THE MARINE BIOLOGICAL LABORATORY.

FIFTH ANNUAL REPORT,

FOR THE YEAR

1892.

BOSTON:
1892.
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</table>
OFFICERS.

1892.

Trustees.


Director.

\textbf{C. O. Whitman,} University of Chicago, Chicago, Ill.

Instructors at the Laboratory.


Artist.

\textbf{Ryoicke Takano.}
INVESTIGATORS AT THE LABORATORY.

A. — OCCUPYING PRIVATE ROOMS.

Howard Ayers, Ph.D., Director of the Lake Laboratory, Milwaukee, Wis.
Melvin A. Brannon, A.M., Science Teacher, Fort Wayne High School, Fort Wayne, Ind.
Charles L. Bristol, M.S., Fellow in Animal Morphology, University of Chicago, Chicago, Ill.
Hermon C. Bumpus, Ph.D., Professor of Comparative Anatomy, Brown University, Providence, R.I.
Cornelia M. Clapp, Professor of Zoology, Mt. Holyoke Seminary and College, South Hadley, Mass.
Edwin G. Conklin, Ph.D., Professor of Biology, Ohio Wesleyan University, Delaware, Ohio.
Charles Wright Dodge, M.S., Professor of Biology, University of Rochester, Rochester, N.Y.
Albert C. Eyckeshymer, B.S., Fellow in Animal Morphology, University of Chicago, Chicago, Ill.
Pierre A. Fish, B.S., Instructor in Zoology, Cornell University, Ithaca, N.Y.
James Ellis Humphrey, S.D., Vegetable Physiologist, Massachusetts Agricultural Experiment Station, Amherst, Mass.
Edwin O. Jordan, Ph.D., Tutor in Anatomy, University of Chicago, Chicago, Ill.
James S. Kingsley, S.D., Professor of Biology, Tufts College, College Hill, Mass.
Frederic S. Lee, Ph.D., Demonstrator of Physiology, Columbia College, New York, N.Y.
Frank R. Lillie, B.A., Fellow in Animal Morphology, University of Chicago, Chicago, Ill.
David J. Lingle, Ph.D., Assistant in Physiology, University of Chicago, Chicago, Ill.
William A. Locy, M.S., Professor of Zoology, Lake Forest University, Lake Forest, Ill.
Jacques Loeb, M.D., Assistant Professor of Physiology, University of Chicago, Chicago, Ill.
INVESTIGATORS AT THE LABORATORY.

Warren P. Lombard, M.D., Professor of Physiology, University of Michigan, Ann Arbor, Mich.
Thomas H. Morgan, Ph.D., Associate Professor of Biology, Bryn Mawr College, Bryn Mawr, Pa.
Marcella I. O'Grady, S.B., Associate Professor of Biology, Vassar College, Poughkeepsie, N.Y.
H. L. Russell, Ph.D., Fellow in Biology, University of Chicago, Chicago, Ill.
William A. Setchell, Ph.D., Assistant in Biology, Yale University, New Haven, Conn.
Oliver S. Strong, M.A., Assistant in Biology, Columbia College, New York, N.Y.
S. Watase, Ph.D., Reader in Cellular Biology, University of Chicago, Chicago, Ill.
William M. Wheeler, Ph.D., Instructor in Embryology, University of Chicago, Chicago, Ill.
C. O. Whitman, Ph.D., Director of the Biological Department and Professor of Animal Morphology, University of Chicago, Chicago, Ill.
Edmund B. Wilson, Ph.D., Adjunct Professor of Zoology, Columbia College, New York, N.Y.

B.—RECEIVING INSTRUCTION.

Elizabeth E. Bickford, S.B., Teacher of Science, Bryn Mawr School, Baltimore, Md.
Martha Bunting, B.A., Post-graduate Student, Bryn Mawr College, Bryn Mawr, Pa.
Esther F. Byrne, B.A., Assistant in Biology, Vassar College, Poughkeepsie, N.Y.
Annie Evans, 1102 14th street, Denver, Col.
Katharine Foot, 742 Judson avenue, Evanston, Ill.
Frederic P. Gorham, Student, Brown University, Providence, R.I.
ida H. Hyde, B.A., Fellow in Biology, Bryn Mawr College, Bryn Mawr, Pa.
Albert P. Mathews, S.B., Assistant in Biology, Massachusetts Institute of Technology, Boston, Mass.
Walter R. Mitchell, B.A., Professor of Biology, Hyde Park High School, Chicago, Ill.
Albro D. Morrill, B.A., Professor of Biology, Hamilton College, Clinton, N.Y.
H. W. Norris, B.A., Professor of Biology, Iowa College, Grinnell, Iowa.
Lillian V. Sampson, B.A., University of Zürich, Zürich, Switzerland.
Mary A. Schively, Woman's Medical College, Philadelphia, Pa.
Aaron L. Treadwell, B.A., Professor of Biology, Miami University, Oxford, Ohio.
Louise B. Wallace, Mt. Holyoke College, South Hadley, Mass.
Martha Vollstein, Demonstrator of Histology, Woman's Medical College of New York Infirmary, 321 E. 15th street, New York, N.Y.
STUDENTS AT THE LABORATORY.

ANETTA F. ARMES, Teacher in the Martin School, Boston, Mass.
SARAH AVERILL, Student at Mt. Holyoke College, South Hadley, Mass.
CHARLES E. BARR, Albion College, Albion, Mich.
ANNA L. BATCHELLER, Vassar College, Poughkeepsie, N.Y.
EDWIN TENNEY BREWSTER, Teacher of Science, Wolfeboro Academy, Wolfeboro, N.H.
DIXIE L. BRYANT, Head of Scientific Department in State Normal School, Greensboro, N.C.
SEVERANCE BURRAGE, Assistant in Biology, Massachusetts Institute of Technology, Boston, Mass.
DANIEL H. COLE, Student, Rochester University, Rochester, N.Y.
LOUISE B. COMSTOCK, 37 Rowley street, Rochester, N.Y.
F. STORY CONANT, Student, Williams College, Williamstown, Mass.
MRS. RHODA A. ESTEN, Teacher, Doyle Avenue Grammar School, Providence, R.I.
CORNELIA GOLAY, Teacher in Miss Mittelberger's School, Cleveland, O.
SUSAN J. GRACE, Assistant in W. D. High School, Chicago, Ill.
MRS. AGNES M. HARDINGE, Assistant in W. D. High School, Chicago, III.
J. J. HARE, President of Woman's College, Ontario, Canada.
N. A. HARVEY, Teacher of Science, Kansas City High School, Kansas City, Mo.
GRACE HASTINGS, Teacher of Zoology, Detroit High School, Detroit, Mich.
LOUISE W. HOOKER, 54 Oxford street, Rochester, N.Y.
EDITH R. HOPKINS, 17 Grove place, Rochester, N.Y.
ELIZA HYNDMAN, Assistant in Science, Cornell College, Mount Vernon, Iowa.
HORACE E. JACOBS, Student, Brown University, Providence, R.I.
MARY E. JONES, Fort Wayne, Ind.
S. C. KEITH, Student, Massachusetts Institute of Technology, Boston, Mass.
MILDRED LAKIN, Teacher of English, Milwaukee High School, Milwaukee, Wis.
CLARA LANGENBECK, Student, University of Cincinnati, Cincinnati, O.
HERMAN T. LUKENS, Teacher of Science, N. W. Division High School, Chicago, Ill.
C. H. Maxson, Rochester Theological Seminary, Rochester, N.Y.

Mary C. Mellyn, Teacher in the Rice Training School, Boston, Mass.

Hattie Merrill, Teacher of Biology, Milwaukee High School, Milwaukee, Wis.

Mrs. Ella W. Metcalfe, 1414 Linden avenue, Baltimore, Md.

Marie L. Minor, Student, Bryn Mawr College, Bryn Mawr, Pa.

Maud W. Morey, Assistant at W. Division High School, Chicago, Ill.

William W. Newcomb, Student, University of Michigan, Ann Arbor, Mich.

Dexter P. Nicholson, Professor in Lawrence University, Appleton, Wis.

Winthrop J. V. Osterhout, Student, Brown University, Providence, R.I.

Mary S. Packard, Vassar College, Poughkeepsie, N.Y.

Elizabeth C. Palmer, Vassar College, Poughkeepsie, N.Y.

Francis S. Parsons, Teacher in Lake View, No. 4 Grammar School, Chicago, Ill.

Herman S. Peepoon, Lake View High School, Chicago, Ill.

Mary J. Sackett, Brooklyn, N.Y.


Dallas L. Sharp, Student, Brown University, Providence, R.I.

William P. Shepard, Hamilton College, Clinton, N.Y.

Edith H. Stearns, Vassar College, Poughkeepsie, N.Y.

Mrs. Helen D. Stearns, Detroit, Mich.

Israel Strauss, Student, Brown University, Providence, R.I.

Ralph W. Tower, Assistant in Biology, Brown University, Providence, R.I.

A. B. Ulrey, Instructor in Department of Zoology, Indiana University, Bloomington, Ind.

Willard G. Van Name, Student, Yale University, New Haven, Conn.

Augustus B. Wadsworth, Student, Massachusetts Institute of Technology, Boston, Mass.

Herbert Eugene Walter, Post-graduate Student, Brown University, Providence, R.I.

Frank W. Wamsley, Student, Brown University, Providence, R.I.

Jeanette C. Welsh, Student, University of Chicago, Chicago, Ill.

Nettie Morton Willey, Instructor in Domestic Economy, Brookline, Mass.

Lucy Langdon Williams, Student, University of Pennsylvania, Philadelphia, Pa.

Bertha L. Wilson, Teacher of Science, High School, Minneapolis, Minn.

Benjamin S. Winchester, Chicago, Ill.

S. Elizabeth Woodbridge, Vassar College, Poughkeepsie, N.Y.
For the fifth year of the Laboratory's existence the Trustees have the pleasure of reporting to the Corporation by far the most successful season in its history.

In 1888, the year in which it was first opened, the Laboratory consisted of two large open rooms, imperfectly fitted and but poorly equipped for advanced zoological work. No means of collecting material for study, other than a small row-boat, were provided. The total attendance during the first summer was seventeen.

In the year following (1889) it was determined to divide that portion of the Laboratory which was to be reserved for advanced work into a number of small laboratories well fitted with aquaria and supplied with running salt water, thus shielding investigators from the bustle and disturbance which is inevitable in a large laboratory. The Laboratory also enlarged its sphere of usefulness by providing, in addition to the course of instruction in Zoology, a course in Marine Botany. The use was secured of another boat capable of being either rowed or sailed.

During this season, largely by the generosity of one person, the Laboratory was provided for the first time with a collection of books worthy to be called a library, and the inconvenience caused to those engaged in research by the want of a separate library and reading-room became even greater than before. At the same time the need of a lecture-room was strongly felt, for thus far all lectures had to be given in the large students'
laboratory. It was to meet these wants that the public was appealed to, and with the means supplied by its generous response the first addition was made to the Laboratory, in the form of an L. Meantime the growth of the Laboratory had been phenomenal, the attendance rapidly increasing; and it was found, during the next summer (1890), that, owing to this increased attendance, the new L but partly relieved the difficulties. During this season the work of the Laboratory was much more extensive and valuable than had been possible heretofore, owing to the important addition to the equipment of a steam-launch, designed by the late Edward Burgess and most admirably adapted for its purpose. It was also during this summer that the Laboratory acquired, through the generosity of Joseph S. Fay, Esq., a valuable piece of land, four times the size of that on which the Laboratory now stands, and but a short distance from it. On this land is a good-sized house, known as the "Gifford Homestead," and a barn, which have been most useful for mess-rooms and storerooms.

In the summer of 1891 the number in attendance rose to seventy-one. Both lecture-room and library had to be used for laboratory purposes, and it became apparent that in another year either the number of workers must be reduced or the accommodations must be increased. To relieve this pressure, and also to forestall the ever-increasing demand, the Trustees, last spring, determined to add a new wing so as to cover with buildings three sides of a quadrangle. These three buildings are shown, with plans, on pp. 20, 21. The original building, erected in 1888, is that on the left. The L of 1890, in the background, connects the original Laboratory with the wing of 1892. The new building of 1892 was made as large as the original Laboratory. At the same time the Director announced a new course of instruction and investigation, that of Physiology, in addition to those hitherto provided.

This Department found its quarters in the new building, and for the first time the Department of Botany was provided with a separate laboratory for its own use. It was expected that this building would be sufficient to relieve the incoming throng of
workers, but the record shows that the growth had not yet reached its maximum. Applications for the privileges of working in the Marine Biological Laboratory exceeded by thirty-nine those of 1891, swelling the roll of 1892 to one hundred and ten investigators and students.

The most important and most gratifying feature of the year's work has been the coöperation of the Colleges and Universities. A reference to the list of Trustees and other officers, and to the Director's Report, will show how remarkable and how extensive this growth has been. Moreover, it is certain that the financial burden, which now annually falls upon us, will be materially lightened, if not altogether lifted, when this movement shall have gone still further.

By the will of the late Dr. R. W. Wood, of Boston, the Laboratory has lately received a bequest of $500. We are especially indebted to those who have supplied us with means, and to the Director of the Laboratory and his staff for their efficient and successful administration of its affairs. Our thanks are due also to the U. S. Fish Commission, for important aid in connection with the salt-water supply, and for many other favors.

In view of the remarkable record of growth and prosperity outlined above, and further emphasized in the Report of the Director, we earnestly appeal to the public for support. Joseph S. Fay, Esq., has most generously discharged a mortgage of $2,000, which up to this time had rested on the Gifford Homestead and land, so that the Laboratory is now no longer burdened by any legal incumbrances. Since, however, every additional student or investigator necessitates the purchase of additional laboratory equipment and furniture, the unexpected growth of last summer involved greater expense than had been anticipated; and at the end of the season the Trustees were obliged to advance $2,000 in order to close all accounts for the current year. Although the running expenses during the coming year will be far less than heretofore, the need of funds is still pressing, to repay the money advanced by the Trustees, and to equip more fully the Physiological Laboratory.

There is also an important matter which up to this time has
required of the Trustees but little attention, but which, with our rapidly growing numbers, forces itself upon us. This is the problem of good table board. The Gifford Homestead, which has been used as a mess-room, is well adapted for the accommodation of comparatively few boarders; it is entirely inadequate to care properly for the large numbers now in attendance, and an addition to the present building is imperative, in order that those investigators teachers and students who so cheerfully and even gladly surrender their summer holidays and eagerly devote themselves to the pursuit of science, may not suffer physically from poor and improper food.

In order, therefore, that the work may not languish, but may be carried forward, we urgently appeal for the sum of $5,000, for immediate use; and as a basis for this plea we point with confidence to the remarkable history and prospects of the educational movement embodied in this Laboratory, as outlined in the Report of the Director which immediately follows.

(Signed) SAMUEL H. SCUDDER, President.
EDWARD T. CABOT, Treasurer.
ANNA PHILLIPS WILLIAMS, Secretary.
A. LAWRENCE LOWELL, Clerk.
SAMUEL F. CLARKE,
FLORENCE M. CUSHING,
WILLIAM G. FARLOW,
EDWARD G. GARDINER,
WILLIAM LIBBEY, Jr.,
J. PLAYFAIR McMURRICH,
CHARLES S. MINOT,
HENRY F. OSBORN,
WILLIAM T. SEDGWICK,
BENJAMIN SHARP,
GEORGIANA W. SMITH,
SIDNEY I. SMITH,
WILLIAM TRELEASE,
EDMUND B. WILSON,
R. RAMSAY WRIGHT.
TREASURER'S

Dr. MARINE BIOLOGICAL LABORATORY IN

By cash, as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Instructors</td>
<td>$1,149.50</td>
</tr>
<tr>
<td>Wages</td>
<td>1,070.13</td>
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<td>Addition to Laboratory</td>
<td>4,015.93</td>
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<tr>
<td>Equipment</td>
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<tr>
<td>Furniture</td>
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<td>Sundry alterations and repairs</td>
<td>412.70</td>
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<tr>
<td>Launch</td>
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<td>Supplies</td>
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<td>Chemicals</td>
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<td>Alcohol</td>
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<td>Insurance</td>
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<tr>
<td>Sundry running expenses</td>
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**$10,829.88**

**Postage**

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<tr>
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<td><strong>206.74</strong></td>
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**$11,036.62**
REPORT.

ACCOUNT WITH E. T. CABOT, TREASURER.

By cash, as follows:

<table>
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<th>Description</th>
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<tr>
<td>Balance Nov. 10, 1891</td>
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<tr>
<td>Assessments</td>
<td>$141.00</td>
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<tr>
<td>Contributions</td>
<td>$5,113.93</td>
</tr>
<tr>
<td>Fees of students and investigators</td>
<td>$2,025.00</td>
</tr>
<tr>
<td>Fees from colleges</td>
<td>$740.00</td>
</tr>
<tr>
<td>Sale of supplies</td>
<td>$853.27</td>
</tr>
<tr>
<td>Interest</td>
<td>$28.36</td>
</tr>
<tr>
<td>Advanced by friends of the Laboratory</td>
<td>$2,010.00</td>
</tr>
<tr>
<td></td>
<td><strong>$11,036.62</strong></td>
</tr>
</tbody>
</table>


Dec. 24, 1892. Examined and approved.

Also examined property, as follows:

- Bonds, $1,000 St. Paul, Min. & Manitoba R.R. Co., 4%
- Bonds, $1,000 Chi., Bur. & Northern R.R. Co., 5%
- Carter mortgage for $800.
- Deposit in Suffolk Savings Bank                      | $177.55  |
- Deposit in New England Trust Co.                    | 321.66   |
  of which $80.28 belongs to the Crocker Fund.

Also belonging to the Crocker Fund:

- Deposit in Home Savings Bank                         | $93.98   |

A. LAWRENCE LOWELL,

For the Committee on Finance.
REPORT OF THE DIRECTOR
OF THE
MARINE BIOLOGICAL LABORATORY,
FOR THE
FIFTH SESSION, 1892.

To the Trustees of the Marine Biological Laboratory:

LADIES AND GENTLEMEN,—I have the honor to lay before you the following report on the fifth session of the Laboratory. The principal points to be noticed are:

1. The growth of the Laboratory.
2. The coöperation of the Colleges and Universities.
3. The courses of lectures and laboratory instruction.
4. The new department of Physiology.
5. The department of Zoölogy.
9. The next step in the development of the Laboratory.

THE GROWTH OF THE LABORATORY.

The Laboratory has been enlarged twice within four years, first by the addition of an L, and second by a building of the size of the original. We now have the students' zoölogical laboratory, the botanical laboratory, the physiological labora-
tory, two general laboratories for beginners in Investigation, thirty private laboratories, a library-room, and a lecture-hall (pp. 20, 21).

The enlargement of our space has been none too rapid to meet the demands already made upon us. This session has seen every room and laboratory occupied to their full capacity. Those who carry the burden of the instruction at the sacrifice of time that would otherwise be devoted to investigation, must be spared much further extension of their work, at least for the present. Some alterations, to be suggested farther on, will make it possible to accommodate about one hundred and twenty next summer. The whole number in attendance this summer was 110, — 60 students and 50 investigators. Of the investigators, 31 occupied private laboratories, and 19 receiving instruction had tables in the general laboratories. The universities, colleges, seminaries, schools, and other institutions represented, were 52. The growth of the Laboratory during the five years of its existence is shown in the following table:

<table>
<thead>
<tr>
<th></th>
<th>1888</th>
<th>1889</th>
<th>1890</th>
<th>1891</th>
<th>1892</th>
<th>1888-1892</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of institutions represented</td>
<td>13</td>
<td>29</td>
<td>32</td>
<td>41</td>
<td>59</td>
<td>110</td>
</tr>
<tr>
<td>Number of persons in attendance</td>
<td>17</td>
<td>44</td>
<td>47</td>
<td>71</td>
<td>110</td>
<td>200</td>
</tr>
</tbody>
</table>

**The Coöperation of the Colleges.**

During the past year, the Laboratory has appealed, for the first time, to the Colleges and Universities to aid in sustaining its work by subscribing for its private laboratories, held at $100 each for the session. Hitherto these had been offered free, but the increased expense resulting from the enlargements of the building, from maintaining a steam-launch in constant service, and from the increase of the staff, made it necessary to ask those interested in the maintenance of the Laboratory to bear this small share of the burden. The request first took a definite form in a circular prepared by a Committee of the Trustees from which the following paragraphs are cited, in order to show
Upper floor.

Lower floor.

96 ft.
in what way the colleges were expected to cooperate, and the grounds for their so doing:

"The Laboratory has hitherto depended largely upon private subscriptions and the efforts of a few individuals to raise the funds necessary for annual maintenance, yet it has been open to students and investigators from all parts of the country, partly free and partly by payment of certain fees. We now desire to connect the Laboratory more closely with the biological work which is being done in the colleges by a relation somewhat similar to that which exists between the Zoological Station at Naples and many of the European Universities, aided by government support. In other words, we wish to look to the colleges partly for future support and for an increased number of students and investigators.

"We invite your cooperation in the maintenance of the Laboratory in the form of a subscription to a student's or investigator's table, or both, during the coming summer, with such provision for the expenses of the incumbent as you think best. In return we will reserve a table or private investigator's room for such students as may be sent by your department, and will extend to them all the privileges which the Laboratory affords.

"We believe that the opportunities which can now be offered for instruction and research through the association of the large number of professors, instructors, and students who annually attend the Laboratory, give these summer courses advantages which cannot be enjoyed elsewhere. The appointment to a student's or investigator's table will be an important complement to the regular collegiate work of students, and an incentive to those who give promise of capacity for advanced study and fitness to become teachers."

The response has been unexpectedly general and prompt. The institutions that have subscribed for the past summer are Columbia, Brown, the Missouri Botanical Garden, Williams, Chicago, Massachusetts Institute of Technology, Rochester, Bryn Mawr, Mt. Holyoke, Vassar, Wellesley, Cincinnati, Miami, and Northwestern. Bowdoin has already subscribed for next summer, and there is reason to expect that the number will
not be less than fifteen by the next session. A number of colleges propose to subscribe for two or three rooms each, so that the number of rooms disposed of by subscription is not likely to fall short of twenty in 1893. At this rate we shall soon have few rooms to offer at any price.

The extent to which the higher educational institutions of the country have thus far been represented in the membership of the Laboratory may be seen from the following list of one hundred and ten names:

**Universities and Colleges.**

<table>
<thead>
<tr>
<th>University/College</th>
<th>City/Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albion College</td>
<td>Albion, Mich.</td>
</tr>
<tr>
<td>Brown University</td>
<td>Providence, R.I.</td>
</tr>
<tr>
<td>Bryn Mawr College</td>
<td>Bryn Mawr, Pa.</td>
</tr>
<tr>
<td>Carrolton College</td>
<td>Northfield, Minn.</td>
</tr>
<tr>
<td>Chicago University</td>
<td>Chicago, Ill.</td>
</tr>
<tr>
<td>Cincinnati University</td>
<td>Cincinnati, O.</td>
</tr>
<tr>
<td>Clark University</td>
<td>Worcester, Mass.</td>
</tr>
<tr>
<td>Collegiate Institute</td>
<td>Kingston, Ontario, Canada.</td>
</tr>
<tr>
<td>Columbia College</td>
<td>New York, N.Y.</td>
</tr>
<tr>
<td>Cornell University</td>
<td>Ithaca, N.Y.</td>
</tr>
<tr>
<td>De Pauw University</td>
<td>Greencastle, Ind.</td>
</tr>
<tr>
<td>Franklin and Marshall College</td>
<td>Lancaster, Pa.</td>
</tr>
<tr>
<td>Hamilton College</td>
<td>Clinton, N.Y.</td>
</tr>
<tr>
<td>Harvard University</td>
<td>Cambridge, Mass.</td>
</tr>
<tr>
<td>Haverford College</td>
<td>Pennsylvania.</td>
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<tr>
<td>Heidelberg University</td>
<td>Tiffin, Ohio.</td>
</tr>
<tr>
<td>Indiana University</td>
<td>Bloomington, Ind.</td>
</tr>
<tr>
<td>Iowa College</td>
<td>Grinnell, Iowa.</td>
</tr>
<tr>
<td>Johns Hopkins University</td>
<td>Baltimore, Md.</td>
</tr>
<tr>
<td>Lake Forest College</td>
<td>Lake Forest, Ill.</td>
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<tr>
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Northwestern University Evanston, Ill.
Oberlin College Oberlin, O.
Ohio University Athens, O.
Ohio Wesleyan University Delaware, O.
Olivet College Olivet, Mich.
Ottawa University Ottawa, Can.
Princeton College Princeton, N.J.
Randolph Macon College Ashland, Va.
Smith College Northampton, Mass.
State University of South Dakota Vermillion, S.D.
St. Lawrence University Canton, N.Y.
Swarthmore College Pennsylvania.
Tufts College College Hill, Mass.
University of Illinois Champaign, Ill.
University of Kansas Lawrence, Kan.
University of Michigan Ann Arbor, Mich.
University of Nebraska Lincoln, Neb.
University of Rochester Rochester, N.Y.
University of South Carolina Columbia, S.C.
University of Toronto Toronto, Ontario, Canada.
University of Virginia Charlottesville, Va.
Vanderbilt University Nashville, Tenn.
Vassar College Poughkeepsie, N.Y.
Wellesley College Wellesley, Mass.
Wesleyan University Middletown, Conn.
West Division High School Chicago, Ill.
Westtown Boarding School Westtown, Pa.
Whitman College Walla Walla, Wash.
Williams College Williamstown, Mass.
Woman's College Ontario, Canada.
Woman's Medical College New York, N.Y.
Woman's Medical College Philadelphia, Pa.
Yale University New Haven, Conn.
SEMINARIES, ACADEMIES, SCHOOLS, AND LABORATORIES.

Allis Lake Laboratory .......... Milwaukee, Wis.
Bridesburg School .......... Pennsylvania.
Bryn Mawr School .......... Baltimore, Md.
Burr and Burton Seminary .......... Manchester, Vt.
California Academy of Sciences .......... San Francisco, Cal.
Central Normal School .......... Lewiston, Ill.
Central School .......... Brooklyn, N.Y.
D. High School .......... Chicago, Ill.
Dunkirk High School .......... Dunkirk, N.Y.
Dwight School .......... Boston, Mass.
Fort Wayne High School .......... Fort Wayne, Ind.
Friends' School .......... Providence, R.I.
Grammar School .......... Providence, R.I.
Harvard Medical School .......... Boston, Mass.
High School .......... Fort Wayne, Ind.
High School .......... Minneapolis, Minn.
High School .......... New Ulm, Minn.
Hyde Park High School .......... Chicago, Ill.
Indianapolis High School .......... Indianapolis, Ind.
Kansas City High School .......... Kansas City, Mo.
Lake View Grammar School .......... Chicago, Ill.
Lake View High School .......... Chicago, Ill.
Martin School .......... Boston, Mass.
Massachusetts Agricultural Experiment .......... Amherst, Mass.
Station
Massachusetts Institute of Technology .......... Boston, Mass.
Meriden High School .......... Meriden, Conn.
FIFTH ANNUAL REPORT.

Milwaukee High School       .       .       Milwaukee, Wis.
Milwaukee Public Museum     .       .       Milwaukee, Wis.
Miss Mittleberger's School  .       .       Cleveland, O.
Missouri State Normal School       .       .       Warrensburg, Mo.
North West Division High School     .       .       Chicago, Ill.
Oak Park High School        .       .       Oak Park, Ill.
Packer Institute            .       .       Brooklyn, N.Y.
Preparatory School of Northwestern University .       .       Evanston, Ill.
Rockford High School        .       .       Rockford, Ill.
Shaw School of Botany       .       .       St. Louis, Mo.
South Jersey Institute      .       .       New Jersey.
State Normal School         .       .       Greensboro, N.C.
Theological Seminary        .       .       Rochester, N.Y.
University School           .       .       Chicago, Ill.
Wolfsborough Academy        .       .       Wolfsborough, N.H.

LECTURES AND LABORATORY INSTRUCTION.

The lectures and lecture courses offered during the session have added immensely to the opportunities for instruction and investigation afforded by the Laboratory. A large number of these lectures were arranged to accompany the work going on in the Laboratory, the lectures and laboratory exercises of one week being devoted to coelenterates, another to the unsegmented worms, another to annelids, another to molluscs, another to echinoderms, another to insects, another to Balanoglossus and the ascidians, another to the sense-organs of Amphioxus, and the ear and lateral line organs of the vertebrates; and so on through a long list. These lectures, it is to be noted, were given by specialists who could speak from first-hand knowledge of their subjects, and who could give information not to be
obtained from any text-books. Moreover, they were given by specialists representing not one laboratory, but a dozen or more of the better laboratories of the country. Manifestly such lectures afford the very best instruction, not only for the beginner, but also for the advanced student and investigator. Perhaps it may be said that investigators alone know the real value of such opportunities, and how to profit most by them. Certain it is, that the Marine Laboratory now forms the only centre in this country for the annual assembling of our biologists. This constitutes its distinguishing feature, gives it a national character, and secures for it a constituency free from all that personal or sectional rivalry, which is so fatal to the progress of science. If the Marine Biological Laboratory contribute, in ever so small a degree, to the abatement of this one standing curse of American science, it will have rendered a service of incalculable value.

In addition to the fifty lectures (33 in zoology and 17 in botany) given with especial reference to the Laboratory work, there has been an extended course of evening lectures on subjects of general interest, given in part by members of the Laboratory, and in part by distinguished scientists coming mostly from New England colleges. This course has been one of unusual interest, as the following list will show:

1. **DR. H. P. BOWDITCH**, of Boston, on "The Determination of Types in Biology" (illustrated by "curves of growth" in children, and by composite photographs).
2-3. **PROF. LOMBARD**, of Michigan University, on "Reflex Action" and on "Fatigue."
4-5. **PROF. E. S. MORSE**, of Salem, on "China" and on "Japan."
6-7. **PROF. LIBBEY**, of Princeton, on "The Physical Geography of the Sea" and on "A Trip to Mexico" (illustrated by lantern views).
8. **PROF. OSBORN**, of Columbia, on "Some Problems in Heredity."
In my last report I called attention to the fact that for lack of space we had not been able to provide for one of the most important branches of our science; and at the same time I dwelt at some length on one of its undeveloped sides. The step we have taken in introducing physiology leads me to recur to this point. It is only as a zoologist that I venture to discuss this subject; and only in this capacity that I undertake to defend the proposition, that general zoological physiology is the promising field in which morphology and physiology may work most profitably together.

Morphology and physiology are two quite distinct sides of biology, each with definite and constant peculiarities of method and aim; but these two sides are only the statical and the dynamical aspect of one and the same thing; one presents the feature, the other the expression. It is only as a matter of convenience that these two aspects are dealt with separately; they are complemental, and have their full meaning only when united. The same function may appear in different forms, but a knowledge of the forms is nevertheless indispensable to an understanding of the function, and, conversely, the function must
be known before we can arrive at a complete interpretation of the form. The best interests of biology demand that morphol­ogy and physiology should be kept in working contact. That is the lesson of the hour, which thoughtful investigators on both sides are coming more and more to realize. The separation of these two great branches of biology has been carried to an ex­treme that impedes the progress of both — an extreme that is unnatural, and that has resulted from keeping physiology too exclusively in the service of Medicine. Physiology has come to mean, in practice at least, little more than the science which treats of the functions of fully developed organs. That this is an important side of physiology goes without saying; but there is another side no less important, which has hitherto been left almost wholly to morphologists. That we have to deal with functions of organisms, as well as functions of organs, is a truth that could not escape the student of Darwin’s or Wallace’s works. Still, we have but just begun to heed the fact that the broader physiology of the future must include the biological economy of organisms, as well as the functional economy of organs. I repeat, the biological economy of organisms must be­come an integral part of physiology, not only in theory, but in practice as well. The activities and inter-relations of organisms bear the same relation to their morphology as do the functions and correlations of organs to their anatomy. The former ac­tivities differ from the latter only in degree, just as an organism differs from an organ only as a composite differs from a simple. As the morphology of organisms includes organology, so the physiology of organisms embraces the functions of organs. As the one covers all organic form from the most minute and simple up to the most highly differentiated and complex, so the other covers all vital phenomena, whether manifested in the smallest particle of living protoplasm, in a cell, a special tissue, an organ, an organism, a species, or any group of organisms. Form and function are always the two aspects, inseparably linked together throughout the entire organic world. The work of the physiologist runs perfectly parallel with that of the morphologist, and wherever the one divides there the other
divides, and for precisely similar reasons. We have the morphology of adult individuals, likewise the physiology; we have the morphology of the developing individual (ontogeny), likewise embryological physiology ("physiontogeny"); then we have the morphology of the species (phylogeny), and alongside the physiology, or the phylogeny of functions ("physiophyly," Haeckel). Metaphysiosis\(^1\) is as old and as universal as metamorphosis, and to attempt to explain functions as we find them to-day, without considering their historical development, is, in many cases at least, as idle as trying to account for the specific forms of existing organisms without the aid of their genealogy. Monumental failures of this kind might be cited on both sides; but it may be said that morphologists have almost universally abandoned this standpoint, while physiologists have quite generally adhered to it. It is the one-sided, anthropocentric development of physiology that has retarded its progress, and that still waits to be corrected. Presumptuous as such statements may appear, coming from a morphologist, they are nevertheless true and must be declared, so long as the malady of one of the twin branches of biology remains the affliction of the other. So long as such fundamental functions of organisms as heredity, variation, and adaptation, are neglected by physiologists, so long will physiology have to bear the reproach of having some of its more inviting fields pre-occupied and developed by morphologists.

What processes of life are more universal or more fundamental than those exhibited in and about the dividing nucleus? What function of living protoplasm has more to tell us about how the organism comes into existence, and how the foundation is laid for the development of all the higher functions, than that of cleavage? What phenomenon of life stands more in need of a physiological explanation than that of sex-differentiation? What question has a more direct practical bearing on the education and development of the human race than that of the transmission of acquired characters? What functions of more

\(^1\) This word suggests itself so readily that it will hardly be recognized as novel; it is, at least, self-defining.
transcendent interest than those of the various sense-organs? Where could a more beautiful example of the evolution of function be found than is furnished in our special senses? How intensely interesting the subject of the derivation of such functions! Will the physiologist, or his protégé the psychologist, give a share of attention to these important matters, or must the morphologist not only find the problem, but work it out, whenever it falls within the range of evolution? That would mean working under all the disadvantages attending the separation of two coördinate branches which are complementary, one to the other. Morphology would lose its natural helpmate, and physiology would forsake its best guide. Morphology analyzes the organic machine, and thus lays the foundation for understanding its physiological use; physiology puts the suggestions of morphology to the test of experiment, and elucidates the dynamical side of the machine. What the machine consists of and what it can do, go together to make up a full concept of its structure and its functions. But the concurrence of the two sciences does not stop here. Morphology raises the question, How came the organic mechanism into existence? Has it had a history, reaching its present state of perfection through a long series of gradations, the first term of which was a relatively simple stage? The embryological history is traced out, and the paleontological records are searched until the evidence from both sources establishes the fact, that the organ or organism under study is but the summation of modifications and elaborations of a relatively simple primordial. This point settled, physiology is called upon to complete the story. Have the functions remained the same throughout the series, or have they undergone a series of modifications, differentiations, and improvements, more or less parallel with the morphological series? To answer this question, physiology has to appeal to the same sources of evidence as does morphology; namely, paleontology and embryology. The paleontological series of forms cannot of course be experimented with; but form and function are so correlated that the latter may often be inferred from the former, and vice versa. The embryological series, often including free larval stages, fur-
lishes one of the grandest fields for experimental study. Here
the physiologist has an opportunity not only to study by ex-
periment, but also by direct observation and inference, and thus
to join hands with the morphologist, both in methods and
results.

We are compelled to recognize different orders of individu-
als, — as the cell, the tissue, the organ, the organism, the
corn, etc., — and of course every order must have its physiology
as well as its morphology. Morphology and physiology are
coextensive, each claiming the whole organic world — as it was,
as it is, and as it becomes. So long as we contra-distinguish
form and function; we must abide by the logic of definition.
We cannot reduce the circumference of the animate world,
however many radii and concentric circles we draw around our
specialties. We may limit the province, but not the realm. If
we limit our study to man, we do not annihilate his relations to
the rest of the animate world. Human physiology and human
morphology represent only the latest terms of series stretching
back to remote initial terms. The complexities of structure and
function of the later terms we can never hope to understand
until, through the study of a sufficient number of mean terms,
we are able to determine the initial ones. Three general series,
each more or less incomplete, are accessible to study: (1) The
systematic series, consisting of adult organisms; (2) the paleon-
tological series, and (3) the developmental series. Morphology
approaches these series by comparative study, and seeks to
make each contribute as complete a story as possible. The same
sources and the same methods are open to physiology. The
importance of the comparative method in physiology, and the
intimate co-relationship of physiology with morphology, are
well exemplified in a charming little treatise by Metschnikoff
on "La Pathologie Comparée de l'Inflammation," — a work that
must be reckoned as one of the fairest gems that adorn the
annals of the Pasteur Institute. This monumental work shows
how Medicine itself must take its lessons from comparative
biology, and approach its work from the standpoint of evolu-
tion.
The history of morphology and physiology is one continuous illustration of their inter-dependence. When the famous Harvey was asked what led him to think of the circulation of the blood, he at once referred the original suggestion to one of the morphological features of the vascular apparatus,—the valves and their arrangement. The hint furnished by structure was then followed up and tested by experiment, and the result was a discovery that brought the position of valves, pulsation of the heart, effects of ligatures, and other facts, into rational relation to one another.

The history of theories of generation furnishes a capital example of how physiological speculation has been guided, checked, and corrected by morphological discovery. The old doctrine of preformation, or preexistence of organisms in the germ, and the notion of the inclusion of one germ-preformation within another, was certainly strongly suggested by the unfolding of plant buds, and by the metamorphoses of insects; but as soon as it became possible to examine more minutely the phases of development, it was found that the fine-spun theories of Bonnet and Haller were refuted by morphological facts; and the doctrine of epigenesis, defended by Aristotle and Harvey, was led to triumph through the observations of Casper Friedrich Wolff.

Our special senses have afforded one of the most fertile fields for speculative physiology. It is needless to dwell on antiquated hypotheses of "vital spirits" residing in the nerves, of a subtle nervous humor, or "imponderable fluid" drawn from the blood and secreted by medullary matter (Cuvier). The history of the hypotheses of life, sensation, and volition are largely, as Whewell has well remarked, "the story of the failures of physiological speculation." It is to the cultivation of the morphological sciences that physiology owes, in a very large measure, its deliverance from the temptation to stray into the region of metaphysics.

As Morphology deals with the ground-structure on which physiology operates, it naturally takes the place of pioneer and guide; but if permitted to wander too far in advance it soon finds itself entangled with physiological problems with which it
is not prepared to cope, and its efforts to release itself often end in sterile speculation. The workers on both sides should therefore advance abreast in hand to hand contact. It is only in such reciprocally helpful relations that specialists can attain the highest possible individual development; and it is only when morphological and physiological experience unite that biology can accomplish such brilliant feats as that of Cuvier in reconstructing an extinct organism from fragmentary remains.

The association of morphological and physiological research enlarges the field of vision on both sides, reduces the chances of useless labor, corrects false notions, stimulates inquiry, converts half views into whole views, and withal secures mutual respect. All this finds a demonstration in the work of the Laboratory, as will be seen when the interesting physiological results obtained this summer by one of our investigators on the ear are printed and read in connection with the exhaustive morphology of the organ, which has been contributed by another member of the Laboratory.

The provocation for dwelling so long on this point, is the lack of interest taken in general physiology, and the difficulty experienced in securing active cooperation from physiologists. As a rule physiologists look upon marine biology as something quite remote from their field of work, and the cases are rare indeed where they have taken an active part in seaside research. It has been our good fortune to draw into connection with the Laboratory Dr. Loeb, whose enthusiasm, zeal, and accomplishments in general physiology, make him a fitting director of this department. Drs. Lombard, Lee, and Lingle have been associated in the lectures and investigation of the physiological laboratory, and a number of students have been engaged in experimental work under the direction of Dr. Loeb. Some of the results of the physiological work are already in press, and papers of unusual interest have been completed by Drs. Lee and Lingle, which may be expected during the year. The marked success with which this work starts off encourages the hope that before another season the merits of this department may attract the attention of some generous-minded
philanthropist, who will undertake to provide it with a library and a strong equipment in the way of aquaria and apparatus.

THE ZOOLOGICAL DEPARTMENT.

A. Instruction.

For an account of the instruction in zoölogy in the students' laboratory I may refer to Dr. Bumpus' report appended below, offering in addition only a general remark or two. The attendance, the interest and zeal shown in the work, the ground covered in lectures and laboratory exercises, all speak for themselves, and show a progress which skilful management, experience in teaching, and devotion to the interests of the school alone could effect.

There is one fact which neither students nor the trustees can think of too often. It is the enormous sacrifice made by every one of the men who devote their summers to such work. No one can perhaps fully realize this, except the investigator himself, who knows the full value of his time. How long can such service be obtained without salaries? Can it be secured even with salaries? This is no idle question; it is a most serious matter. We have been fortunate enough so far to have men who were above the temptation of any salary that could be offered them. They have been profoundly interested in the development of the Laboratory, and they have lent their aid in the hope that their labors would contribute to this end. In special cases very fair salaries have been offered for assistance; but the offer has had but little influence. The main consideration always is: Is it prudent, after a year's academic routine, to engage in summer teaching? And if strength remains for the task, can the time be sacrificed? The summer is the best and almost the only time available for research for most of our investigators, and hence it is not a question of giving up a few months only, but a whole year in teaching. Research work is absolutely essential to a successful scientific career, as well as to the satisfaction of the yearning for knowledge; hence the sacrifice of a summer touches one's ambition for scientific
standing, his deep love for original work, the leading motives and aims of his professional life. Could the enlightened public but catch the spirit, the purpose, the self-sacrifice, and the far-reaching importance of the work here begun, it would not long suffer from the lack of means to carry it forward.

What we need and what we must have, if this work is to continue and prosper, is a permanent scientific staff, upon whom we can call for whatever assistance in the way of lectures and laboratory instruction may be required. A staff of salaried officers, having most of their time free for investigation, could well afford to devote regularly every summer a few weeks to instructing students. Herein lies the solution of our present difficulty.

The same provision would also secure the most efficient instruction for beginners in investigation. This side of our work must, I am certain, appeal with peculiar force to those who take an interest in the progress of biology. The opportunities we offer in this direction are, to say the least, exceptional; and as was foreseen would be the case, they have attracted eager and promising students from many parts of the country. They have appealed to college students and professors alike, to members of scientific academies, laboratories, and museums, and to instructors in almost every grade of school. Every year the number of applicants for the tables has increased. Last year we had nine receiving instruction in investigation, and this year nineteen. In this work it requires about one instructor for every three pupils. Such expensive work, requiring the assistance of an expert teacher in each special line of study, can of course only be provided for a relatively small number. But the smaller the number, the more effective the work of the teacher. The results are to be measured not only by the work accomplished in the Laboratory, but also by the increased power and influence which the pupil will have in consequence of his training. Our aim is to make investigators as well as investigation. We have met with such encouraging results that we feel that this work must go on at all hazards, and at whatever sacrifice of time and money it requires. I regret
the necessity of having to dwell on the importance of work to which I am a small contributor; but my share is comparatively so small and insignificant, that I am able to speak more freely and with less danger of exciting any undeserved imputation. Work of this kind is its own best reward, and the laborer is well repaid, if his toil prove fruitful, either in research of his own or of others.

B. Investigation.

Hitherto I have mentioned by titles the works undertaken during the session. It will, perhaps, be more in keeping with our purposes if I call attention to the nature of the work, and give only the titles of papers that have reached completion since my last report.

The principal lines of work have been experimental studies of the phenomena of sex differentiation, fecundation, and cleavage; the embryology of hydroids, worms, molluscs, crustacea, insects, fishes, and amphibia; studies on metameric segmentation; the anatomy and histology of the sense-organs and various other organs of the vertebrates; and marine bacteriology.

The work in embryology has already yielded results that will reflect the highest credit on American biology. For the first time in the history of embryology, one of our number has accomplished the feat of tracing the annelid larvae through every stage of development, cell by cell. For once we have a complete developmental history, precisely known in every detail. It is a monumental addition to our knowledge, and it will stand as a classical example of thoroughness in method, accuracy in observation, and brilliancy in results. Science covets such productions, and with them cancels every indebtedness for the most magnificent endowments placed to her account.

Another similar work on molluscan development has been brought to completion, and with such signal success that it will form a companion stone in the foundation now being laid for comparative embryology. Several other papers in the embryology of these two important groups are already far advanced and full of promise.

In the field of Arthropod embryology, we have added to the
list beginning with the lobster and Limulus, a monographical work on the development of insects, which embodies the results of several years' study. This work, which must be credited in part to the Morphological Laboratory of Clark University, covers a varied and most difficult ground, and forms a superb contribution, as thorough and comprehensive in treatment as it is exquisite in artistic execution.

Several important memoirs on amphibian development are in progress, and one, worked out in part here and in part at Clark University, has been finished this summer. The work covers the whole period of development up to the establishment of the fundamental features of the embryo, including the formation of the egg and the phenomena of fecundation. The habits, food, oviposition, spermatophores, etc., are also described. This is the first time that the American newt has been made the subject of such thorough embryological investigation, and the results obtained form a contribution of marked excellence and permanent value.

The contribution on the subject of sex-differentiation will be found to contain results and conclusions of the highest philosophical interest, and distinctly in advance of the views hitherto offered.

It is unnecessary to extend comments on individual papers further. My object in calling attention to the nature and merits of the work of the Laboratory is accomplished, if it suffices to give you an idea of what the work leads to, and what it means for the advancement of American biology. My connection and interest in this work undoubtedly lead me to take a favorable view of it; but I venture to say that when the verdict of the non-partisan scientific world is given, it will be seen that my partisanship has led me to understategather rather than overstate the matter.

List of Zoological Works in Press, or nearly Finished.

Works to be continued another summer not included.

— "The Relation of the Internal to the External Phenomena of Cleavage."


C.

REPORT ON THE WORK OF THE STUDENTS' AND TEACHERS' DEPARTMENT.

By Professor H. C. Bumpus.

Instruction in this department has been given by Dr. W. M. Wheeler, Mr. P. A. Fish, and myself, along the lines previously designated in the annual announcement. Though early in the season it was thought that with the addition of the new botanical laboratory ample room would be provided for those pursuing more elementary courses of study, the attendance has been such as to necessitate the use of every available place in both laboratories, sixty students having been registered. Though this number shows an increase of nearly fifty per cent. of the attendance of a year ago, the amount of work actually accomplished has been even greater, as a very large proportion of the students have pursued the prescribed work for the entire term. It is gratifying to note that the number of transient students is now so far reduced that it would seem advisable in the future
to admit only those who propose to work during the full term.

The larger attendance has necessitated an increase of the teaching staff, and a somewhat more systematic arrangement of the laboratory work and of the lectures. The latter, which have supplemented the Laboratory work, have been generally given by those specially interested in the subjects under consideration, and it is felt that the success of this department is in a very large measure due to the valuable services that have thus been generously rendered by those from the Department of Investigation. A list of the lectures is submitted herewith:

List of Morning Lectures.


" 15. "General Morphology of Unsegmented Worms." DR. W. M. WHEELER.


" 20. "The Formation of the Teleost Embryo." DR. WHITMAN.


" 25. "Comparison of Results from the use of Golgi's and other methods in the Study of the Olfactive Membrane." DR. HOWARD AYERS.


" 27. "The Formation of the Teleost Embryo" (continued). DR. WHITMAN.


" 3. "The Formation of the Elasmobranch Embryo." DR. WHITMAN.


" 5. "The Embryology of the Echinoderms." DR. J. S. KINGSLEY.


" 10. "The Origin and History of Kupffer's Vesicle." DR. WHITMAN.

" 11. "The Embryology of Insects." DR. W. M. WHEELER.

" 12. "Limulus and the Arachnids." DR. J. S. KINGSLEY.

" 15. "Amphioxus." MR. P. A. FISH.


" 17. "Concluding Lecture on the Formation of the Vertebrate Embryo." By DR. WHITMAN.


REPORT OF DR. SETCHELL ON THE WORK OF THE BOTANICAL DEPARTMENT.

MISS GRACE D. CHESTER has been investigating the development of Brachytrichia Quoyi, B. and Fl.

MR. W. J. V. OSTERHOUT has begun observations on the development of Selaginella apus, Spring.

MR. M. R. BRANNON has advanced his work (begun this session) on the Structure and Development of Grinnelia Americana, Harv.

MR. SEVERANCE BURRAGE has continued his investigations (begun last season) into the habits of Drosera filiformis, Raf.

I have been working upon a distorted form of Pteris aquilina, L., and the ferment from the glandular hairs of Drosera filiformis, Raf.

MR. BRADLEY M. DAVIS has a paper on "The Development of Champia parvula, Harv., from the Carpospores," which was begun at the Laboratory last year, ready for the press.

I have published two papers; some work on both of which was done in the Laboratory.

They are:


Lectures in Botany.

July 8. "General Cell Structure of Plants."

" 11. "Types of Sexual Reproduction in Plants."

15. “Morphology and Affinities of the Conjugatae.”
22. “Morphology of the Phæozoosporeæ.”

Aug. 2. “Morphology of the Fucaceæ.”
4. “Reproduction of the Cutleriaceæ and the Dictyotaceæ and the Affinities of these groups.”
5. “Morphology of the Sphæropleaceæ, Ædogoniaceæ, Coleochætaceæ, and Volvocaceæ.”
8. “Affinities of the various groups of Algae.”
15. “Morphology and Affinities of the Muscineæ.”
16. “Morphology and Affinities of the Filices.”

REPORT ON THE LIBRARY.

Since the last report, the library has acquired by gift numerous monographs and pamphlets, and has maintained and added to the Laboratory subscriptions to important journals. The continuance of the periodicals forming the Evans Library has been assured for the current year through the gift of Miss Eugenia Gardiner, of one hundred dollars, to be applied to this purpose. It has not been found possible to make any purchases for the library from the general Laboratory funds.

The following donations have been received and catalogued:
Donor.  Unbound Monographs, Pamphlets, etc.

A. Agassiz  7
H. Ayers  1
E. R. Boyer  1
Miss C. M. Clapp  Several vols. U. S. Fish Com. Reports.
J. S. Fay  3
J. E. Ires  1
E. O. Jordan  40
C. S. Minot  2
C. A. Oliver  1
W. A. Setchell  1
R. W. Shufeldt  1
Smithsonian Institution  16
United States Fish Commission  1
A. E. Verrill  5
W. M. Wheeler  2

In addition to these valuable gifts, special mention must again be made of the donation, from the Boston Society of Natural History, which was briefly noted in the last report. This comprised ten volumes of the Proceedings of the Society (Vols. XV.-XXIV.; Pts. 1 and 2, Vol. XXV.), and nine important monographs, extracted from the Memoirs of the Society.

Dr. C. S. Minot has given to the library, besides the pamphlets above mentioned, three unbound volumes of "Insect Life;" and from Professor Bumpus has been received a set of Haller's Elementa Physiologia Corporis Humani (eight volumes).

The following journals are now taken by the Laboratory:

Anatomischer Anzeiger.
Annales des Sciences Naturelles, Zoologie.
Annales des Sciences Naturelles, Botanique.
Archives de Biologie.
Archives de Zoologie expérimentale et générale.
Archiv für Anatomie und Physiologie.
Archiv für mikroskopische Anatomie.
Biologisches Centralblatt.
Botanisches Centralblatt.
Botanischer Jahresbericht.
Botanische Zeitung.
Fauna and Flora des Golfes von Neapel.
Jahrbücher für wissenschaftliche Botanik.
Jenaische Zeitschrift.
Journal of the Royal Microscopical Society.
La Cellule.
Morphologisches Jahrbuch.
Quarterly Journal of Microscopical Science.
Zoologischer Anzeiger.
Zeitschrift für wissenschaftliche Zoologie.
Zeitschrift für wissenschaftliche Mikroskopie.
Zoologische Jahrbücher.

Mrs. W. B. Rogers has subscribed for Nature, to be sent to the Laboratory during the current year.

One of the library's most urgent needs is that some provision be made for binding the periodicals which have accumulated during the last four years. There are nearly one hundred volumes of journals still unbound, and in this condition they are liable to misuse, displacement, and loss. It seems advisable that, before another session of the Laboratory, they should be suitably bound in order to facilitate their use, and guard against loss and injury.

During the past session the work of the investigators has been materially furthered by the liberal offer of the Boston Society of Natural History of sending to the Laboratory books needed for special research. Many investigators have availed themselves of the resources thus generously placed at their disposal, and the Laboratory library has been in this way effectively supplemented.

A special donation to the library, of one hundred dollars, has been received from the Misses Sampson, and should enable long-needed additions to be made to the stock of reference-books and sets of journals.
THE NEXT STEP.

We have now seen about the limit of what can be accomplished without funds. The two functions of instruction and investigation have worked admirably together, each growing stronger in the success of the other. We have endeavored to keep the two properly balanced, but I think we have nearly reached the limit of our capacity for instruction with our present space and means. We already see that to tax our teaching forces much more, would not tend to improve the side of investigation. For further development then two things have to be provided, namely, room and funds. As we cannot well enlarge our building, and as the conditions for both branches of our work could be immensely improved by providing a separate building for the investigators, our next step is clearly defined. It is a suitable observatory for the exclusive use of those engaged in original research. Preparatory to this, a site is to be selected and secured. This done, the plan of the building worked out, the equipment estimated, the income necessary to the maintenance of the observatory with its officers and scientific staff ascertained, we shall be prepared to lay the whole matter before any one who may be disposed to contribute to the foundation of a biological observatory—an observatory which shall be an honor to America, and worthy of that promising science of the future to which the world looks for grander discoveries than have yet enriched human knowledge or contributed to the welfare and advancement of the race.

Respectfully submitted,

C. O. WHITMAN,
Director.
LIFE MEMBERS.

Mr. F. L. Ames, Dr. W. S. Bigelow, Mr. Robert C. Billings, Miss H. C. Bradlee, Mr. A. A. Cary, Miss F. M. Cushing, Miss Lucy Ellis, Mr. William Endicott, Jr., Mrs. Glendower Evans, Prof. William G. Farlow, Mrs. George Faulkner, Mr. J. S. Fay, Mrs. S. B. Fay, Miss Amy Folsom, Mr. John Foster, Dr. E. G. Gardiner, Mr. William O. Grover, Mr. George W. Hammond, Mrs. H. L. Higginson, Mr. C. C. Jackson, Miss Marian C. Jackson, Dr. George G. Kennedy, Mr. N. T. Kidder, Miss Anna C. Lowell, Mr. A. Lawrence Lowell, Miss Ellen F. Mason, Miss Ida M. Mason, Mrs. Daniel Merriman, *Mrs. Frances A. Minns, Mr. Thomas Minns, * Mr. William Minot, Prof. Charles S. Minot, Miss M. C. Mixter, Miss Laura Norcross, Mr. Alfred Pell, Mrs. John C. Phillips, *Mr. William R. Robeson, Miss Annette P. Rogers, Mrs. William B. Rogers, Mr. Henry Saltonstall, Mr. J. P. Spaulding, Miss M. A. Wales, Mrs. C. E. Ware, Miss M. L. Ware, Mrs. S. D. Warren, Mr. William F. Weld, Mr. Henry M. Whitney, Mr. Thomas Wigglesworth, Miss Mary A. Willcox, Mrs Anna Phillips Williams, Mrs. H. D. Wilmarth.

*Deceased.
MEMBERS.

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Miss Ellen Frothingham,  
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Prof. Simon H. Gage,  
Mr. W. F. Ganong,  
Miss Eugenia Gardiner,  
Mr. John H. Gerould,  
Miss Leah Goff,  
Dr. G. Brown Goode,  
Mr. F. P. Gorham,  
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Mr. W. S. Lemen,  
Prof. William Libbey,  
Mr. Frank R. Lillie,  
Dr. David J. Lingle,  
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Prof. T. H. Morgan,  
Prof. A. D. Morrill,
Prof. E. S. Morse,         Mr. William H. Sayward, jr.,
Prof. H. F. Nachtrieb,     Mr. R. C. Schiedt,
Mr. Lyman Nichols,         Miss A. F. Schively,
Prof. D. P. Nicholson,     Miss Mary A. Schively,
Prof. W. H. Niles,         Prof. William B. Scott,
Mr. James H. Norton,       Dr. S. H. Scudder,
Prof. Marcella I. O'Grady, Prof. William T. Sedgwick,
Prof. Henry F. Osborn,     Mr. W. A. Setchell,
Mr. J. G. Owens,           Prof. A. B. Seymour,
Prof. A. S. Packard,       Prof. Benjamin Sharp,
Miss M. S. Packard,        Mrs. George O. Shattuck,
Miss E. C. Palmer,         Miss N. L. Shaw,
Mr. J. E. Peabody,         Mr. W. P. Shepard,
Mr. H. S. Peepoon,         Mr. C. P. Sigerfoos,
Prof. J. H. Pillsbury,     Mrs. C. C. Smith,
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Dr. H. P. Quincy,          Dr. William S. Stevens,
Miss Harriet Randolp,      Mr. Israel Strauss,
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Mr. Richard Rathbun,       Mr. R. W. Tower,
Prof. Jacob Reighard,      Prof. A. L. Treadwell,
Mrs. R. H. Richards,       Prof. William Trelease,
Mrs. T. O. Richardson,    Prof. Spencer Trotter,
Prof. C. V. Riley,         Mr. A. B. Ulrey,
Mrs. Royal E. Robbins,     Mr. B. H. Van Vleck,
Miss Mary Rodman,          Prof. A. E. Verrill,
Dr. William H. Rollins,    Mrs. Clara Walden,
Mrs. William H. Rollins,   Miss Jennie E. Waldo,
Prof. J. T. Rothrock,      Mr. H. E. Walter,
Mr. H. L. Russell,         Mr. F. W. Wamsley,
Miss M. J. Sackett,        Prof. F. L. Washburn,
Miss E. F. Sampson,        Dr. S. Watase,
Miss L. V. Sampson,        Mr. H. J. Webber,
Mr. Samuel Wells, 
Mr. W. M. Wheeler, 
Mr. Franklin W. White, 
Dr. C. O. Whitman, 
Miss C. R. Whitmore, 
Dr. W. F. Whitney, 
Dr. Edward Wigglesworth, 
Prof. B. G. Wilder, 
Miss N. M. Willey, 
Dr. F. H. Williams, 
Mrs. A. L. Williston, 
Miss Bertha L. Wilson, 

Prof. E. B. Wilson, 
Prof. H. V. Wilson, 
Prof. W. P. Wilson, 
Mr. B. S. Winchester, 
Dr. Martha Wollstein, 
Miss Elizabeth Woodbridge, 
Miss C. A. Woodman, 
Mr. W. M. Woodworth, 
Mr. A. M. Worthington, 
Prof. A. A. Wright, 
Mrs. J. H. Wright, 
Prof. R. Ramsey Wright.
### DONORS AND GIFTS

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<td>Miss Lucy Ellis</td>
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<td>Miss M. C. Mixter</td>
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<td>Miss Edith F. Sampson</td>
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<td>Dr. H. F. Sears</td>
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<td>Miss Lillian V. Sampson</td>
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INCORPORATION.
1888.

No. 3170.

COMMONWEALTH OF MASSACHUSETTS.

BE IT KNOWN, That whereas Alpheus Hyatt, William Stanford Stevens, William T. Sedgwick, Edward G. Gardiner, Susan Minns, Charles Sedgwick Minot, Samuel Wells, William G. Farlow, Anna D. Phillips, and B. H. Van Vleck have associated themselves with the intention of forming a Corporation under the name of the Marine Biological Laboratory, for the purpose of establishing and maintaining a laboratory or station for scientific study and investigations, and a school for instruction in biology and natural history, and have complied with the provisions of the Statutes of this Commonwealth in such case made and provided, as appears from the certificate of the President, Treasurer, and Trustees of said Corporation, duly approved by the Commissioner of Corporations, and recorded in this office;

Now, therefore, I, HENRY B. PEIRCE, Secretary of the Commonwealth of Massachusetts, do hereby certify that said A. Hyatt, W. S. Stevens, W. T. Sedgwick, E. G. Gardiner, A. Minns, C. S. Minot, S. Wells, W. G. Farlow, A. D. Phillips, and B. H. Van Vleck, their associates and successors, are legally organized and established as, and are hereby made, an existing Corporation, under the name of the MARINE BIOLOGICAL LABORATORY, with the powers, rights, and privileges, and subject to the limitations, duties, and restrictions which by law appertain thereto.

Witness my official signature hereunto subscribed, and the seal of the Commonwealth of Massachusetts hereunto affixed, this twentieth day of March, in the year of our Lord ONE THOUSAND EIGHT HUNDRED AND EIGHTY-EIGHT.

HENRY B. PEIRCE,
[SEAL.]
Secretary of the Commonwealth.
BY-LAWS.

1. The annual meeting of the members shall be held in Boston on the second Wednesday of November in each year, at such time and place as shall be designated by the Trustees; and at such meeting the members shall choose by ballot a Clerk, Treasurer, and nineteen Trustees, who shall hold their offices for one year, and until others are chosen and qualified in their stead.

2. Special meetings of the members may be called by the Trustees, to be held in Boston at such time and place as they may designate.

3. The Clerk shall give notice of meetings of the members by publication in some daily newspaper published in Boston at least seven days before such meeting, and in case of a special meeting the notice shall state the purpose for which it is called.

4. Ten members shall constitute a quorum at any meeting.

5. The Trustees shall have the control and management of the affairs of the Corporation; they shall present a report of its condition at every annual meeting; they shall elect one of their number President, and may choose such other officers and agents as they may think best; they may fix the compensation and define the duties of all the officers and agents, and may remove them, or any of them, except those chosen by the members, at any time; they may fill vacancies occurring in any manner in their own number or in any of the offices. They shall from time to time elect members upon such terms and conditions as they may think best.

6. Meetings of the Trustees shall be called by the President, or by any two Trustees, and the Clerk shall give notice thereof by written or printed notice sent to each Trustee by mail, post-
BY-LAWS.

paid. Four Trustees shall constitute a quorum for the transaction of business.

7. The President shall, annually, in the month of February, appoint one Trustee who, with the President, shall constitute a committee on finance to examine from time to time the books and accounts of the Treasurer, and to audit his accounts at the close of the year. No investments of the funds of the Corporation shall be made by the Treasurer, except approved by the finance committee in writing.

8. The consent of every Trustee shall be necessary to a dissolution of the Marine Biological Laboratory. In case of dissolution, the property shall be given to the Boston Society of Natural History, or some similar public institution, on such terms as may then be agreed upon.

9. These by-laws may be altered at any meeting of the members, provided that the notice of such meeting shall state that an alteration of the by-laws will be acted upon.
THE ANNUAL CIRCULAR FOR 1892.

The Marine Biological Laboratory.

INCORPORATED IN 1888.

FIFTH SEASON, 1892.

CORPS OF INSTRUCTORS.

Dr. C. O. Whitman, Director.

Professor of Zoölogy, Clark University; Editor of the Journal of Morphology.

H. C. Bumpus. Associate Professor of Zoölogy, Brown University.

E. G. Conklin. Professor of Biology, Ohio Wesleyan University.

Pierre A. Fish, Instructor in Physiology and Anatomy, Cornell University.

Jacques Loeb. Professor of Physiology, Bryn Mawr College.

W. A. Setchell. Instructor in Botany, Yale University.

Sho Watase. Assistant in Animal Morphology, Clark University.

W. M. Wheeler.

Ryoicche Takano, Artist. G. M. Gray, Laboratory Assistant.

J. J. Veedel, Collector.

In addition to the regular course of instruction in Zoölogy, Botany, and Microscopical Technique, consisting of lectures and laboratory work under the direct and constant supervision of the instructors, there will be a number of lectures on special subjects, by members of the Staff. A course of lectures in Embryology will be given by Professor Whitman; in Biological Physiology, by Dr. Loeb; and two or more courses in Invertebrate Zoölogy, by Dr. Bumpus and Dr. Wheeler.

There will also be ten or more evening lectures on biological subjects of general interest. Among those who may contribute these lectures and take part in the discussions upon them may be mentioned, in addition to the instructors above named, the following:
Dr. H. Ayers, of the Lake Laboratory; Prof. H. H. Donaldson, Clark University; Prof. William Libbey, Jr., Princeton College; Dr. Warren P. Lombard, Clark University; Prof. Charles Sedgwick Minot, Harvard Medical School; Prof. E. S. Morse, Salem; Prof. H. F. Osborn, Columbia College; Prof. W. T. Sedgwick, Massachusetts Institute of Technology; Prof. E. B. Wilson, Columbia College.

The Laboratory is located on the coast at Wood's Holl, Massachusetts, near the Laboratories of the United States Fish Commission. The building consists of two stories—the lower for the use of teachers and students receiving instruction, the upper exclusively for investigators. The Laboratory has aquaria supplied with running sea-water; boats; a steam-launch; collecting apparatus, and dredges; it is also supplied with reagents, glassware, and a limited number of microtomes and microscopes. By the munificence of friends the library will be provided henceforth not only with the ordinary text-books and works of reference, but also with the more important journals of zoology and botany, some of them in complete series.

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THE LABORATORY FOR INVESTIGATORS

Will be open from JUNE 1 to AUGUST 30. It will be fully equipped with aquaria, glassware, reagents, etc., but microscopes will not be provided. In this department there are twenty-four private laboratories supplied with aquaria, running water, etc., for the exclusive use of investigators.

Owing to the growth of the Laboratory and the great demand for tables, the Trustees have voted to enlarge the present building so that a spacious new wing will be ready for use on July 1.

Those who are prepared to begin original work, but require supervision, will occupy tables in the general Laboratory for Investigators, paying for the privilege a fee of fifty dollars. The number of such tables is limited to ten.

An Elementary Course in Investigation will be introduced this season, designed to meet the needs of those who have completed the general courses in the Students' Laboratory. Definite problems of limited scope will be assigned and worked out as a means of training in the ways and methods of research. The fee for this course also will be fifty dollars, and the number of tables will likewise be limited to ten.

Applicants should state precisely what they have done in preparation for original work, and whether they can bring a complete outfit, viz.: microscope, microtome, camera-lucida, etc. Special attention is invited to these opportunities, as it is believed that they are unusual.

For the completion of any considerable piece of investigation, beginners usually require from one to three full years. It is not expected, therefore, that the holders of these tables will finish their work in a single season. The aim is rather to make a secure beginning, which will lead to good results if followed up between sessions, and renewed, if need be, for several successive years. No applications for less time than the whole session will be received.
THE LABORATORY FOR TEACHERS AND STUDENTS

Will be opened on Wednesday, July 6, for regular courses of seven weeks in Zoology, Botany, and Microscopical Technique. The number admitted to this department will be limited to fifty, and preference will be given to teachers and others already qualified. By permission of the Directors, students may begin their individual work as early as June 15 without extra charge, but the regular courses of instruction will not begin before July 6.

Though more advanced students who may wish to limit their work to special groups will have an opportunity to do so, the regular course in Zoology, in charge of Professor Bumpus, will embrace a study of the more typical marine forms and elementary methods of Microscopical Technique. The laboratory work outlined below will be accompanied by lectures.

**JULY 6-13.** Study of the Lobster.
**JULY 13-20.** Vermes (Nereis, Balanoglossus, and Phascolosoma, Polyzoa, Turbellaria).
**JULY 20-27.** Cælenterates (Campanularia, Tubularia, Metridium).
**JULY 27-AUGUST 3.** Mollusks (Venus, Ostrea, Sycotypus, Loligo).
**AUGUST 3-10.** Echinoderms (Asterias, Arbacia, Thyone).
**AUGUST 10-17.** Crustaceans (Branchipus, Pandarus, Lernaea, Lepas, Idotea, Talorchestia, Cancer).
**AUGUST 17-26.** Vertebrates (Amphioxus, Raja, Teleost).

Mr. W. A. Setchell will have charge of the work in Botany.

The tuition fee is thirty dollars, payable in advance. Applicants should state whether they can supply themselves with simple and compound microscopes. Microscope slides, dissecting and drawing instruments, bottles, and other supplies, to be finally taken from the Laboratory, are sold at cost. Further information, if desired, may be had by addressing Prof. HERMON C. BUMPUS, Wood's Holl, Mass.

Applications for places in either department should be addressed to Mrs. ANNA PHILLIPS WILLIAMS, Secretary, 23 Marlborough Street, Boston.

Rooms accommodating two persons may be obtained near the Laboratory, at prices varying from $2.00 to $4.00 a week, and board from $4.50 to $6.00. By special arrangement, board will be supplied to members at The Homestead at $5.00 a week.

A Department of Laboratory Supply has been established in order to facilitate the work of teachers and others who desire to obtain materials for study or for classes. It is proposed to furnish, e.g., certain sponges, hydroids, starfishes, sea urchins, marine worms, crustaceans, mollusks, and vertebrates, preserved in good condition, at fair prices. Orders for the coming college year should be given as soon as possible. Circulars giving information, prices, etc., may be obtained by addressing the "Department of Laboratory Supply," in care of the Secretary.
Wood's Holl, owing to the richness of the marine life in the neighboring waters, offers exceptional advantages. It is situated on the north shore of Vineyard Sound, at the entrance to Buzzard's Bay, and may be reached by the Old Colony Railroad (2½ hours from Boston), or by rail and boat from Providence, Fall River, or New Bedford. Persons going from Boston should buy round-trip tickets ($2.85).

The Annual Report of the Trustees, containing an account of the organization and work of the Laboratory, may be obtained from the Secretary.

TRUSTEES.

SAMUEL H. SCUDDER, President . Boston Society of Natural History.
EDWARD T. CABOT, Treasurer . . . . 53 State St., Boston.
SAMUEL F. CLARKE . Williams College, Williamstown.
FLORENCE M. CUSHING . . . . . . . . Boston.
WILLIAM G. FARLOW . Harvard University, Cambridge.
EDWARD G. GARDINER, Massachusetts Institute of Technology, Boston.
PROF. WILLIAM LIBBEY, JR. . College of New Jersey, Princeton.
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