

In dead cells caffeine never produces proteosomes. If we treat *Spirogyra*, which is an excellent object for studying the behavior of the proteosomes, for one minute with a dilute solution of iodine in potassium iodide the globules may still be produced immediately afterwards but not after ten minutes. It can easily be shown that the substance has not passed to the outside by osmosis, since the liquid surrounding the treated alga does not show any reaction with caffeine. Various tests proved that the proteosomes consist of protein matter, but in most cases there are impurities present, especially tannin, a fact which has misled Pfeffer and some of his students so far as to assume these proteosomes to be merely compounds of tannin with common albumin and with caffeine. It is evident that such compounds would not exist in two different modifications and would not change their entire behavior with the death of the cells as above described. Pfeffer's objections are untenable, as repeatedly demonstrated. He has, for example, assumed that on the death of the cells certain compounds leave the protoplasm and upon entering into the vacuole cause there a change of the proteosomes. But it is easy to convince one's self that proteosomes can also often be produced in the cytoplasm itself, especially in the case of *Spirogyra*. Since these proteosomes remain in the cytoplasm also unchanged so long as the cells are alive, the assertion of Pfeffer is groundless. He has also argued that the phenomenon in question, viz, the production of proteosomes, may be due to the neutralization of the acid cell sap, but we have shown that the cell sap of *Spirogyra* has no acid reaction* and nevertheless it yields frequently numerous proteosomes.†

It is to be regretted that many plant phy-

* Botanische Zeitung, 1884.

† A careful observer will not confound these easily changing proteosomes produced only in living cells (as Dr. Albert F. Woods has suggested) with other glo-

biologists rely upon the declarations made by some 'authority' instead of forming their own opinion from an unbiased critical investigation. The history of science shows that erroneous conceptions are often sustained for a long time in scientific circles simply because a man of a certain influence has defended them. The recognition of the genuine respiration of green plants furnishes a good illustration to this remark. Liebig, by weight of his authority, wiped out this truth for 20 years from science.

OSCAR LOEW.

U. S. DEPARTMENT OF AGRICULTURE.

THE NEW YORK BOTANICAL GARDEN.*

THE corporate body known as the New York Botanical Garden was created by an act of the legislature approved by the governor April 28, 1891, and amended March 7, 1894. This association was called into existence "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."

By the same act the Board of Commissioners of the Department of Public Parks were authorized to set aside two hundred and fifty acres of Bronx Park, and erect suitable museum and other buildings at a cost

bular masses produced by hypochlorite of soda upon the protoplasm of dead cells. Such formations and their distinction from proteosomes were described by Woods in SCIENCE, April, 1899.

* Written by the request of the Editor of SCIENCE. See also article on same subject by author in the *Popular Science Monthly* for June, 1900.

Garden was begun in 1896, and Dr. N. L. Britton was elected Director-in-chief in that year. The perfecting of the plans for the buildings, roads, driveways, walks and plantation occupied the greater part of the attention of the management during this year and the next. The actual erection of the most important of these structures, the museum building, was begun in the Spring of 1898, ground having been broken for it late in 1897, and it was handed over to the board of managers of the Garden in March, 1900. During this constructive period many additions were made to the staff, and a large amount of material suitable for the museums was accumulated, while much progress has been made in the building of driveways and the development of the plantations.

The area included within the Garden has been, and will be freely accessible to the public at all times, for the enjoyment of the beauties of the wild woodlands, and of the collections of living plants, but the completion of the museum and horticultural houses marks the beginning of the full activity of the institution and a brief description of the manner in which it discharges its chief functions may be of interest.

The collections of living and prepared plants in the plantations and museums are arranged to present information on the form, relationship, mode of life, habit, and general biological characters of the principal types of vegetation in such manner as to be capable of comprehension by persons unacquainted with the technical aspects of botany. A number of special groups of plants have been established in suitable places in the Garden. The trees are in the arboretum of the Bronx on the side and summit of a long ridge; unsorted and reserve material of all kinds is kept in the nurseries on the eastern slopes of the same ridge; the salicetum is established on the border of a marsh in the northern end of the Garden giving

the willows and poplars the conditions under which they grow best. The fruticetum occupies an adjoining upland plain, affording space for the cultivation of a large number of shrubs, while the conifers are located on slopes to the westward of the hemlock forest. The viticetum is along the western edge of the forest, and the trellises of logs and timbers extending for a length of six hundred feet give suitable support to the vines. The herbaceous collection occupies an open glade to the westward of the forest and lies between two granite ridges. It is traversed through the middle by a small stream widened at places into lagoons for aquatic forms. About twenty-two hundred species are now in cultivation in this plantation. The wide border plantations which are established along the boundaries also offer opportunities for the growth of a great variety of trees, herbs and shrubs, and serve as screens and supplementary nurseries.

The horticultural houses, also erected by the city for the Garden and now essentially completed are located in the western part of the grounds at some distance from, and facing the museum. A palm house with a total height of dome of ninety feet is the central feature from which lower ranges extend on either side making a total length of front of five hundred and twelve feet.

The collections of living plants are arranged in the same system as the synoptic collection in the museum. Every plantation except the nurseries and boundary borders contains species of the same general habit, and the horticultural houses are used for the cultivation of forms which may not endure the outdoor climate of this locality. Not only will the plants from warmer zones be grown under glass, but when it is desired to develop native species out of their season they may be forced and brought to full development and bloom in the winter.

The museum is a fireproof building of brick, stone, and terra cotta, 308 by 110

feet, located in the western part of the grounds near the Bedford Park station of the Harlem division of the New York Central railroad. The building has a basement floor and three stories with a total floor area of nearly two acres, and window opening to half this amount, thus securing a

of from one hundred to five hundred. Adjoining the lecture hall are two large exhibition halls which are designed for horticultural shows and other temporary displays.

The first floor of the museum is devoted to the display of economic plants and their useful products. Glass fronted cases with



The Museum Building—New York Botanical Garden.

good illumination, so highly desirable in a museum. A lecture theater occupies the basement floor of the western end, offering seating capacity for seven hundred hearers and furnished with all necessary appliances for the illustration of lectures. During the spring and autumn, courses of popular lectures are given on Saturday afternoons which have already drawn an attendance

movable and flying shelving are arranged in alcoves opening on the windows. Only about one-third of the case equipment of the building has as yet been set up. Dried specimens on herbarium sheets, conserved material in tubes, and jars, dry, and in formalin, and drawings, illustrate the method of preparation and appearance of the derivatives. It is of course utterly impossible

to demonstrate all the economic plants of the world or make even an approximately complete display within the space of a building, but the temporary installation now in place, represents many of the more important foods, drugs, timbers, woods, fibers, gums, waxes, resins, oils, sugars, starches, poisons, utensils, etc. The proper development of this collection requires a great amount of the most careful labor, and the curator has been fortunate in securing the co-operation of importers, producers, and manufacturers in the addition of exhibits.

The second floor contains a type exhibit of the vegetation of the globe arranged in families in the Engler and Prantl sequence. Specimens dry and in liquid preservatives, fruits, seeds, models, drawings and photographs are used to place the concept of the species before the observer. A set of hinged frames on standards contain the plants growing naturally within a hundred miles of New York City, and these are placed in their proper places in the series. Thus a case of the main series contains a representative of the family *Violaceæ*, and the frames near by display the local members of same family.

A number of microscopes of special design have been constructed for the purpose of displaying permanently the simpler and more minute organisms, or the structure of the higher forms.

The preparation of the material used in the exhibits is carried on in a number of rooms in the basement floor, and the members of the staff engaged in this work are assisted by a cabinet maker and printer.

The entire area of the Garden has been handled most sympathetically by those in charge of the architectural features of the Garden. The buildings were erected in the more open western part of the grounds, which offered the least valuable landscape features, and the surface around them has been improved by plantings. The natural

beauties of the tract have been most zealously guarded from disturbances of all kinds. The attractive panorama of wild woodland and stream offered to the artist and lover of nature have been left absolutely untouched, but made more valuable by increased ease and safety of access. Thus to the general public, the Botanical Garden offers all the privileges enjoyed by them in the original park together with the interesting displays offered by the large special collections of interesting plants in the plantations and horticultural houses, as well as the exhibits in the museum. The increasingly large number of visitors attests the popularity of this feature of the institution.

Another class of constituents consists of the patrons, fellows, life members and annual members of the Garden, who now number over nine hundred. A person becomes an annual member on invitation of the Board of Managers and payment of ten dollars per year, and enjoys certain privileges among which are: tickets to all lectures given under the auspices of the Board of Managers either at the Garden or elsewhere, invitations to all exhibitions given under the auspices of the Board of Managers, a copy of all handbooks published by the Garden, a copy of all annual reports, copies of the monthly *Journal*, and an opportunity to buy some of the other publications of the institution at reduced prices.

One of the most important functions of the Garden consists in the advancement of the technical knowledge of botany and the furtherance of research in all subdivisions of the subject.

The collections in the plantations, horticultural houses and museum offers an excellent melange of material upon which investigations may be based, and the herbarium, library and laboratories are the direct means for the facilitation of such research work. The Garden, as an indepen-

dent institution, offers its facilities to advanced students or investigators from any part of the world who may secure registration in the proper manner. Persons thus registering at the Garden are entitled to the privileges of a student at Columbia University without payment of further fees in accordance with the terms of a contract in existence between the two institutions. The essential features of this agreement stripped of formal verbiage are as follows:

student may become a candidate at Columbia or other institutions of university rank.

Twenty-two students have had the privileges of the Garden during the collegiate year now closing. Eight of these were registered as students at the Garden and fourteen from Columbia. Two of these have undergone the examination for the degree of doctor of philosophy, and three for master of arts in Columbia University.



Main Horticultural houses : view from the northwest. New York Botanical Garden.

the herbarium and botanical library of the University are deposited at the Garden, the graduate work of the University in botany is carried on at the Garden under the guidance of a member of the staff of the Garden or of the University according to the election of the student: students registered at the Garden may elect work with members of either staff, and are entitled to the privileges of a student in other lines in Columbia University.

It is to be noted that the Garden is not enabled to confer degrees, but the advanced

The great diversity of natural conditions offered by the area comprised in the Garden, includes the widest range of cultural conditions, and in connection with the horticultural houses gives ample facility for work with living material. These advantages have already been realized in the cultural tests of critical or little known species, and in physiological experimentation.

The range of investigations which may be carried on in any institution is limited by its collections of living and preserved specimens and the accomplishment of re-

searches upon this material depends directly upon the facilities offered by its herbaria, library, and laboratories, and the spirit in which these opportunities are administered.

The main herbarium, library, and laboratories of the New York Botanical Garden are chiefly located on the third floor of the Museum and their arrangement is illustrated by the diagram in figure 4.

The main herbarium occupies a room eighty-five by forty-seven feet in the east wing, which is illuminated by four large skylights in addition to the windows. The plants are arranged in two parallel series of cases occupying opposite sides of the room, with large oak tables in the middle and at the ends of the room.

The Columbia University herbarium occupies the western side of the room, and "it is one of the oldest, and in itself one of the largest in America, contains over 600,000 specimens. This herbarium was begun early in the century by Dr. John Torrey, and contains the material upon which his classic botanical writings, extending over half a century, were based. Upon his death, 1873, this collection came into the possession of Columbia College. On this as a foundation the present Columbia herbarium was built. Mr. John J. Croke presented two valuable collections to Columbia; the one, that of Professor C. F. Meisner, of Basle, Switzerland, one of the world's leading botanists, the other that of the late Dr. A. W. Chapman, of Apalachicola, Florida, in which are contained the specimens upon which Dr. Chapman founded his 'Flora of the Southern United States.' A few years later the mosses, and many of the hepatics and lichens accumulated by Mr. C. F. Austin, came into the possession of Columbia, while the latest acquisition of great size and importance, secured through the kindness of friends of the university, was the famous collection of mosses brought to-

gether from all parts of the world by the late Dr. J. G. Jaeger, of Switzerland. To this ample nucleus Dr. Torrey's successor, Dr. N. L. Britton, while professor at Columbia, and his associates, added continually by securing collections from all parts of the globe, and by special collecting trips to various parts of North America.

The most complete sets of specimens secured on two noteworthy South American journeys of exploration are here preserved; the one trip was that made by Dr. Rusby through the Andes of Bolivia, the other that of Mr. Morong in Paraguay and Chili."

The Garden has accumulated about 200,000 herbarium specimens since its organization. In this number is included the famous Ellis collection of fungi, including over a hundred thousand and forming one of the largest and most complete collections of fungi in the world, outranking any similar collection in America. Various private herbaria have been acquired by gift and purchase, among which are those of John J. Cooke, F. M. Hexamer, H. E. Hasse, P. A. Rydberg, Lewis R. Gibbes, Peter V. LeRoy, Harry Edwards, Anna M. Vail and Francis E. Lloyd. Accessions are being made at the rate of fifty to a hundred thousand specimens per year.

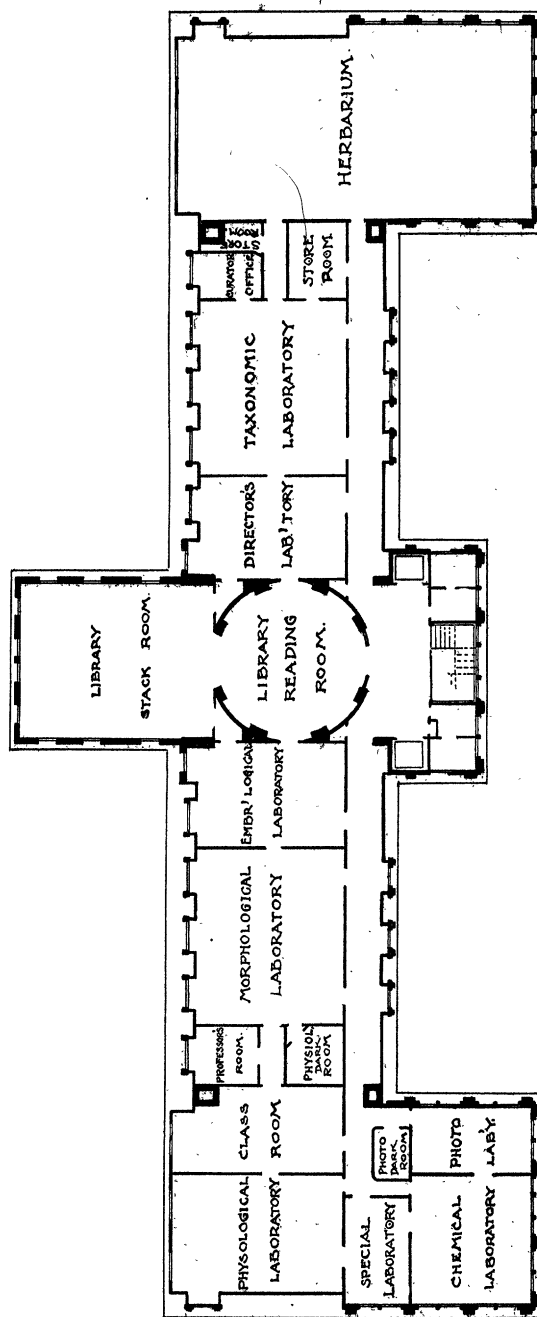
The main herbarium room is supplemented by two store rooms, and the office of the curator of the museums near it. In addition adequate preparation and storage rooms in the basement serve for the reception and handling of duplicate and unmounted material, as well as for the press upon which final labels are printed. Directly west of the herbarium suite is the taxonomic laboratory, which is especially adapted for systematic and anatomical investigations.

The laboratory of the Director-in-chief occupies a large room between the taxonomic laboratory and the library. The embryological laboratory occupies a cor-

responding position on the other side of the reading room, and opens into the main mor-

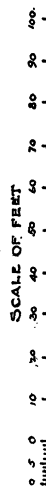
ward, and also receive indirect light from the hallway through numerous glass panels.

MUSEUM BUILDING NEW YORK BOTANICAL GARDEN



ROBERT W. GIBSON
ARCHITECT.
54 BROAD STREET NEW YORK.

PLAN OF THIRD FLOOR.



Plan of laboratories, libraries and herbarium, New York Botanical Garden.

phological laboratory. These laboratories are illuminated by windows facing north-

The instrumental equipment of the laboratories comprises a number of microscope

stands suitable for investigators, from the most prominent makers, and a full complement of objectives, immersion and apochromatic. The outfit in question has been planned to meet the habits and prejudices of workers from any part of the country, and it has been found possible to duplicate the apparatus to which any student has become accustomed.

The construction for special furniture for the laboratories awaits the definition of the forms most suitable for the character of the work which may be undertaken here.

A most interesting comparison with the battery of modern high power optical apparatus on hand, is afforded by a collection of old microscopes given by Mr. Chas. F. Cox of the Board of Managers, which forms a special laboratory exhibit. This collection illustrates the development of the microscope during the last century and a half.

The physiological dark room opens from the morphological laboratory, and is fourteen feet square with double doors and independent ventilation, connecting directly with the outside air. It is heated indirectly by the walls of the contiguous rooms, and its position in the middle of the wing of the building together with its content of over thirty-five hundred cubic feet of air secure for it a very equable temperature. This room has been in constant use for six months including the period of tests of the heating system of the building and the total range of temperature has not exceeded four degrees centigrade, and at no time has a variation of two degrees been noted in a single week. The humidity varies from sixty to eighty per cent. in the work now in progress, and it has been found to offer much more suitable conditions for experimental work than any room used for a similar purpose which has come under the notice of the writer.

A corridor leads from the morphological laboratory to the class-room between the

dark room and the office of the director of the laboratories (Professor's room, Fig. 4). The class-room is thirty-five by twenty feet, and one end is furnished with such accessories as to make it suitable for the weekly convention of workers from the laboratories. The other end serves for the private laboratory of the director of the laboratories and contains the departmental library.

The physiological laboratory is a skylighted room, thirty-five by thirty-two feet, occupying the corner of the building. It has a stone floor set in water-tight cement, a tank for aquatics, and tables for cultures. An ample heating surface is provided, and a special system of steam pipes around under the skylights secures ventilation, and acts as a preventive of dripping moisture. Ventilation of the ordinary type and that of the greenhouse are provided, while a set of shades may be used to cut off the direct rays of the sun. By such means a range of temperature similar to that of an intermediate greenhouse is secured. To this room are brought specimens from the plantations and greenhouses for experimental and observational purposes, and these are removed as soon as the work with them is finished.

A small chemical laboratory opens from the physiological laboratory, and leads into the large chemical laboratory occupying the corner of the wing. This room has not yet been provided with the special furniture and fittings necessary for chemical work. It has a large ventilating hood leading into a duct into which all the ventilating flues of the room empty. A ventilating fan driven by a powerful motor is capable of renewing the entire body of air in the room in a few minutes and thus preventing the escape of noxious gases into the contiguous laboratories.

The second corner of the wing is occupied by the photographic laboratory and

balance room, which is equipped with an outfit comprising a set of screens, cameras, and a selection of anastigmatic and planar lenses which provide for almost every contingency of indoor and outdoor work, including photomicrography and projection. The adjoining dark room opens directly into the hallway and contains the apparatus necessary for developing the printing.

The basement floor of the museum contains two rooms devoted to laboratory purposes. One is planned for the storage of chemicals and other supplies, for glassblowing and general preparation work. The second is a constant temperature room, thirty-four by twenty feet, furnished with double walls, doors and windows; this is designed to be separated into several smaller chambers in which different temperatures may be maintained. A series of thermographic tests of the temperature resulting from outside and inside causes are now in progress, from which the final fittings necessary for absolute control of the different temperatures may be determined.

The worker who comes to the herbarium or laboratories is supposed to have already demonstrated his ability to carry on independent research work, and after he has been provided with the necessities for the prosecution of the work he has only so much of advice and consultation with the member of the staff under whom he has elected work as to insure its successful prosecution. No facilities are given for elementary instruction. All the members of the staff and the workers in the laboratories meet once every week to listen to the presentation of results accomplished by one of their number, or by some visiting botanist. The opportunity for the discussion of newly found results has been found most stimulating to the persons concerned, and interesting to all attending.

The library consists of a large reading room or rotunda under the dome, of a stack

or book room to the rear in the square central wing and two small store rooms for pamphlets and duplicates.

The stack room is admirably lighted by three west, four north and three east windows, and by a long central skylight. The reading room is lighted both from the windows in the dome and from the stack room, and is furnished with chairs and large oak tables.

The book stacks are forty in number, arranged along both sides of the book room. They are constructed by steel plate of one-tenth inch in thickness, are double-fronted, made in sections four feet long, two feet deep and six and a-half feet high, with solid ends and tops, but no fronts or doors, the lowest shelf being about three inches from the floor. They are painted a dark olive-green in japanned finish. Each stack is provided with five movable shelves with adjustable space or holes on the inside of the cases about one inch apart, through which small bolts are thrust to catch the shelves. For the folios there are four large metallic double-fronted cases, three feet high with a table top five by three and a half feet, in the center of the stack room. Each case has two sections on each front, one with three plain shelves and the other arranged with a system of roller shelves for the easier handling of the heavier folios.

In accordance with the agreement with Columbia University all the botanical books of this institution, amounting to about 5000, are deposited here. The Garden has acquired about 2000 volumes since its organization. The general character of the library may be known when it is stated that an invoice, February 1, 1900, showed 127 volumes of general dictionaries and non-botanical reference works, 100 volumes on general science, 200 volumes on geology and paleontology, 1733 volumes of periodicals and proceedings, 52 volumes of collective and historical works, 495 vol-

umes on morphology and physiology, 50 volumes on geographic distribution, 2105 volumes of floras and taxonomic monographs on the phanerogams, 900 volumes on cryptogams, 640 volumes on agriculture, 325 volumes on gardening, 200 volumes on forestry and 200 volumes on meteorology. The total number of volumes on the shelves was 7117. Since this count was made the additions raise the total to about 8000. Some care has been taken to exclude books and proceedings which have only an incidental interest to botany, with the idea that such additions decrease the actual working efficiency of the library and increase the labor necessary for its administration. The books are classified according to the Dewey system of indexing, and pamphlets and separates are not indexed or included in the count until bound up in volumes by subject.

The collective efficiency of the facilities described above is such that the institution bids fair to meet the expectations of all its different classes of constituents. The large number of specialists of the staff, together with those of other institutions who offer to guide research here, gives the student, who may come here to carry on investigations, the widest range of election of work. Among those offering to guide research in the Garden are: Professor L. M. Underwood, Dr. C. C. Curtis, Dr. M. A. Howe, Dr. N. L. Britton, Dr. D. T. MacDougal, Dr. P. A. Rydberg, Dr. G. V. Nash, Dr. J. K. Small, Professor F. E. Lloyd, Mrs. E. G. Britton, and Professor E. S. Burgess.

The personal interest and care shown by the members of the Board of Managers in the organization of the Garden has resulted in placing it on its present broad foundation, while the energetic administration of the business details by the Director-in-chief has brought the institution through the most critical part of its constructive period without departure from the original plans,

without financial deficit, and with no undue loss of time.

The original guarantee fund has been preserved intact and increased by gifts and bequests to nearly \$300,000, the income of which is available; a second source of income consists of the fees of the members, and a third source is the support received from the Department of Public Parks of the City of New York.

D. T. MACDOUGAL.

SCIENTIFIC BOOKS.

The Unknown. By CAMILLE FLAMMARION. Harper & Brothers. 1900. Pp. 488.

This volume consists of a plea for the existence of unknown or unrecognized psychical forces or manifestations, and an attempt to popularize this branch of investigation, by an astronomer who is known for similar contributions to other fields—some of them of a pronounced imaginative type. When one applies to the work the critical examination which science demands, the estimate of its value must be distinctly unfavorable. Its defects are many and serious; its merits do not go beyond those included in a laborious compilation of refractory material and a thorough and sincere interest. Its contents include two introductory chapters on the dangers of excessive incredulity as well as of a too ready credulity; a large collection of cases of communications made by the dying and regarded as evidence of telepathy; a similar collection of related cases of thought transmission and clairvoyance under other conditions; a consideration of dreams and of premonitions and of hallucinations, mainly again as indicative of abnormal psychic operations; and some scattered and weak attempts to interpret these phenomena on a telepathic and 'psychic force' hypothesis. The dominant tone of the book is one not uncommon in French writings of similar purpose, and one particularly unattractive to the Anglo-Saxon intellect; there is much protesting of the necessity of careful observation and of not accepting anything except on a sufficient evidence, and again of the limitations of human knowledge and of the readiness with which even