the skeleton of *Lampris* was submitted to renewed examination. That examination forced the speaker to acceptance of the ideas of the older ichthyologists, rather than those of Boulenger; the four actinosts, or pterygials, of acanthopterygian fishes are recognized, and the coracoid of Boulenger is identified with the fourth actinost. The hypocoracoid is found in the great posterior bone called interclavicle by Boulenger. Thus the normal structure of an acanthopterygian fish is recognized. As a consequence, the genus is restored to the group of acanthopterygians. The forms and proportions of the principal bones of the shoulder girdle are nearly paralleled by undisputed acanthopterygians and relatives of the scombroideans—the Caproidæ or Antigoniidæ. Nevertheless, the differences between *Lampris* and all other fishes, as Boulenger has shown, are sufficiently great to entitle it to rank as the type of not only a distinct family (Lamprididæ), but a special superfamily (Lampridoidea).

C. JUDSON HERRICK,
Secretary.

SECTION G, BOTANY.

THE meetings of Section G of the American Association were held in Lecture Hall No. 1, on the first floor of the Columbian University Medical School. Sessions were held Tuesday morning, Tuesday afternoon and Wednesday morning, December 30 and 31, 1902.

The abstracts of papers presented are as follows:

Range of Variation in Eutypella glandulosa (Cke.) E. & E.: C. L. SHEAR, Department of Agriculture, Washington, D. C.

Eutypella glandulosa is a pyrenomycete growing on dead *Ailanthus glandulosus*. Specimens recently collected at Washington illustrate well the variability which may be expected in various parts of the plant and the conditions which seem to influence it. The parts most variable are the stromata, perithecia (number and shape) and ostiola (length and character of mouth). The stroma is sometimes almost entirely wanting, at other times well developed and conspicuously pulvinate. The perithecia vary in number from one to forty, and in shape from globose to pyriform, with all sorts of irregularities caused by pressure against each other. The ostiola are sometimes scarcely discernible, while in some specimens they reach 5 mm. in length. The tips are normally quadrisulcate, but in the long examples they are frequently acute and smooth. The asci and sporidia appear most constant, showing no corresponding variation in the extreme specimens noted. The variations found seem directly connected with the supply and the manner of supply of moisture during the development of the fungus; the maximum extreme in size and number of parts occurring where the branches bearing the plants were lying in a low place, and were more or less covered with matted grass. It is very desirable to determine the parts most variable and the range of variation in order to segregate correctly the different species in this as well as in other genera of pyrenomycetes.

Antithetic versus Homologous Alternation: DOUGLAS H. CAMPBELL, Stanford University.

Bryophytes have left scanty fossil remains, hence their relation to other forms must be deduced from comparative morphology. This discussion will concern itself with a single class of pteridophytes—the ferns. Antithetic alternation assumes that the sporophyte of the ferns is an elaboration of some bryophytic sporogonium; homologous alternation assumes that bryophytes and pteridophytes are not

genetically related. The homologous theory, based upon (1) the alga-like prothallium of certain ferns, together with (2) apospory and apogamy. The objections are (1) the alga-like protonema is almost certainly of secondary origin; (2) apospory and apogamy are readily explicable in other theories. The most primitive ferns have the least alga-like gametophytes. The numerous resemblances in both gametophyte and sporophyte point to a common origin for bryophytes and pteridophytes. Gametophytes are always aquatic: sporophytes are distinctly terrestrial structures. The evolution of the sporophyte is demonstrated by a series of liverworts. The sporophyte of bryophytes culminates in *Polytrichum* and *Anthoceros*. The sporogenous function becomes subordinate and vegetative tissues become highly developed. The uniformity in spore production is one of the strongest arguments for the common origin of archegoniates. *Anthoceros* resembles most closely the hypothetical primitive pteridophyte. The sporophytes of bryophytes and pteridophytes show many points of agreement, besides being an asexual generation derived from the oospore. Those resemblances probably represent true homologies. Objections to considering apogamy as a reversion are that apogamy occurs almost always under abnormal conditions, and in highly variable and specialized forms. Lang's hypothesis of the origin of the sporophyte is not sustained by the actual behavior of the gametophyte exposed to the assumed conditions, shown in various California liverworts and ferns. Coulter's theory as to the importance of photosynthesis in determining the origin of the leafy sporophyte is not impaired by the facts. The development of special green organs is not necessarily associated with terrestrial plants. Apospory and apogamy are analogous to adventitious budding. The water supply is the prime factor in the development of the sporophyte.

Specific Differences in the Wood of Elm Trees: W. J. Beal, Agricultural College, Mich.

The wood must be examined from a number of trees of any one species and from several places in each tree. The most reliable differences may not be the same in all genera. In elms, the number of rows and the size of open ducts, the thickness of the cell walls and the proportions of the medullary rays, are all important in determining the species.

Some Undescribed Structures in Synchytrium decipiens: F. L. Stevens, West Raleigh, N. C.

Several structures of problematic function in the nucleus and cytoplasm of the *Synchytrium* cell are described and figured. They are developed in connection with nuclear division, although their entire divergence from any previously described cytological structure renders an attempt at exact interpretation hazardous. (Illustrated by a plate and lantern slide.)

On the Manipulation of Sections of Leaf Cuticle: S. M. Bain, University of Tennessee, Knoxville, Tenn.

The author outlines his experience in handling leaf sections with special object of determining thickness of cuticle. His method is to imbed in paraffin, cut with blade of microtome knife in slanting position and unroll scrolls on drop of distilled water on slide. Preparations are then set aside and water is allowed to evaporate at room temperature. The sections are thus attached by simple adhesion to the glass, the whole process being a modification of the method of Nussbaum. Where many

sections are to be made simply to study the cuticle, the best plan is to remove the epidermis from the leaf before passing into reagents. Double staining with hæmatoxylin and Sudan III. is recommended for photomicrographic purposes.

Suggestions Relative to Botanical Periodicals and Citations: W. A. KELLERMAN, Ohio State University, Columbus, Ohio.

Since botanical periodicals have become numerous, it is considered desirable and practicable that there should be greater specialization, and especially that contributors should offer their manuscripts to those substantial journals which most distinctly represent the phase of botany concerned. If authors would thus generally discriminate according to the nature of their copy, existing and more or less specialized periodicals would become more valuable to the class of readers to which each principally appeals. Opportunity would also offer for additional magazines distinctive in character and definite in scope.

Ready and accurate citation would be enhanced if publications always bore simple, short and correct titles. Proper running head-lines are indispensable. They should contain (left page) page number, name of publication and volume number (also series if any), and (right page) date, subject (or author and subject) and page number, in order just named. No number of part (if any) should appear in headline; it should only appear on cover-page.

The rules for citation adopted by the Madison Botanical Congress should be amended in several respects—the more important being that section which requires the use of the illy understood and scarcely suggestive abbreviations for the months, such as F., Ja., Ag., O., N. and D.; the well-established abbreviations are generally used and should be sanctioned by rule.

Origin of the Patagonian Flora: PROFESSOR GEO. MACLOSKIE, Princeton, N. J.

The Patagonian flora (including that of southern Chili and the islands) contains about 2,100 species and 300 good varieties of phanerogams already described, belonging to 522 genera and 110 families. The Gramineæ have 276 species with 50 varieties, and the Compositæ about 400 species. They are chiefly derived from the Andean region; fewer from Argentina; with minor but significant contributions from Australasia, New Zealand and the Antarctic islands. Papers of Gray, Hooker and others about the North American flora are here amended so as to suppose a migration southwards on the advent of cold periods, sending to Australia and southern Chili, as far as Fuegia, forms which had been previously derived from the Arctic lands; also so as to consider the flora of the Northern Hemisphere and the Oregon-Cordilleras of North America as not primitively Scandinavian, but rather from Central Asia, whence they have radiated in all directions. This explains some of the affinities between the flora of Patagonia and that of Australia, New Zealand, Japan, etc. Besides this, there are evidences of direct transfer of plants between Patagonia, New Zealand and Australasia, by either sea or currents of air; and probably there was at one time, not a land-continuum, but a chain of islands such as would result from the elevation of the Cordilleras towards the south, and consequent emergence of elevated regions in the direction of South Shetlands and of parts towards the south pole. Victoria Land, beyond the south pole, with its volcanoes, may be part of this Cordilleran extension, and other fan-like expansions are traceable.

There are so many isolated and characteristic forms in Patagonia and neighboring parts as to indicate that it is a true

botanical region, although not closely limited from the adjacent lands. In this respect it contrasts with the Arctic regions, which have few peculiar forms. We may cite among its characteristic forms species of *Hamadeyas, Chusquea, Philesia, Lapageria, Chloræa, Arjona, Iodina, Acæna, Patagonium, Schinus,* forms of *Verbena, Pernettya, Benthamiella, Acicarpha, Azorella, Nassauvia, Perezia;* also remarkable cases of discontinuity as *Drimys* and *Veronica elliptica.*

Nuclear and Cell Division in Diplophrys stercorea Cienk.: Edgar W. Olive, Harvard University, Cambridge, Mass.

Diplophrys stercorea is an organism belonging to the Labyrinthuleæ, a group on the border line between the plant and animal kingdoms. It passes through two stages in its life-cycle—a vegetative stage in which the spindle-shaped individuals live separate and distinct from one another and a resting stage in which many individuals crawl to definite centers and there heap up in stalked, orange-colored colonies, visible to the naked eye. During the active vegetative state, the naked cells creep about over a nutrient substratum, being probably propelled by the extremely delicate, fine pseudopodia which they bear at the almost opposite poles of the spindle. The individuals in this condition each contain usually one yellowish oil body, which lies in the cytoplasm close beside the nucleus and which breaks up into minute granules during active movement or during nuclear division. The nucleus, which is plainly visible in the living organism, is of simple type, consisting of a single spherical chromatin mass, or karyosome, surrounded by karyolymph, the whole enclosed within a membrane. During nuclear division, the karyosome divides by simple constriction into two equal parts. Division of the naked spindle-shaped cell results from the progressive cleavage of a fission plane, which starts at one side and travels transversely across the cell at an oblique angle. This oblique plane of fission is unusual, since longitudinal or transverse fission is the rule among unicellular forms. The oil bodies are equally represented in the two daughter cells, and in the subsequent resting condition they usually become aggregated into one refractive yellow mass.

On the Behavior of Certain Yeast Organisms in Pure and Mixed Cultures: Wm. B. Alwood, Blacksburg, Va.

This paper treats briefly of the physiological activities of yeast organisms isolated from the fruits of apple, and then sown as pure and also as mixed cultures in an apple must of known chemical composition. The results obtained are illustrated by two graphic charts.

The Desert Botanical Laboratory of the Carnegie Institution: D. T. MacDougal, New York Botanical Garden.

A notice in regard to this laboratory has already been published in Science. Dr. MacDougal stated in greater detail the purposes and scope of the laboratory. President Gilman, Professor McGee, Professor Toumey and others took part in the discussion.

The Pines of the Isle of Pines: W. W. Rowlee, Ithaca, N. Y.

A taxonomic discussion of the West Indian hard pines and a comparison of them with the species of the Gulf states.

A new species, *Pinus recurvatus,* is described and commented upon. The ecological significance of the dense summer wood of these species is ascribed to the xerophytic conditions under which the plants exist. Specimens and photographs were used to illustrate the paper.

Studies in Araceæ: DOUGLASS H. CAMPBELL, Stanford University.

The material was collected at Kew. The species especially studied were *Aglaonema commutatum* and *Spathicarpa sagittæfolia.*

Aglaonema commutatum shows extraordinary variation in the development of the embryo-sac. The ordinary angiospermous type was never found. The number of nuclei in the mature sac is probably, in most cases, eight, but may be as many as twelve. A definite egg apparatus and antipodal cells are rarely met with, and the former is rarely at the micropylar end of the sac, but usually lateral in position. Three or four nuclei are often found in process of fusion, presumably as a preliminary to the endosperm formation. The formation of the endosperm proceeds from the base of the sac; cell walls are present from the first. The tissues of the young embryo are very little differentiated; at maturity it fills the embryo-sac. *A. pictum* conforms to the ordinary angiospermous type.

Spathicarpa sagittæfolia shows no marked deviation from the angiospermous type except in the great development of the antipodal cells subsequent to fertilization. The nuclei of the antipodal cells attain enormous dimensions. The development of the endosperm is much as in *Aglaonema.* The embryo is small.

A Preliminary Synopsis of the North American Species of the Genus Mitrula: E. J. DURAND, Ithaca, N. Y.

During the last summer species of the genus *Mitrula* were unusually abundant in the vicinity of Ithaca, N. Y. Photographs and full descriptive notes were obtained of so many species (some of which were undescribed) that it seemed desirable to attempt an arrangement of the North American species. A general preliminary synopsis of these species makes up the bulk of the paper. Further study of material in the large herbaria will be necessary before the paper will be ready for publication.

On a Fungus Disease of the Mulberry Fruit: W. A. ORTON, Department of Agriculture, Washington, D. C.

This paper gives a brief description of a disease of the mulberry in the southern states caused by an undescribed fungus which fills the seed. Specimens of the infected seeds, and also slides and drawings, were exhibited.

Numerical Variation in Plants: JESSE B. NORTON, U. S. Department of Agriculture, Washington, D. C.

A review of past work in this line—Ludwig's work and his approach to a logical explanation of the Tibonacci series of 3, 5, 8, 13, etc., as based on phyllotaxy—other literature—place and time, modes, etc.

The importance of phyllotaxy and anthotaxy in considering numerical variations, illustrated with curves constructed on the variations in numerous plants—*Sanguinaria, Chrysanthemum leucanthemum, Ranunculus,* etc.

The lack of regularity in phyllotaxy and variation of anthotaxy in individual plants and flowers as a cause of secondary modes in variation curves, illustrated by *Chrysanthemum leucanthemum,* also the relation of the whorled series 1, 2, 4, 8, 16, 3, 6, 9, 12, etc., to the alternate series 1, 3, 5, 8, 13, etc., and its multiples, as giving modes in different species not in perfect accord with the Fibonacci series.

The relation of double curves and individual plants showing tendency toward single curves in individual plants—*Chrysanthemum leucanthemum*—and changes in anthotaxy in individual heads.

The relation of reversed and normal phyllotaxy and anthotaxy to the change

in mode in curves is shown in the pine-apple and chrysanthemum.

Transgressive variation due to change of anthotaxy is found in *Iris*.

Contrasts and Resemblances between the Sand Dune Floras of Cape Cod and Lake Michigan: Henry C. Cowles, Chicago, Ill.

Physically the dunes of these two regions agree: (1) In the character of the sand, except that larger grains are found at Cape Cod; (2) in the general features of dune formation and movement; and (3) in the pronouncedly xerophytic conditions for plant life. The following contrasts were observed: (1) Obscure zonation on the ocean beach (this is much less marked on the bay side of Cape Cod); (2) a vertical sea front on the dunes nearest the sea, doubtless chiefly due to sea encroachment (this feature is wanting at Nantucket); (3) the Cape Cod dunes are much lower, (4) less extensive, and (5) present a much less typical contour; (6) the dune movement is much more rapid on the Cape, as shown by self-registered measurements on half-buried trees.

Ecologically there is general similarity: (1) In the vegetation forms of the two regions; (2) in the wonderful endurance of swamp plants which are encroached upon; (3) in the general content and dynamics of the associations (but on the Cape lichen pioneer stages are often found and pines do not always precede oaks). The contrasts are: (1) The beach flora does not show clear zonation on the ocean side of the Cape, and the plants are huddled at the foot of the fore-dunes; (2) the ocean beach (but not that of the bay shore) has a much sparser plant covering than does the lake beach; (3) half-buried plants show a surprisingly vigorous leaf development on the Cape dunes; (4) the plant covering on moving dunes is more dense at Cape Cod; (5) tree shapes are less modified on the lake dunes; (6) some species mesophytic in one region are xerophytic in the other.

Floristically the two regions are astonishingly alike, the per cent. of common species being as great or greater than would be true for inland associations at such a distance.

In conclusion, the resemblances are more striking and more far-reaching than the contrasts, showing that halophytic and tidal factors are relatively unimportant in determining sand-dune or even sand-beach floras on Cape Cod. The contrasts which exist are probably due, in the main, to differences in moisture and wind relations. In most respects the Cape conditions seem to be the more severe, and yet the vegetation covering these is more dense and the growth more vigorous.

The Production of New Varieties of Oranges: Herbert J. Webber and Walter T. Swingle.

The great desideratum of the orange industry at the present time is a hardy variety that will be able to withstand the occasional severe freezes without serious injury. The deciduous trifoliate orange is perfectly hardy as far north as Philadelphia, but its fruit is small and practically worthless, though sometimes used for preserves. Several years ago the writers started experiments for the U. S. Department of Agriculture, in the production of a hardy orange by hybridizing the very hardy trifoliate orange with varieties of the ordinary sweet orange. Our aim has been to secure a new hybrid orange that would have the hardiness of the trifoliate orange and the sweet, edible fruit of the common orange. The experiments have not yet been completed, but two hybrids have been secured which possess decided

merit and will be valuable for culture north of the present orange belt.

These two hybrids have fruits about the size of a tangerine orange, varying from two to two and a half inches in diameter. The texture of the pulp is perfect in every respect, the membranes between the segments being tender and the axis very small. They are thin-skinned, very juicy and nearly seedless. Unfortunately, however, they are too sour to be eaten out of the hand without sugar. In flavor they are more like lemons or limes than oranges, but as a matter of fact they stand alone and are like no other fruit existing. They are *new creations* in the fullest sense of the term, like Burbank's plumcots. They are neither trifoliate oranges nor ordinary oranges, though in many characteristics they are strikingly intermediate between these two fruits. Neither are they lemons nor limes, though they will more nearly take the place of these fruits than oranges. The new fruits are very aromatic and have a sprightly acid flavor, with a trace of bitter, which reminds one of the lime and grape fruit. They make a superior ade which rivals lemon or lime ade. They will probably prove to be valuable also for culinary purposes to use in the place of lemons. The trees resemble the trifoliate orange mainly, though having much larger leaves, and will probably prove valuable hedge plants. They are evergreen or semi-evergreen, retaining their leaves the year round in Florida. In more northern localities they will probably lose their leaves in winter. The fruits ripen early and will be gathered before frost. Their hardiness has not yet been thoroughly tested, but young nursery trees have passed through a freeze without losing their leaves or showing any injury, while ordinary oranges beside them were defoliated and twigs the size of one's finger killed.

While the success already obtained is far-reaching, even more important results will doubtless be obtained when seeds from these fruits are grown and selections made from among the progeny, as it is well recognized that the segregation of characters ordinarily takes place in the second generation of a hybrid.

On the Production of Wart-like Intumescences produced by Various Fungicides: HERMANN VON SCHRENK, St. Louis, Mo.

Peronospora parasitica appeared in epidemic form on the cauliflower in a greenhouse of the Missouri Botanical Garden. The leaves were sprayed with various fungicides with and without the addition of glue. As a result of the spraying the lower sides of the leaves became covered with large wart-like growths after several days. These were formed by cells of the palisade parenchyma enormously elongated, giving the appearance of œdematous cells. The œdematous condition is supposed to have been caused by a stimulating action of the copper salts.

Evolution not the Origin of Species: O. F. COOK, U. S. Department of Agriculture, Washington, D. C.

Evolution, or progressive change in the characters of species, is a phenomenon quite distinct from the origination or separation of species, and due to distinct causes.

Natural selection and other aspects of environmental influence conduce to the segregation of groups of individuals which have then the opportunity to become different, but the segregation does not cause the differences, which arise through the accumulation of variations assisted by cross-fertilization.

Some Experiments in Cell and Nuclear Division: FRANK M. ANDREWS, Indiana University.

Experiment I., Influence of Hydrogen.—Young staminal hairs of *Tradescantia*

virginica were put in a three per cent. solution of cane sugar and then brought under the influence of pure hydrogen. Under such circumstances nuclei in the resting stage can not divide, but nuclei which have begun division can complete it. No cell wall is formed; when, however, oxygen is again introduced, a cell wall is formed.

Experiment II., Influence of CO_2.—Nuclear division can not take place in nearly pure CO_2, nor can nuclei which have begun to divide complete the division as stated by Demoor.

Experiment III., Influence of Ether.—No resting nucleus can divide in ether. In one per cent., three per cent., four per cent., five per cent. and six per cent. of ether, nuclei that have begun to divide can complete division and form a cell wall. In seven per cent. ether nuclear division can not take place. Nuclei in ether do not change from indirect to direct division as stated by Nathanson.

Experiment IV., Influence of Cold.—At 2° C. nuclei can divide. At —3° C. or —4° C. nuclei can not divide as stated by Demoor.

Experiment V., Influence of Chloroform.—In chloroform diluted one half with water, nuclei that have begun to divide can complete the division and a cell wall is formed.

Experiment VI., Influence of Ammonium Carbonate.—In a one fourth per cent. or one half per cent. solution of ammonium carbonate, nuclei that have begun to divide can complete division and a cell wall is formed. A one per cent. solution of ammonium carbonate kills the cell in one minute and before nuclear division can advance.

New Examples of Diurnal Nutation: F. L. STEVENS, West Raleigh, N. C.

Nutation similar to that exhibited by *Helianthus* is demonstrated by lantern slides for several other genera, prominent among them being *Bidens, Amaranthus, Ambrosia, Medicago, Melilotus, Artemisia, Lespedeza, Trifolium,* etc.

Problematic Fossils, supposed to be Seaweeds, from the Hudson Group: DAVID WHITE, Washington, D. C.

Slabs of calcareous shale, deposited in shoal-water flats and marked with mud cracks and iron stains, bear impressions of fragments of supposed algæ of singular characters and distinctness. The fossils represent a narrow sinuous axis, now flattened, but probably nearly subcylindrical originally, alternately and repeatedly forking at an extremely wide angle at intervals of 1–2 cm., the subdivisions recurring so as to describe nearly regular and equal incomplete rings or semicircles about 3 cm. in diameter. The lobes, which end obtusely, nearly equal the axis in width, and by their ring-like form and regularity in alternate arrangement present a very striking appearance on the slab. The fossils are true intaglio impressions, or trails, destitute of carbonaceous matter. The structure of the mould bears no evidence of layers or wadding as in worm burrows. They are tentatively regarded as fucoidal and comparable to *Palæophycus* or *Buthotrephia,* though it is possible that they represent extraordinary trails made by some annelid or other animal organism. The specimens were collected by Dr. Robert Hessler in Fayette County, Indiana.

On Cultures of the Leaf-spot of the Grape, Phyllosticta Labruscæ Thm.: A. D. SELBY, Wooster, Ohio.

The paper states the results of successful efforts made at the Ohio Agricultural Experiment Station, to secure the development of the various stages in the growth of this fungus on culture media. Perithecia preceded by pycnidia were obtained

repeatedly upon agar-agar made from this substance with meat extract and peptone, to which 2 per cent. of grape sugar (glucose) and .03 per cent. tartaric acid were added to approximate the proportion of these substances in ripe grapes. These perithecia contained mature asci and ascospores, and are apparently referable to the same species found heretofore in the old, rotted grape berries and referred to diverse genera—*Physalospora, Larstadia* and *Guignardia.* It seems referable to the species known as *Larstadia Bidwillii* Viala & Ravaz.

CHARLES J. CHAMBERLAIN,
Secretary.

*THE NEW YORK ZOOLOGICAL PARK AND AQUARIUM.**

THE year 1902 has been a notable one in the history of the New York Zoological Society. The municipality of New York through Park Commissioner Willcox invited the society to take over the direction of the New York Aquarium. This was a mark of strong approval by the city of the management of the Zoological Park by the society. After some deliberation the invitation was accepted, the necessary legislation at Albany was secured, and a contract was made with the municipality whereby the society should receive not less than $45,000 per annum for the maintenance of the aquarium, and should assume entire control of the personnel and the right to dismiss any of the existing employees, the contract to be terminable on six months' notice on the part either of the society or of the municipality. Mr. Charles H. Townsend, of the United States Fish Commission, was invited to become director of the aquarium. For conference and advice the society appointed a scientific committee including Professor Charles L. Bristol, of New York University, Professor Bashford Dean, of Columbia, Dr. Alfred G. Mayer, of the Brooklyn Institute of Arts and Sciences, and two other gentlemen. Fortunately, at this time Mr. Townsend was sent abroad by the United States government as expert in connection with the Seal Fisheries dispute with Russia, and this enabled the society to arrange for a complete tour of the aquaria of Europe. Mr. Townsend brought back plans, photographs and notes upon the best features of the foreign aquaria.

The director, with the aid of the advisory committee, has already experimented on a number of important changes in the aquarium, including a new system of labeling and illumination of the tanks. He has also planned the introduction of a fish-hatching exhibit which will be in operation throughout the year, the arrangement for a larger variety of exhibits, especially of invertebrate forms of marine life, the closer touch with the public school system of New York by making provision for supply of material in connection with the biological courses in the schools, etc. Alterations in the aquarium, which will vastly improve the interior, are now being considered at an estimated cost of $30,000. It is probable that the necessary appropriation will be made, and that by next year the aquarium will be thoroughly well appointed. Fortunately, the design is admirable in all respects except illumination and ventilation, and both these defects can be remedied.

The attendance averages 5,000 persons a day, and the opportunities for spreading a knowledge and love of nature among the people of the city are very great.

THE ZOOLOGICAL PARK.

In the Zoological Park the attendance this year was 731,515, an increase of 38 per cent. or 200,000 over the year 1902. There were 127,000 visitors in the month

* From the seventh annual report.