are very decorative. Some fern-relatives, represented by the genera *Salvinia* and *Marsilea*, will also be found on the south bench.

House No. 11. Here are placed the tree-ferns and such

other specimens of tropical ferns as are too large for the benches in house No. 10. Many specimens of tree-ferns, from various parts of the world, are here brought together. These graceful plants usually 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 group of staghorn-ferns, occupying one corner of the 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*), will be found in the center of this house near the walk; 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.

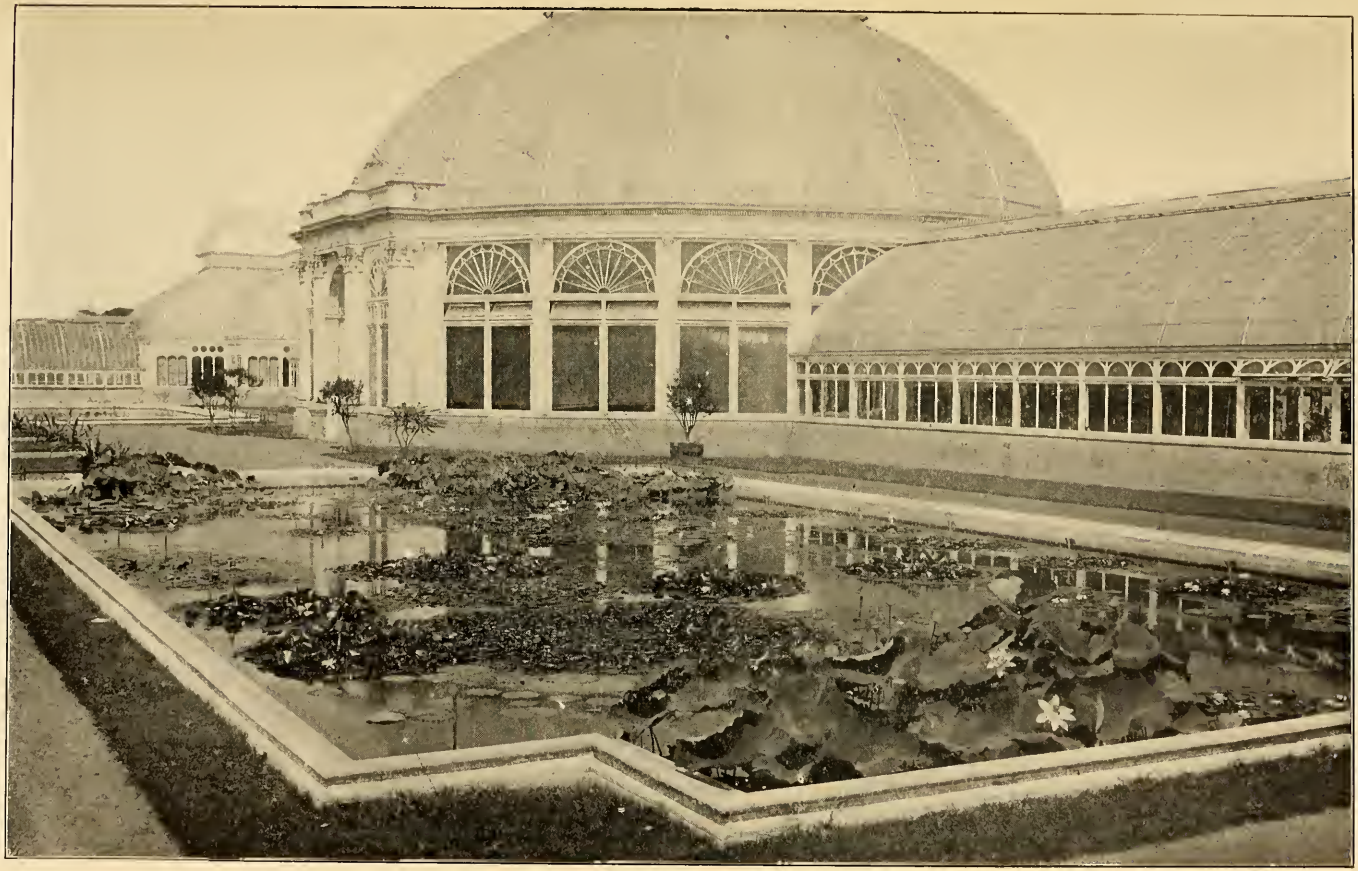
House No. 12. The plants in this house, as well as those in house No. 14, are arranged in botanical sequence, with a view to furnishing a collection for the comparative study of plant families and genera; to make this as complete as possible, as many representatives of families and genera are brought 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 tree-fern 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 continued 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. Nearly all the plants in houses 12, 13 and 14 are natives of warm temperate regions.

Among the more interesting species on the west side bench are many Australian plants, represented by grevilleas, hakeas, and others; a group of insectivorous plants will 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 will 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 as are too large for proper exhibition in houses 12 and 14. The endogenous plants will 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 arau-

carias, 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 cylindric clusters, much resembling a common bottle-brush, whence the popular name. Farther to the left is a large plant of *Hydrangea hortensis;* this presents a gorgeous show of blue flowers early in the summer. 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 camellia, 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. A little beyond these to the left will be found 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



COURT OF THE CONSERVATORIES

tree (*Olea europaea*), of which a small specimen will 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 near the olive is a fine plant of *Bougainvillaea*, 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.

House No. 14. The general arrangement of this house was mentioned when describing house No. 12. Entering from house No. 15, to the left will 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 will 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 will also be found here.

House No. 15. This house is mainly devoted to the orchids, the side benches and rafters being entirely given over to this family. On the central bench is located a collection of small palms and cycads.

The orchid family 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 New World its greatest numbers occur in Brazil and other parts of northern South America. In temperate regions rela-

tively 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 will be found in bloom.

Among the palms on the central bench the most interesting is 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; in the specimen here shown the upper portion of the seed may be seen projecting above the soil. 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.

Tanks for water-plants.—In the court formed by the conservatories are two tanks in which are grown a large collection of water-lilies. 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, in the main, 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 (*Victoria regia* and *Victoria Cruziana*), 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.

THE MUSEUM BUILDING

Power House. Steam for heating the conservatories 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 at the power house and supply steam not only to the conservatories, but also to the museum building through another subway about twelve hundred feet in length.

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. 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 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.

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 trees.

The public collections in this building are:

1. THE MUSEUM OF ECONOMIC BOTANY

This occupies the entire main floor, and here are brought together both crude and refined products of plants used in the arts, sciences and industries, illustrated also by photographs and drawings. Especial care has been taken to admit nothing but authentic specimens, and these are arranged as products,

including foods, drugs, fibers, gums, resins, sugars, and others as indicated by the accompanying floor plan.

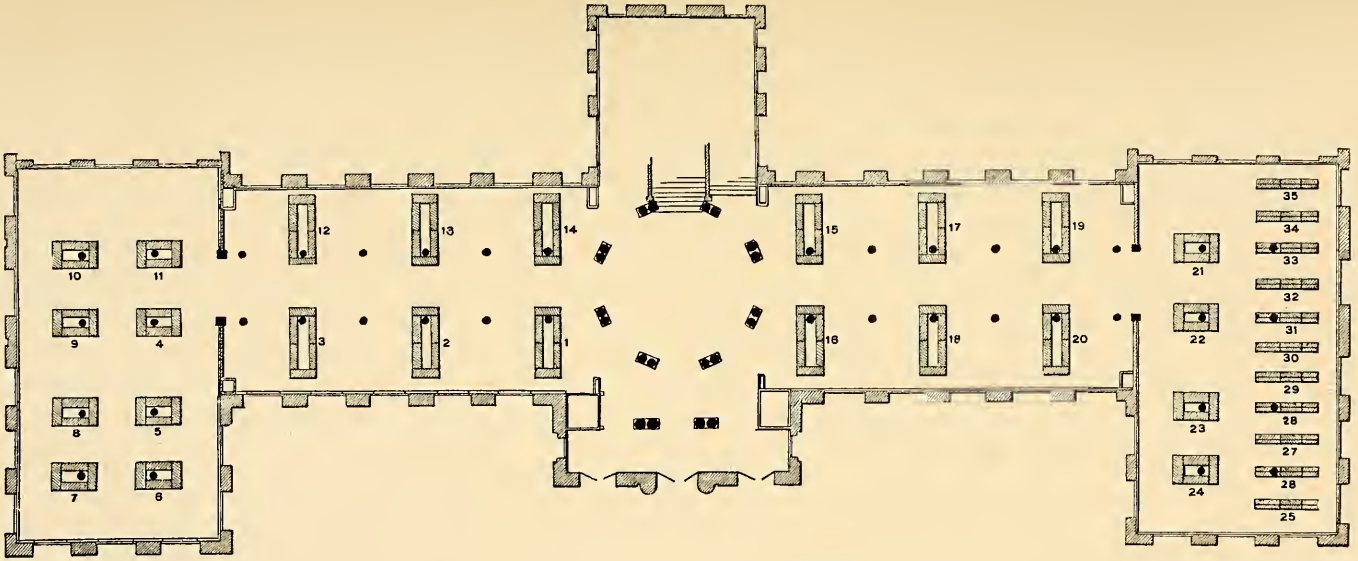
The arrangement of the larger groups is as follows: Foods and fibers occupy the west hall, the former in cases on the north side, the latter on the south. The west wing is mainly given over to exhibits other than foods, fibers, drugs and woods. The east hall contains the drugs, while the east wing is set aside for the woods and wood products, and for a collection illustrating North American dendrology.

Fibers. Cases 1 to 18. — In the first case of the series devoted to fibers will be found cotton, 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. There are several different kinds of the cotton plant from which fiber is derived. The fruits of some of these may be seen with the cotton bursting from the capsule, while some of the many different products are also shown.

The fiber of many other plants, derived from the 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, from jute, hemp and abutilon fiber; and paper made from wood and other fibers.

India Rubber and Allied Products. Cases 19 and 20. — The first case in the west wing contains india rubber and allied products. Here are the implements and utensils used in collecting the rubber "milk" from the trees which grow in the tropical forests. Rubber is derived mostly from trees belonging to the mulberry family, spurge family and dogbane family.

Several varieties of rubber may be seen in the different stages of refinement, together with some articles as manufactured for the market. Here too is an allied product,



FLOOR-PLAN, MUSEUM OF ECONOMIC BOTANY

1–3. Cases 1–18. Fibers.
4. Cases 19 and 20. India Rubber and Allied Products.
Cases 21 and 22. Resins.
5. Cases 23–26. Spices and Flavoring Agents.
6. Cases 27 and 28. Fodder Plants.
Case 29. Dye Stuffs.
Case 30. Tanning Materials.
7. Cases 31–33. Tobaccos and Masticatories.
Case 34. Miscellaneous Specimens.
8. Cases 35–38. Beverages.
9. Cases 39–42. Fixed and Volatile Oils.
10. Cases 43 and 44. Plant Constituents.
Cases 45 and 46. Sugars.
11. Case 47. Starches.
Cases 48–50. Cork and Paper.
12–14. Cases 51–68. Foods.
15–20. Cases 69–86 and 169–186. Drugs.
21–35. Cases 87–168. Woods and North American Dendrology.

gutta percha, which is derived from the trunks and foliage of certain trees belonging to the sapodilla family, these trees growing in many portions of the tropics. The specimens exhibited show this product in both the crude and refined condition.

Resins. Cases 21 and 22. — The cases devoted to resins contain on the one hand a large trunk of the long-leaf pine, with a turpentine box, together with a series of specimens of turpentine and resin, 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.

Spices and Flavoring Agents. Cases 23 to 26. — 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 is extracted from the roots of the licorice plant. Ginger is a rootstock, the underground stem of the ginger plant; cinnamon is a bark; bay, sage, mint, thyme are leaves; cloves are flowers; coriander, allspice, black pepper, celery seed, caraway seed, vanilla bean and tonka bean are fruits; mustard and nutmeg are seeds, and mace is the outer coat of the nutmeg.

Fodder Plants. Cases 27 and 28. — Following the spices are fodder plants, which are shown as sheaves, and consist of grasses, sedges, bush-clovers and related plants.

Dye Stuffs. Case 29. — The dye stuffs are represented by logwood, madder, alkanet root, indigo and oak galls.

Tanning Materials. Case 30. — The tanning materials are also very important from an economic standpoint; they are represented by saw-palmetto, mangrove, pine, hemlock and sumac. The crude materials of the mangrove and the saw-palmetto are accompanied by the fluid extract which contains the tannic acid and also by the spent material or refuse which remains after the extract has been made.

Tobaccos and Masticatories. Cases 31 to 33. — Tobaccos are shown by a series of bundles of the cured leaves of the

tobacco plant (*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 sapodilla 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 case is given over to:

Miscellaneous Specimens. Case 34. — In this case may be seen the substances used in the manufacture of soap, insect powders and related substances.

Beverages, including Chocolate. Cases 35 to 38. — Beverages are represented by both the non-alcoholic, as coffee, tea, maté or Paraguay tea, Jersey tea and fruit juices, and the alcoholic and malt beverages, as wine, beer, ale and porter. In the block of cases devoted to beverages will be found chocolate, which is derived from the seed of the chocolate tree (*Theobroma*). The collection there shown consists of 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.

Fixed and Volatile Oils. Cases 39 to 42. — 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 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. 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.

Plant Constituents. Cases 43 and 44. — This exhibit consists of a series of alkaloids, acids, glucosides and 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.

Sugars. Cases 45 and 46. — 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 cocoanut palm and the sugar palm, is made into palm sugar.

Starches. Case 47. — 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 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 arrow-root plant yield arrow-root 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 48 to 50. — Cork is the light outer bark of the cork oak, a tree indigenous to southern Europe. 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.

Foods. Cases 51 to 68. — 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 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 69 to 86 and 169 to 186. — 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 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, pennyroyal, 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 stonewort are rootstocks; sandalwood and quassia chips are woods; sassafras medulla is pith; birch, slippery elm, sassafras, cinnamon, wild cherry, horsechestnut, 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 flower 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.

Woods. Cases 87 to 168. — 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.

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 three series of objects:

(*a*) The general synoptic collection.

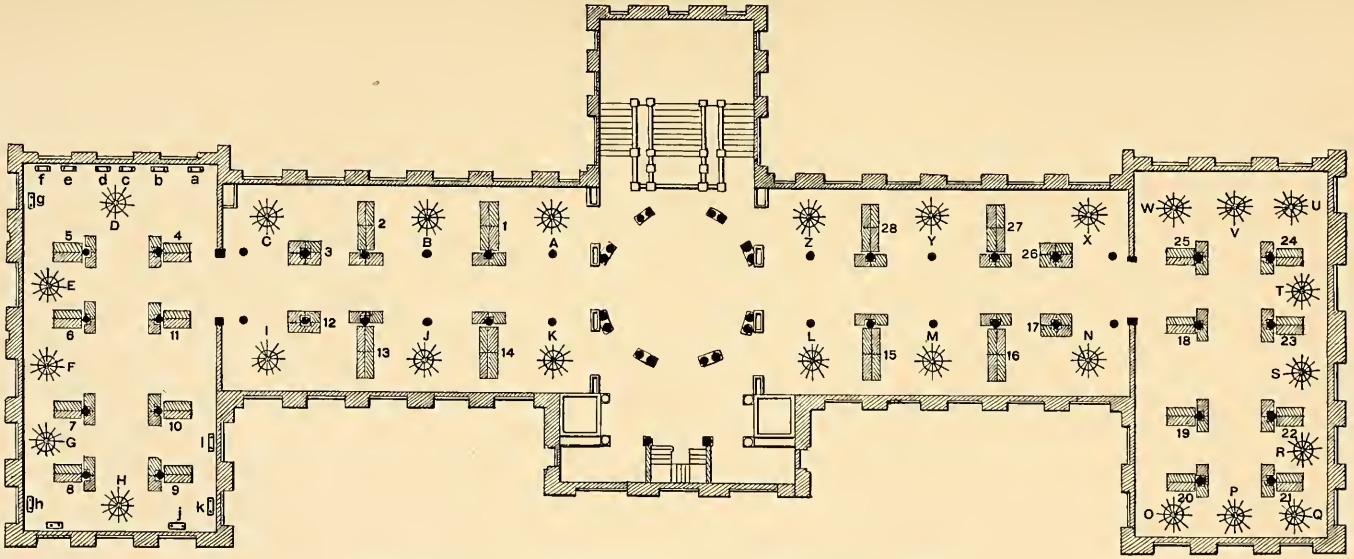
(*b*) A series of microscopes showing selected specimens.

(*c*) Illustrations of the local flora.

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 subkingdoms: (1) the Thallophyta, in which the plant-body is not differentiated into stems and leaves, 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.



FLOOR-PLAN, MUSEUM OF SYSTEMATIC BOTANY

1–28. 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 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 is said to attain seven hundred feet in length. 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 lichens and 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 are both parasitic and saprophytic. To this group belong the yeasts and mildews. 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. Next in order are the alga-like fungi (case 32); 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 fungi thus far considered are either parasitic or saprophytic in their mode of life; the lichens form an independent symbiotic group, each lichen consisting of a fungus and an alga living together, the one nourishing the other. 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, or seedless plants with roots, stems and leaves, but without vascular tissue (cases 37 to 48). This group is best known through the mosses, which form its largest division; but of simpler structure are the hepatics or scale-mosses (cases 37 to 40); although they were formerly associated with the true mosses, their tissues are much less differentiated than those of the mosses and the structure of their various organs much less complicated. 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 more simply organized plants. The leaves, too, are more like scales 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 is the group Anthocerotes; 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 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 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 group of plants. However, 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 (horse-tails).

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 spermatophytes largely predominates; namely, the angiosperms, fruit-bearing plants, or 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 fruit-bearing plants (cases 59 to 128) fall into two divisions, the one in which the seed contains a single leaf, the monocotyledons (case 59 to 71); the other in which the seed contains 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 first microscope is a preparation showing the vegetative condition of one of the slime-moulds, organisms in which the characteristics of plant and animal are so little differentiated that it is nearly impossible to affirm with confidence that they belong either to the one kingdom or to the other. In the vegetative stage — the stage here exhibited — the organism is strikingly similar in its essential attributes to some of the lower animals. Later, in the reproductive stage, there is at least a superficial resemblance to the fungi, which are undoubted plants. By means of the second microscope the spore-bearing stage of a slime-mould may be seen. The stalks and the netted framework of the spore-case walls remain, but the spores have mostly fallen. A few of the spores, however, appearing like minute dark dots, can be detected, adhering to the network. Under the lenses of the third 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. 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 specimens exhibited

are chiefly from among those which grow upon decaying organic refuse. One interesting parasite exhibited is a fungus parasitic upon another fungus, which, in turn, is a parasite on the leaves of the common lilac. Another fungus shown lives chiefly within the cells of the underground parts of one of the orchids, yet it can scarcely be called a parasite, inasmuch as its presence in the tissues of the orchid is beneficial to the orchid as well as to itself. 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 two microscopes are shown sections of lichens, illustrating their mode of reproduction and the fact that a lichen consists essentially of two organisms, a fungus and an alga, intimately associated and constituting what for many purposes may be looked upon as a single organism.

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. Following 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. The remaining preparations show the structure of the leaf-stalk and root of common types of ferns.

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.

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 the first appearance of plant life on the earth, as far as the remains of extinct plants have been preserved. The arrangement adopted is therefore based upon the sequence of the geological time divisions: Eozoic, Palaeozoic, Mesozoic and Neozoic, and their sub-divisions into periods; Laurentian, Cambrian, Lower Silurian, Upper Silurian, Devonian, Carboniferous, Triassic, Jurassic, Cretaceous, Tertiary, Quaternary and Recent or Modern. This arrangement is therefore geological, but incidentally it is also biological, and is based on 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 more complex types, represented by cycads, conifers and both monocotyledonous and dicotyledonous plants closely related to our living flora.

The series of exhibits begins in the first case to the left as one enters the east wing of the basement. The sequence of the specimens in the wall cases corresponds to that of the floor cases.

In the first floor-case may be seen representatives of Eozoic and Palaeozoic Time: Laurentian, Cambrian, Lower Silurian, Upper Silurian, Devonian, and Carboniferous Periods. At the north end 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. Many of the 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 sea-weeds 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 this case are also the remains of the earliest fern-plants

and their allies (Pteridophyta) 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.

In the second floor-case are representatives of Palaeozoic Time: Carboniferous Period. — The specimens in this case are exclusively ferns or plant-remains which were originally described as ferns but which are now thought to belong to a different group, the Cycadofilicales, that is, plants that had characteristics of both the ferns and the sago-palms, but rather more closely related to the cone-bearing trees than to the ferns.

The third floor-case contains types of Mesozoic Time: Triassic and Jurassic Periods. — The plant-remains in this case are mostly sago-palms or cycads, with some other cone-bearers and fern-plants.

The fourth floor-case embraces plant-remains from the rocks of Mesozoic Time: Lower and Middle Cretaceous Period. — These specimens represent the first appearance of the fruit-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 period consist largely of ferns and cone-bearers, while those of the Middle Cretaceous show a preponderance of seed-bearers. The specimens from the Dakota Group of Western America are exceptionally fine, many of them being perfectly preserved and showing both cast and impression of the same leaf.

The fifth floor-case contains the plant remains of Mesozoic Time: Middle and Upper Cretaceous Period. Here may be seen interesting specimens of the fossil floras of both eastern and western North America, including the ancestors of our living tulip-tree (*Liriodendron*).

In the sixth floor-case may be seen the plant-remains of Neozoic Time: Tertiary, Quaternary and Recent or Modern

Periods. The specimens in this 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 petrifaction, 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 the adjoining wall-case 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 petrifaction, 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 incrusted by mineral matter deposited from springs; while on the upper shelf and 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 public popular lectures covering a wide field of botanical and horticultural subjects are delivered here on Saturday afternoons in autumn and spring; 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.

A series of lectures to the pupils and teachers of public schools, designed to illustrate and supplement their work in nature study, is given in the large lecture hall on afternoons in autumn and spring, and these lectures are attended by many thousand children.

A special series of lectures designed for teachers alone is given on Saturday morning in the autumn and spring.

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.

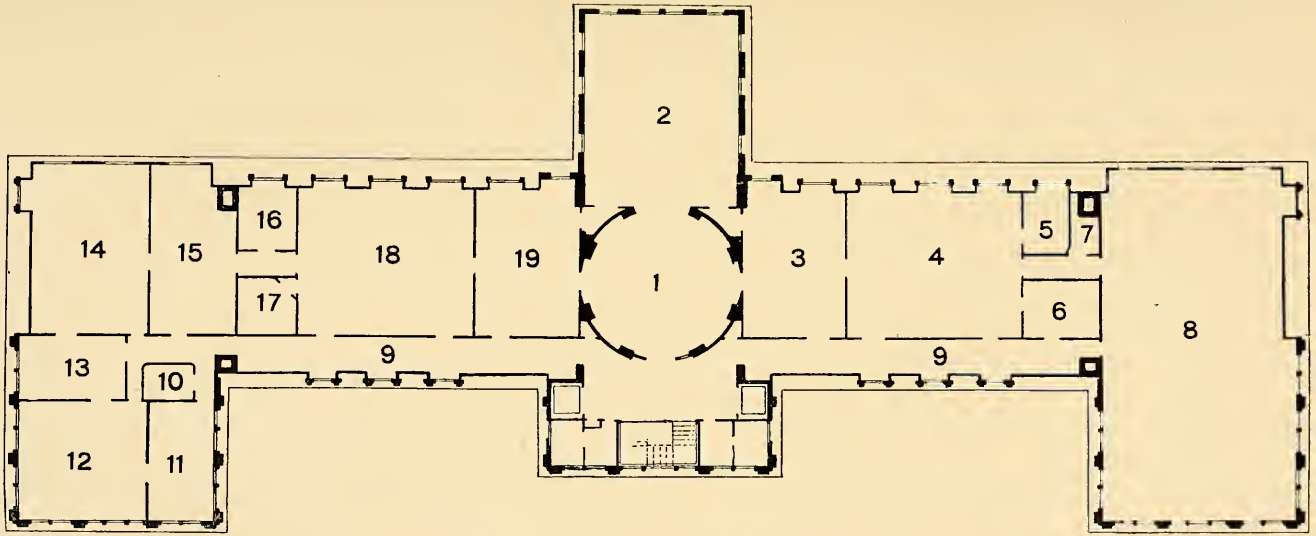
The Torrey Botanical Club holds monthly meetings from October to May, on the afternoon of the last Wednesday of each month, in the museum building, and many of its field meetings on Saturday afternoons throughout the season are held at the Garden.

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 in the world of books and pamphlets dealing with these subjects.

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.



PLAN OF UPPER FLOOR OF MUSEUM BUILDING

1. Library Reading Room.
2. Library Stack Room.
3. Director's Laboratory.
4. Herbarium of Fungi.
5. Curator's Room.
6. Moss Herbarium.
7. Storeroom.
8. Main Herbarium.
9. Hall.
10. Photographic Dark Room.
11. Balance Room.
12. Chemical Laboratory.
13. Study.
14. Physiological Laboratory.
15. Study.
16. Study.
17. Physiological Dark Room.
18. Morphological Laboratory.
19. Herbarium of Algae.

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. A valuable series of old microscopes, illustrating the history and development of that instrument, has been presented by 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, as shown by the accompanying plan. The planting out of these trees was commenced in 1901, and, as rapidly as the finished grades of this portion of the grounds have been established and the driveways and paths completed, additional planting has been done; 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 3½ 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 within the Garden, and indicated on the general plan 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 Carolina hemlock (*Tsuga caroliniana*), from the mountains of southern Virginia to Georgia, may also be seen here, as well as the Japanese hemlock spruce, to which the name *Tsuga* was first applied.

In the area to the westward of the conservatories, and bounded by the surrounding paths, 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 northeast 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, or blue, spruce, the young foliage of which has a decided blue color, whence its name. It usually grows about 100 feet tall in its native country. The Norway spruce, with a number of horticultural forms, makes a group on the highest portion of the area devoted to the spruces and is a commonly cultivated tree. It 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 Germany 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, 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 and several of its horticultural varieties. It 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 leaves. 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 and Himalayan 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 Tyrolese mountain pine, from the Tyrolese and Venetian Alps, forming a group of some dozen plants; near this is the Japanese red pine, and two 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 their 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

VIEW IN THE PINETUM, THE MUSEUM BUILDING IN THE DISTANCE

pine of Europe and Asiatic Russia. On the easterly slope of this higher land and on the lower ground nearby will be found, among others, the red or Canadian pine, from north-eastern 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, is a miscellaneous collection of coniferous trees, and also the members of the yew family (Taxaceae). Among the miscellaneous coniferous trees here are: the Japanese cedar, a tree which is barely hardy in this latitude, and of which only a single specimen is at present in the collection; the umbrella pine, from Japan, a very decorative plant; the deodar, or Indian cedar, from the Himalayan region; and the Mt. Atlas cedar, from northern Africa. The larches (*Larix*) will also be found in this neighborhood, on the ridge. These 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 two genera. Of the true yews (*Taxus*), there are: the American yew, or ground hemlock; the English yew, and several of its horticultural forms, the wood of which was highly prized in ancient times for the manufacture of bows; and the Japanese yew. The cluster-flowered yew (*Cephalotaxus*) is represented by Fortune's cluster-flowered yew, from northern China, and the iraga boku, of the Japanese, from Japan. Other representatives of this group will be found in conservatory houses nos. 12 and 13.

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. Other 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 regions 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 low cedar, of North America, Europe and Asia, is a pretty dwarf species. The savin juniper, of Europe and northern Asia, and its American representative, the prostrate juniper, of northern North America, are both neat low-grow-

ing 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.

At the westerly end of this same area is the arbor vitae (*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 a single specimen. 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 Grounds

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 500 meters long and averages about 100 meters 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 two series : (*a*) The systematic plantation ; (*b*) the morphological garden ; a third series (*c*) to illustrate economic plants,

is now being installed; the viticetum (*d*) or collection of vines, both woody and herbaceous, 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. To the east of the brook are the seedless plants, represented by the ferns and their allies, and the families of seed-bearing plants belonging to the large endogenous division, or those with parallel-veined leaves and with one seed-leaf (monocotyledons). 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, will 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 will 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 and the American royal fern, the brake or bracken, and a number of species of the shield-ferns and of the spleenworts. A collection of forms of the lady-fern, representing many variations, will be found here also. Some of the aquatic representatives of the ferns and their allies will be found in the pond nearby.

In this pond will 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, will 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; Job's tears, the ivory-like fruits of which are often used for beads in tropical regions, where it is common; 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*, perhaps the most striking of which is Fraser's sedge, 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 this genus. 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 will 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. Along the edge of the brook

just beyond is the yellow-eyed grass family, and near it the pipewort family. Coming now to the spiderwort family, we have represented mainly the spiderworts and day-flowers. Among the former are the spiderwort, the mountain spiderwort, and the reflexed spiderwort; in the latter is the common day-flower. In a small pool and along its eastern edge is placed the pickerel-weed family. Here will be found a large clump of the pickerel-weed (*Pontederia*) which is so common in swamps and along streams in the vicinity of New York; here will 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.

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, the swamp pink, 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 will 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 the group of magnolia trees, where will 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 present 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 goosefoot 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 four-o'clock, pokeweed, carpetweed, and purslane families. In the four-o'clock family will 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. 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, will 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.

The pink family follows, with three beds. Many kinds of pinks, catchflies, chickweeds, and gypsophils will be found here. In the first pool, formed by the widening of the brook, is the water-lily family; the large yellow pond lily or spatter-dock, a native of eastern North America, will be found here, as will also its relative, the red-disked pond lily, from north-eastern North America; the small white water-lily, a native of northwestern North America and Asia, the European water-lily, from Europe and Siberia, and 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 will be found larkspurs, columbines, buttercups, meadow-rues, anemones, liver-leaf, and many other relatives; aconite, or monkshood, 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 twinleaf, a native of the northeastern United States; and the Japanese plants, the two-leaved aceranthes and the red epimedium. In the poppy family will be found the oriental poppy, a native of Asia Minor and Persia, and here may be seen also the cordate bocconia, 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 will 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 and Nevius' stonecrop, both 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, will be found in the conservatories. Across the path from the orpine family will 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 will 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 will be found at the fruticetum. The mimosa family has relatively but few representatives in temperate regions, most of its numerous members being confined to warm temperate regions and to the

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tropics; the Illinois acuan is one of the plants representing this family here, and many others will 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 will be found at the conservatories. To the right of the mimosa family will 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; besides our common wild geranium or crane's-bill will be found, among others, plants of the following: the knotted crane's-bill, from southern Europe; the Armenian crane's-bill, from Armenia; and the crimson crane's bill, from Europe and western Asia. A little farther on, near the brook, will 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 belongs the common rue, of southern Europe, and the fraxinella; this family also includes the oranges and lemons, specimens of which will be found at 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, will 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 specimens of it will 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; the halberd-leaved rose-mallow, also a North American plant, with its pinkish white flowers with a deeper center, is also showy; 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 large collection of our native species, together with some from foreign lands, is here brought together and many of these will be recognized as old friends. Up on the ridge to the right, across the walk, will 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 will 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 plant of which will 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 cool regions; it is largely represented in warm temperate and tropical regions, and many other species will be found in the conservatories. But a short distance from the violet family is the evening-primrose family; here will 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 will 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 money-wort, a native of Europe, but introduced into many places in this country, sends its long creeping stems 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 is to be found a little beyond the plumbago family; various gentians are represented, among them the blind gentian, a native of the United States, and the Thibet gentian, from the Himalayas and China. In the brook, just beyond the little stone bridge, will be found the buckbean 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 bindweed, 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; Britton's 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; the common alkanet, of Europe, and the showy landolfia, from the Himalayan region, are also shown. In the vervain family, in a small bed to the left, will be found: the wedge-leaved fog-fruit (*Lippia*), from the western United States and Mexico; the blue vervain, from the eastern United States; and the white, or nettle-leaved, vervain, a native of eastern North America. We now come in the sequence to the mint family, to which are devoted six beds; among the true mints will be found here the creeping whorled mint, the curled mint, and the spearmint all from the Old World. Many familiar plants will 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 will 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 sola-

nums; 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 will be found the unicorn-plant family, represented by the yellow unicorn-plant, a native of Brazil. A little beyond is the globularia family, represented by a single species of globularia. To the right is the acanthus family; not many of these plants are hardy in this latitude, but at the conservatories many representatives will be found, as the family is largely confined to tropical and warm temperate areas; in this bed will be seen the hairy ruellia, from the southeastern United States, and the long-leaved acanthus, a native of southern Europe. 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 Rugel's plantain and rib-grass, are pernicious weeds in this neighborhood, often disfiguring an otherwise even lawn. Just beyond the mints will be found the two beds of the madder family; to this belongs the dainty little bluets or innocence, which sometimes gives 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*) will 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 feverwort and the narrow-leaved feverwort; this family being largely composed of woody plants, many other species, including the true

honeysuckles, will be found in the fruticetum and in the viticetum. To the left is the valerian family with a single bed; here will 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 will be found here. The bell-flower family is a little further on and to the left; 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, will 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 blue cardinal flower, 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 will 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.

(*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, will 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 toothing 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, twining, root-climbing, and tendril-climbing stems, specimens have been selected or placed to the left of this bed and properly labeled.

A little beyond the pool will 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 accommodating 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.

(*c*) Economic Garden

The collections illustrating plants producing substances directly useful to man in the arts, sciences and industries are now being installed at the northern end of the long glade containing the herbaceous collections just described. They illustrate food-plants, fiber-plants, drug-plants, fodder-plants, and a variety of other economic species.

(*d*) Viticetum

The area devoted to the plantation of vines is at the easterly side of the economic garden. Hardy vines, whether woody or herbaceous, belong here, and a rough arbor has been constructed for them to climb on. This collection is now being developed, and only a few of the species which it is intended eventually to grow there are as yet in place. The families will be referred to below in the order of their sequence. 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 birthwort family, is the akebia family, where one will 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. The next family, occupying both sides of the arbor, is the rose family, where will be found some climbing roses. Following this, also on both sides of the arbor, is the pea family, where one must seek the peas and wistarias. Further on, occupying both sides, is the staff-tree family, where will 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. Opposite to this is the morning-glory family, where the morning-glories and moon-flower belong. 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. The sequence terminates with the gourd family, to which belong, as economic plants, the watermelon, cucumber, squash, musk-melon, and gourds; a common vine of eastern North America, and frequent in the valley of the Bronx, is the one-seeded bur-cucumber, or star-cucumber, also a member of this family.

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 meadow. In this collection are brought together all the 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 large 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 easterly lake. 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.

The first is the willow family, beginning near the entrance to the stone bridge across the Bronx River; 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 easterly lake. Here will 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 obtained 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 birch family follows the willows on the east side of the path; here are the hazelnuts, the alders, and the shrubby birches; the common hazelnut 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 will 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 will be found therefore in the arboretum. Immediately following this is the mulberry family, represented here by two specimens of the Tartarian mulberry. At the triangle a little further on is the cercis-leaf family, represented by the cercis-leaf (*Cercidiphyllum*), a Japanese tree, and known to the people there as katzoura; there are three specimens of this, most attractive in the spring with their tender greens flushed with rose.

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 follows the barberries, immediately across the path from the cercis-leaf family; here will

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 eastward of the cercis-leaf 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. To the west of this is the Virginia willow family, with shrubs of the Virginia willow, a native of the southeastern United States. To the north of this is the hydrangea family; here will 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 uncompleted north path; here is the common witch-hazel, of eastern North America, from which the extract of witch-hazel, or Pond's extract, is made; 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 large-flowered exochorda, 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 wine-berry, and the purple flowering-raspberry, the latter common in rocky woods in this part of the country. Farther to the south, and bordering both sides of the transverse path, is the group of the true roses; many kinds will 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.

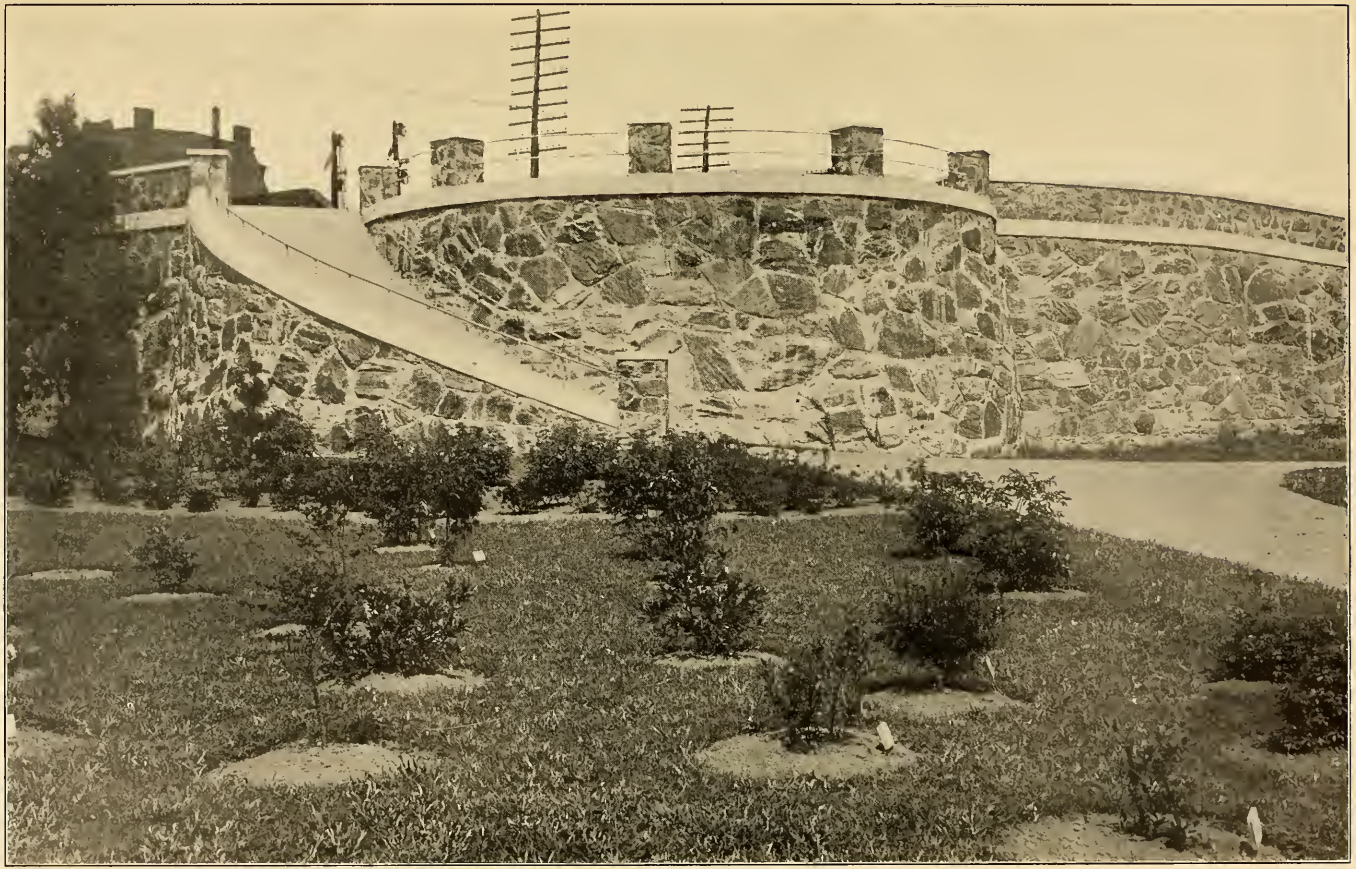
Following this is the apple family; to this belong the apples and pears, many of which, being trees, will be found in the arboretum. Of a shrubby habit, and so members of this collection, are many of the hawthorns or thorn-apples, the quinces, the rose-boxes, the choke-berries, the service-berry and 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 will 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, with 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 purplish flowers. Across the transverse driveway to the north, and directly on the opposite side, will be found the pea family. Here are various species of the pea-tree: the pigmy pea-tree, from the Himalayan region; the Chamlagu pea-tree, from China; the common pea-tree and the small-leaved pea-tree, both from Siberia. In the fall the two-colored bush-clover, from China, is a show of purple bloom. 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, both 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 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 will be found at the conservatories,

together with other woody members of this family. The tanners'-tree family comes next with a single representative, the tanners'-tree, from the Mediterranean region. 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, we find the holly family on the nearest point, shown by the serrate holly and the crenate holly, both from Japan; the European holly is grown in the conservatories and the American holly at the arboretum. 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. Crossing the path to the north of the triangle we come to the maple family; most of the maples are trees, so 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 south-eastern United States; many of the buckeyes and horse-



APPROACH TO THE WOODLAWN ROAD ENTRANCE

chestnuts are trees, and are grown in the arboretum. Following this is the soapberry family, with the soapberry, from the southeastern United States, 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 have been used as a substitute for tea, and it is said that the industry is being revived in Pennsylvania; 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. The mallow family, further along the path, is represented by two 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 will 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, will be found at the conservatories. Also near the mallows will 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.

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 panicled 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.

Across the path from the dogwoods, at the foot of the steps, will be found the white-alder family. Here are the Japanese sweetpepper bush, and the North American sweetpepper 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 the same genus, from the southeastern United States, is called stagger-bush. 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 num-

VIEW IN THE FRUTICETUM, OR SHRUB COLLECTION

ber of the privets, including the California privet so much used for 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 adelias. 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 will be found at 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; aad the woolly viburnum, from China and Japan; among American forms may be mentioned the arrow-wood, the coast 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 will 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, will 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 Chinese 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 will 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.

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 (*Popu-*

lus) as a collection apart, many species grown here not being represented in the arboretum and fruticetum. Immediately beyond the uncompleted north path at the fruticetum is a row of poplars, fringing the southerly end of the north meadow, consisting of several trees each of Simon's poplar, from China, and Wobst's poplar, a Russian species. 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 will 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 will be found a row of trees of the cottonwood, or Carolina poplar, found wild in eastern North America; and another 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; the black willow, of North America, and the pussy willow, a native of the northeastern United States. Many other species are represented in this collection.

6. The Deciduous Arboretum

This plantation extends over most of the garden area east of the Bronx River. The sequence of plant families begins at the southeast entrance to 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. This collection is only partially formed, but additions are made to it every season. The groups will be referred to in the order of their sequence.

The first is the willow family which occupies the low-lying land near the southeast entrance and the ridge to the north, 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. Bolle's poplar, a form of the white, or silver-leaf, poplar, is quite ornamental in its lobed leaves; the white or silver-leaf poplar is a native of Europe and Asia. 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 golden willow, from eastern North America, and the weeping willow, native of Asia, a tree commonly planted for ornamental purposes, and sometimes known as Napoleon's willow.

The walnuts and their relatives will be found to the west of the nursery on the ridge. The narrow-winged wing-nut, from China, and the Rhoeas-leaved wing-nut from Japan, are both 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

VIEW IN THE ARBORETUM

and the butternut are both wild elsewhere in the Garden. 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 on both sides of the driveway to the south and southwest of the stable, where birches, alders, and hornbeams are planted; the Japanese hornbeam is represented by a single specimen along the road to the propagating houses; 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 manufactures of sledges, and from its tough bark they also make canoes and baskets. The Japanese white birch, a close relative of the American and European white birches, is represented. 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, and the poplar-leaved birch are wild elsewhere in the Garden. 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 walnut and birch families, and on both

sides of the road leading to the Lorillard mansion. The oaks, the chestnuts, and the beeches belong here. The oaks (*Quercus*) are represented by many species. One of those to the east of the road referred to above 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, will 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. To the west of the road will be found other oaks. 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 southeastern Europe and western Asia,

is valued in that region on account of its bark which is used in tanning leather. 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; in addition to this, in various parts of the grounds, the American chestnut will be found in many wild specimens. The beeches (*Fagus*) are located to the westward of the chestnuts, in the north part of the swale. The European beech and its purple-leaved variety will both be found here in small recently planted trees. Small trees of the American beech are also here, but large wild specimens will 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 southern hackberry, of the southeastern United States; and the American nettle-tree or sugar-berry, 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 will be found to the south of the driveway; it is a native of the central parts of the United States; the red mulberry and the white mulberry are wild. The cercis-leaf family has for a representative the cercis-leaf, of Japan, located just to the south of the row of tulip-trees just east of

the Bronx River. The magnolia family will be found mainly in the swale lying between the two ridges, with a few specimens on the western slope of the west ridge. 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 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 whitewood; the Indians formerly made their canoes from this wood.

The plane-trees will be found just to the north of the elms. Here is a small tree of the oriental plane, native from southeastern Europe to India. A little to the southwest of this is a large specimen, native to the grounds, of the American plane, known also as the button-wood and button-ball, and there are many other wild trees along the Bronx River. The oriental plane is largely used as a shade tree in Europe, and is sometimes planted in this country. 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 will 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 prune-leaved crab-apple, a native of northern China and Japan; and Soulard's crab-apple, from the central United States. In the plum family, among others, will be found, the rose-bud cherry, a Japanese plant, and a highly decorative species; the double form of the Japanese flowering cherry, native throughout eastern Asia; the ordinary sweet cherry, originally from Europe and western Asia, a delicious fruit, of which there are many horticultural forms; and the ever-blooming cherry.

Near the eastern end of the long bridge are trees illustrating the senna family, the pea family, the rue family, and the mahogany family. 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. 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 Chinese cork-tree, from the Amur region, China and Japan. 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 the new conservatory site, are trees of the ailanthus and sumac families. The former is 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. Among the sumacs (*Rhus*) are Osbeck's sumac, from China; the staghorn sumac, native of the eastern United States, from the young shoots of which the pipes for drawing off sap from sugar-maple trees are often made; the bark of its root is especially rich in tannin; the narrow-winged sumac is a representative from the Himalayan region.

On the ridge to the west of the new conservatory site, and

to the north of the sumac family, are the maple and buckeye families. The maples (*Acer*) are represented by a number of species. Perhaps the most important 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. 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. Two Old World representatives are the common European maple, of Europe and western Asia, and the sycamore maple, 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. From the southeastern United States comes the white-barked maple, also in the collection. The ash-leaved maple, or box elder, of eastern North America, is represented by several specimens.

In the buckeye family 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 cordate linden, a native of Europe and Siberia, and a third is the white, or silver, linden of eastern Europe.

Next in the sequence comes the ginseng family, represented by several species of aralia; many other species of this family will 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; the Indians of the south at one time made bread of the dried fruit. Few members of this family are hardy in this latitude, so other representatives must be sought for at the conservatories.

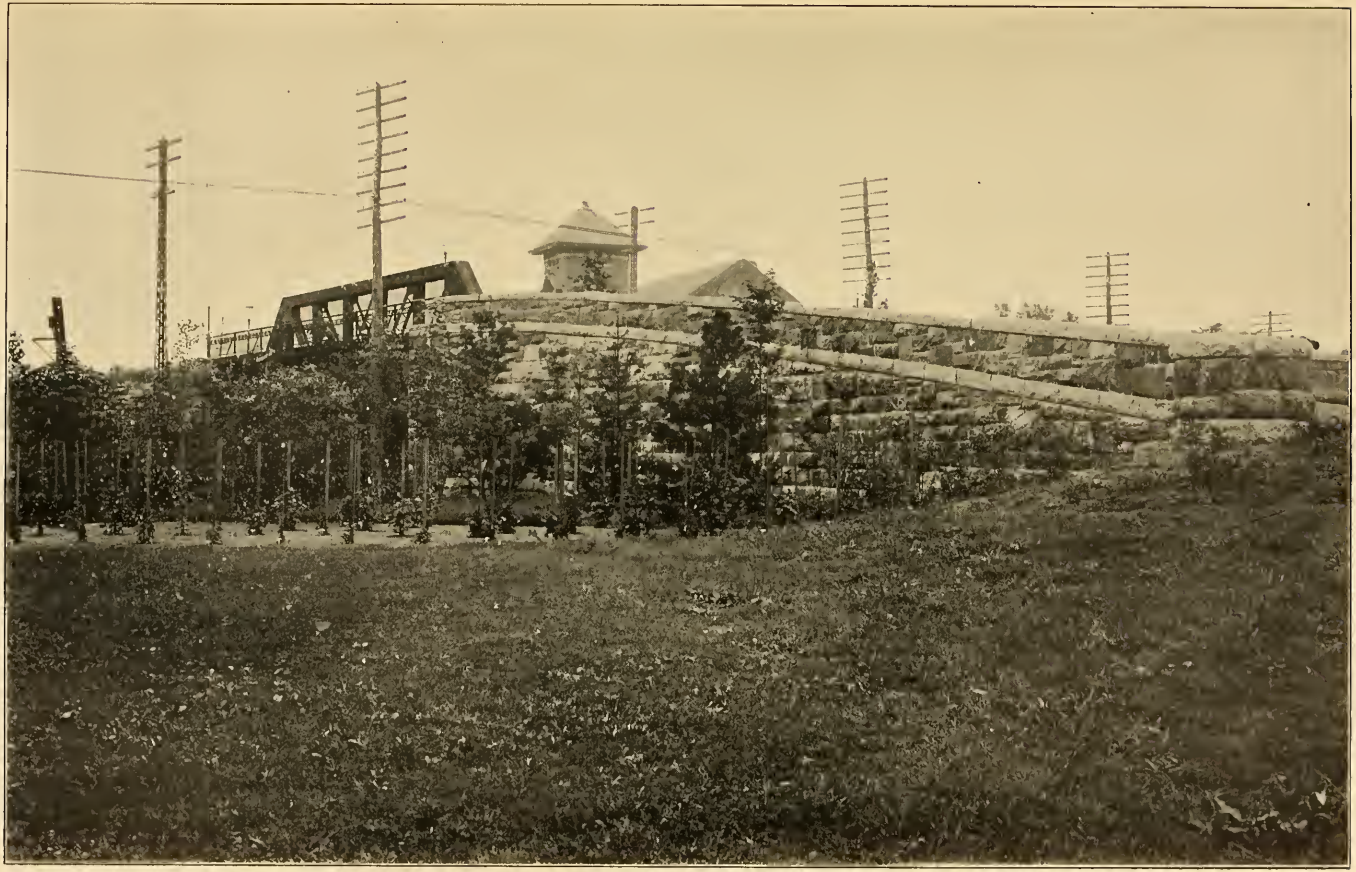
Beyond the ginseng family, on the western slope of the hill, is the olive family, represented by several species of the ashes (*Fraxinus*), some of which are useful for timber. The common European ash is to be seen, and among North American representatives are the green ash; the Texas ash, restricted to that state; the Biltmore ash, from Pennsylvania to Georgia; the white ash and the red ash are common; Bunge's ash, a native of China, is also represented. 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. 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 Lorillard mansion and below the " Blue Bridge." The area west of the river extends from just above the " Blue 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 water fall at the Lorillard 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, chestnut, sweet birch, red maple, hickory, 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



MOSHOLU PARKWAY ENTRANCE

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.

8. The Gorge of the Bronx River

The gorge of the Bronx River extends from the "Blue 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 Lorillard 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 Lorillard mansion, and the elevation of its surface is only a few inches higher at the "Blue 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.

9. 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 Lorillard 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 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 Lorillard 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.

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 coöperation 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 eight points as follows:

1. Mosholu Parkway. 2. Bedford Park Avenue. 3. Southern Boulevard. 4. Hemlock Forest. 5. Southeastern entrance (not yet constructed). 6. Bleecker Street. 7. Newell Avenue. 8. Woodlawn Road.

Paths located so as to lead to all the principal features are included in the plan, with an aggregate length of over ten miles and approximately one-half of this system has already been built.

All the roads and paths have been located so as to do no

UPPER BRIDGE ACROSS THE BRONX RIVER

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 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 will ultimately clothe them with foliage, at least in part.

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 rubble stone foot-bridge of five arches, to replace the wooden bridge just at the northern end of the hemlock forest, and long known as the "Blue Bridge," is now under contract to be built on designs by the same engineer; studies are in progress for a bridge to replace the wooden bridge which crosses the gorge of the Bronx River at the Lorillard mansion; and the sixth bridge in the plan is a foot-bridge to cross the Bronx River in the north meadows, but this has not yet been designed, as its need is not yet urgent.

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; a considerable portion of the drainage system still remains to be built.

The water supply has also been built in accordance with the general plan, and the system is being extended from year to year as the development of the grounds proceeds.

The general planting plan includes provision for completely surrounding the grounds, except at entrances, with border screens. This planting has already been accomplished along the entire western and northern boundaries, and partly along the southern boundary. These screens are composed of a very great variety of trees and shrubs, variously grouped, and average about fifty feet in width. It has not been practicable hitherto to plant these screens along the eastern border of the park on account of being obliged to wait for the construction of the street known as the Bronx Boulevard or Bronx Park East, the land for which is now being secured by the city by condemnation proceedings.

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 Railroad Station and thence to the Mosholu Parkway entrance; 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 garden are daffodils, crocuses, irises, phloxes, paeonies, rose mallows, sun-flowers, cone-flowers, coreopsis, columbines, and many others.

Guides

In order to provide a method for viewing the collections under guidance, an aid leaves the front door of the Museum

A PART OF THE BORDER SCREEN

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 and Herbaceous Garden. Tuesday: Pinetum. Wednesday: Fruticetum and North Meadows. Thursday: Deciduous Arboretum, Nurseries, Propagating Houses. Friday: Public Conservatories. Saturday: Museums.

City Ordinances

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.

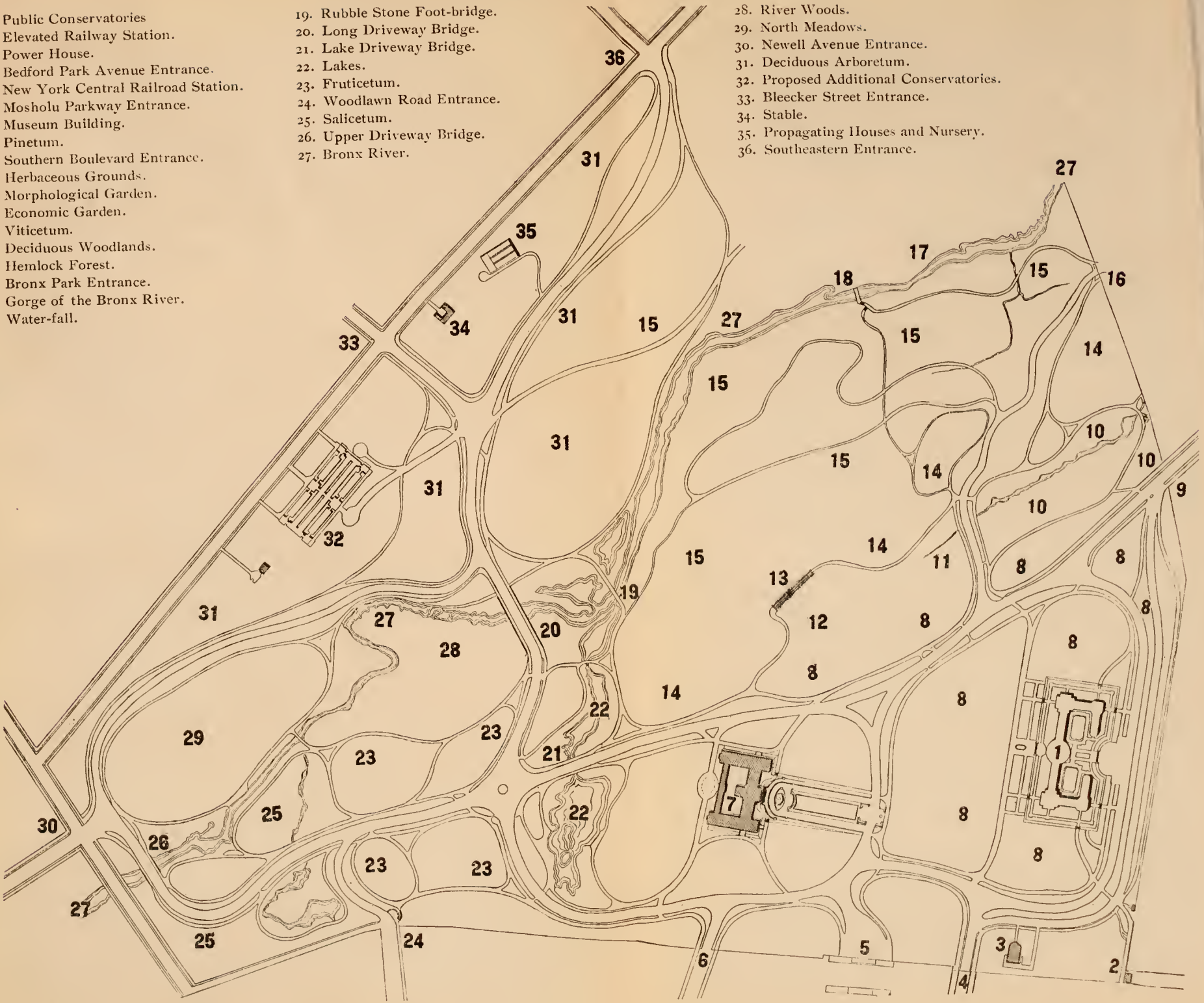
7. Boating or rafting on the ponds, lakes and streams, is forbidden.

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.

1. Public Conservatories
2. Elevated Railway Station.
3. Power House.
4. Bedford Park Avenue Entrance.
5. New York Central Railroad Station.
6. Mosholu Parkway Entrance.
7. Museum Building.
8. Pinetum.
9. Southern Boulevard Entrance.
10. Herbaceous Grounds.
11. Morphological Garden.
12. Economic Garden.
13. Viticetum.
14. Deciduous Woodlands.
15. Hemlock Forest.
16. Bronx Park Entrance.
17. Gorge of the Bronx River.
18. Water-fall.
19. Rubble Stone Foot-bridge.
20. Long Driveway Bridge.
21. Lake Driveway Bridge.
22. Lakes.
23. Fruticetum.
24. Woodlawn Road Entrance.
25. Salicetum.
26. Upper Driveway Bridge.
27. Bronx River.
28. River Woods.
29. North Meadows.
30. Newell Avenue Entrance.
31. Deciduous Arboretum.
32. Proposed Additional Conservatories.
33. Bleecker Street Entrance.
34. Stable.
35. Propagating Houses and Nursery.
36. Southeastern Entrance.



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