MASSACHUSETTS

INSTITUTE OF TECHNOLOGY.

ANNUAL REPORT

OF THE

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DECEMBER 11, 1895.

JOHN WILSON AND SON.
University Press, Cambridge.
1896.

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To the Corporation of the Massachusetts Institute of Technology:

My message to-day is, in general, one of congratulation. In spite of losses deeply felt in the Corporation and Faculty, the work of the school has gone bravely on; new courses of instruction have been instituted, new laboratories equipped, although no buildings have been erected; our numbers have held good, in spite of continued hard times which have told very heavily upon the main body of our students. On the 28th of May last, we added to the list of our alumni one hundred and forty-three graduates bearing the diploma of the Institute, all of them, we believe, well prepared to do their work in life.

Among the events of the year, that which naturally first rises to our minds is the grant bestowed by the Legislature of Massachusetts, in answer to the petition of the Corporation which was authorized at our last annual meeting, and the text of which was appended to the last annual report of the President. Nothing could be more gratifying than the response which came from all parts of the Commonwealth, as soon as it was made known that the usefulness of the Institute was threatened by its straitened financial means. Not only from the eastern counties of the Commonwealth, where the school is best known and from which the larger part of its students are drawn, but from the great central county of Worcester, which has an excellent technical institution of its own, and from the four western counties, came the warmest assurances of sympathy and support. The bill passed both Houses of the Legislature, appropriating twenty-five thousand dollars a year for the term of six years, with a single amendment, cordially accepted by those who represented the Institute in the matter, appropriating in addition two thousand dollars a year during the same term for ten free scholarships

beyond those established under the Acts of 1887 and 1888. The text of the bill will be found appended to the present Report. For this bounty of the State it behooves all friends of the Massachusetts Institute of Technology to be sincerely grateful; and its officers of instruction pledge themselves through me, here and now, that at the end of this term of years the Commonwealth of Massachusetts shall be, not poorer, but richer, for the relief so opportunely afforded to this school of industrial science.

It may be said that an institution like this, after nearly thirty years of active life, ought not to be in such a case, financially, that relief to an amount like that embraced in the Act of April 17, 1895, should be found important, — much more, indispensable. This is true; but it is no fault of those who have guided the destinies of the school or have given instruction within its walls. The fact that the needs of the school were so pressing, at the time of our petition, was wholly due to the resort of students to its halls, directly in consequence of the ever-increasing reputation which had been given to it by the conspicuous success of its graduates in the various industrial professions toward which our training is directed. The petition of the Institute of Technology was not a cry for compassion from an institution that had outlived its usefulness and was slowly decaying from popular neglect, but an appeal for co-operation and assistance in a work in which the Commonwealth is itself deeply interested, and which contributes vitally to the support and development of its industries and its trade. Had the Institute of Technology remained a small college of two hundred and fifty or three hundred students, such as it was fifteen years ago, its means would now be reasonably sufficient for its wants. Its unprecedented growth, multiplying its necessities several fold, has required that much which should have gone to the permanent establishment of the Institute on a broad and enduring basis, be devoted to meeting the immediate and urgent exigencies of successive years. The time has not yet been long enough to create that large body of endowments

which in modern education is required for the proper security and support of an institution of learning of the first class. With our twelve hundred students we ought to have millions of dollars, to render the school independent of temporary fluctuations, to which it is now so painfully subject, and to afford a guarantee that through succeeding generations it shall be found in the fore-front of scientific and technical progress. No other institution of our size but has two, three, or four times the amount of wealth to draw upon which we possess. It has only been exceeding good fortune, combined with extraordinary courage, energy, and self-devotion on the part of its trustees and teachers, that has more than once rescued the school from paralysis, if not from extinction. Is it possible that the means will be long withheld which shall suffice to afford security for the future, as well as the power of continuous improvement and advancement according to our opportunities and to the needs of the great industrial community within which we are placed?

In spite of the fact that more than one hundred colleges and universities in the United States are offering instruction more or less like that which we give, the reputation of the Massachusetts Institute of Technology still suffices to make its diploma a passport to technical employment. I am glad to believe that the reasons for this unusual success of our graduates is due to the character of our instruction, as described by Mr. William Mather, M. P., President of the Association of Technical Institutions in Great Britain. In his annual address delivered in London in February last, Mr. Mather pointed to the Massachusetts Institute of Technology as the best model for scientific and technical schools in his own country, adding these words: "The spirit and energy of the students, their conspicuous practical knowledge, the thoroughness with which their scientific knowledge is tested in the course of instruction, step by step, and the power of adaptation and resource they possess on entering workshops and manufactories, railroads or mines, public works and constructive engineering, — all these fruits of the training of this

Institute are, so far as I have seen, not equalled on the Continent. I think these are the qualities we need in England."

On the 28th of May, I conferred, on behalf of the Faculty and Corporation, the degree of bachelor of science in electrical engineering upon thirty-three young engineers. At the time I handed them their diplomas more than one-half, nearly two-thirds, had secured professional positions. Professor Swain informs me that all his graduates in civil, sanitary, hydraulic, and railroad engineering are in service; and that he has been obliged to decline numerous applications. Professor Richards, in his annual report, states that since the first of September he has had ten applications for men where he has been able to send but two. Professor Sedgwick finds it impossible to keep up with the demand for biologists and bacteriologists. In the chemical department we have frequently been obliged to call upon other institutions for their graduates, as laboratory assistants, in the failure to keep enough of our own to fill the places. I might continue the story, but these statements suffice. While, here and there, by reason of exceptional ill fortune, or from lack of tact and address, a graduate of the Institute of Technology may for a time be out of employment, it remains true that the industries of the United States take up the young men whom we have trained for life as readily as, and even more readily than, they did in the time of our first five or six classes. So far from the supply outrunning the demand, it may be said that the first work of the Institute has, from the beginning, been to create the demand which its graduates should supply. When the school was opened in 1865, there was a moderate demand for civil engineers; for that profession, whose title simply meant that those who bore it were not military engineers, had long enjoyed a certain standing. The profession of mining engineer had also acquired a certain popular repute, mainly through the influence of graduates of European schools. But few, even of intelligent and cultivated people, in 1865 knew what a mechanical engineer was, why he should be called so, or what problems he would be called upon to attack. It was

not until young men began to go out from this and other schools trained as mechanical engineers, that manufacturers, bridge builders, railroad corporations, and persons in a hundred industries who were charged with the generation and use of power, found out that they wanted just such men. In the same way, the American demand for chemists, which, thirty years ago, was supplied by a few graduates from German universities, has been continually expanding until hundreds annually are added to the rolls of that profession. Ten years ago the Institute of Technology opened its course in electrical engineering, the first offered to students in the United States, or possibly in the world. To-day we have in our three upper classes one hundred and twenty-five young men preparing themselves for this service. If, when they come to graduate, they shall find its approaches somewhat crowded by the ill-considered rush of thousands of uneducated or half-trained aspirants, they will with a little patience and persistence learn that there is still "plenty of room in front."

The Graduating Class.

The school year of 1894–95 closed fortunately, on the 28th of May. Of the members of the class, 25 graduated in Civil Engineering, 30 in Mechanical Engineering, 3 in Mining Engineering, 15 in Architecture, 13 in Chemistry, 33 in Electrical Engineering, 2 in Physics, 11 in Chemical Engineering, 4 in Sanitary Engineering, 5 in Naval Architecture, while 4 graduated from the Department of General Studies. These numbers aggregate 145, while yet the graduating class contained but 143. The explanation of this discrepancy brings out the interesting fact that, for the first time in the history of the school, two courses have been completed simultaneously by the same student. This was done in May last, Mr. S. P. Hunt receiving a degree both in Electrical and Chemical Engineering, while Mr. Charles L. Parmalee received a degree both in Civil and in Sanitary Engineering. These gentlemen had entered the Institute with advanced

standing from other colleges. Of the Bachelors of 1894, three — Messrs. Charles Greeley Abbott, Fred Maynard Mann, and Walter Osgood Scott — received the degree of Master of Science, on the completion of an additional year of successful study.

The Entering Class.

The registration of this year, as by the Catalogue now in press, amounts to 1,187 against 1,183 twelve months ago. It appears, therefore, that in the number of students this year the school has held its own.

Year.	No. of Students.
1865–66	72
1866–67	137
1867–68	167
1868–69	172
1869–70	206
1870–71	224
1871–72	261
1872–73	348
1873–74	276
1874–75	248
1875–76	255
1876–77	215
1877–78	194
1878–79	188
1879–80	203
1880–81	253
1881–82	302
1882–83	368
1883–84	443
1884–85	579
1885–86	609
1886–87	637
1887–88	720
1888–89	827
1889–90	909
1890–91	937
1891–92	1,011
1892–93	1,060
1893–94	1,157
1894–95	1,183
1895–96	1,187

Students by Classes.

The aggregate number of students for 1895–96 is divided among the several classes as follows: —

Graduate students, candidates for advanced degrees	4
Regular students, Fourth Year	189
" " Third "	189
" " Second "	197
" " First "	272
Special students	336
Total	1,187

Comparison with the corresponding figures of last year shows that there has been an increase among the regular students in the fourth year of 36; in the third year of 3. There has been a decrease of 1 in the number of candidates for advanced degrees, of 18 in the second year, of 4 in the first year, and of 12 among the special students.

Assigning the special students to classes, according to the predominant studies pursued by them, we reach the following division of the whole body among the several years: —

Class.	Regular.	Special.	Total.
Graduates of the M. I. T., candidates for advanced degrees	4		4
Fourth Year	189	69	258
Third Year	189	100	289
Second Year	197	119	316
First Year	272	48	320
Total	851	336	1,187

Statistics of Examinations.

Of the 1,187 students of the present year, 409 were not connected with the school in 1894–95. Of these, 239 were admitted as regular students of the first year upon the basis of their entrance examinations. The 170 remaining comprise (1) those who had previously been connected with the Institute, and now resumed their places in the school; (2) those who were admitted provisionally without examination; (3) those who were admitted by examination as special students; (4) those who were admitted on the presentation of diplomas or certificates from other institutions of college grade. In addition to the 239 who were thus admitted to the Institute on examination and have taken their place in the school, 61 were admitted on examination, but have not joined the first-year class. This number is precisely that of last year. It has always been remarkable that so many persons should take the trouble of passing the two days' entrance ex-

amination for the Institute, and yet not avail themselves of their right to admission. In brief, this body is made up of (1) those who find themselves so heavily conditioned, as the result of inadequate preparation, that they give up the idea of coming to the school altogether or postpone their entrance with a view to further preparation; (2) those who, having obtained certificates of entrance, use them for securing admission to other colleges, just as we every year receive a considerable number of those who have elsewhere obtained certificates of clear admission; (3) those who are kept away by the ordinary accidents of life, affecting themselves or their families; (4) those who have long desired to come to the Institute, and who, having completed their preparatory courses, perhaps with excellent results, go so far as to present themselves for examination and secure their admission, and are then obliged by poverty to give up their long-cherished plans. Very often, to our knowledge, young men pass their examinations here; but, after trying every means through the summer to secure the necessary funds for beginning their course, are obliged to give up the attempt.

In the case of the 239 persons who were admitted on examination and have joined the school, the results of the examinations, embracing both those of June and those of September, were as follows: —

Admitted clear	175
" on one condition	43
" on two conditions	18
" on more than two conditions	3
	239

Thirty-five applicants were rejected.

Two things may be said regarding these examinations. First, that the results this year, as well as those of last year, show the eminent advantage of the system of preliminary examinations, according to which an applicant is permitted to divide his examination between two successive years. Almost every one who had passed his preliminary examination in June, 1894, was admitted as the result of the final examinations of 1895; while the proportion of conditions among this class of

applicants was very small indeed. Secondly, a very gratifying proportion of those applying for admission, this year and last, took examinations upon more than the subjects actually required. Of the 175 who were admitted "clear," 61 "passed off" some one of the subjects of the first year, generally in mathematics.

Teachers at the Institute.

The attractions of the Institute for teachers who desire to extend their acquirements and to fit themselves for higher work, are continually on the increase. This year we have forty members of that profession registered as students here. When these numbers are considered in connection with the maturity of the pupils and the character of the work done, it will be seen that the Institute of Technology has claims to be regarded as one of the important normal schools of the state. The interest expressed in science-teaching last year was so great that it was decided to offer to teachers studying at the Institute a course of lectures upon that and cognate subjects. This course was given on Saturdays, during the second half-year, from 12 to 1 o'clock, the average attendance being over fifty.

The topics and the lectures were as given below:—

On Certain General Aspects of Teaching and the Teaching Profession. Professor W. T. Sedgwick. (Four Lectures.)

On the Teaching of the Elements of Science. Ellen H. Richards, Instructor in Chemistry.

On the Teaching of Chemistry. Professor Thomas M. Drown.

On the Teaching of Beginners in a Chemical Laboratory. Assistant Professor F. L. Bardwell.

On the Teaching of Beginners in Physics. George V. Wendell, Instructor in Physics.

On the Teaching of Physical Geography. Professor William H. Niles.

On the Teaching of Mathematics. Professor H. W. Tyler.

On the Teaching of Physiology. Dr. Theodore Hough, Instructor in Physiology.

On the Teaching of Zoölogy. DR. R. P. BIGELOW, Instructor in Zoölogy.

On the Teaching of Botany. PROFESSOR W. T. SEDGWICK.

An address on *Epochs in the History of Teaching.* JAMES P. MUNROE, S.B., formerly Secretary of the Institute.

EXAMINATION AT DISTANT POINTS.

In addition to the entrance examinations held at Boston in June and September, examinations were also conducted in June at Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Easthampton (Mass.), Exeter, (N. H.), Kansas City, Los Angeles, Louisville, New York, Philadelphia, Pittsburgh, Poughkeepsie, St. Paul, Seattle, Washington, and Paris, France.

RESIDENCE OF STUDENTS.

STATES.	Candidates for Advanced Degrees.	Fourth Year.	Third Year.	Second Year.	First Year.	All Regular Students.	Special Students.	Total.
California	..	2	1	1	1	5	3	8
Colorado	..	1	..	1	3	5	2	7
Connecticut	..	5	7	6	4	22	5	27
Delaware	..	1	1	..	2	4	1	5
Dist. of Columbia	..	1	..	3	6	10	6	16
Florida	..	1	..	..	..	1	..	1
Georgia	..	1	..	..	..	1	1	2
Idaho	..	..	..	..	1	1	..	1
Illinois	..	11	9	3	10	33	9	42
Indiana	..	..	..	..	2	2	..	2
Iowa	..	1	1	..	8	10	2	12
Kansas	..	..	..	3	..	3	1	4
Kentucky	..	..	3	2	4	9	2	11
Louisiana	..	2	..	..	..	2	..	2
Maine	1	6	4	7	9	27	11	38
Maryland	..	1	2	..	4	7	2	9
Massachusetts	2	111	115	137	155	520	201	721
Michigan	..	1	..	1	2	4	3	7
Minnesota	..	..	2	..	1	3	2	5
Missouri	..	1	2	..	2	5	4	9
Montana	..	..	1	..	..	1	..	1
Nebraska	..	1	..	..	..	1	1	2
New Hampshire	..	7	4	5	8	24	6	30
New Jersey	..	..	..	3	..	3	2	5
New Mexico	..	1	..	..	..	1	..	1
New York	..	13	11	7	14	45	19	64
Ohio	1	8	6	4	4	23	14	37
Oregon	..	..	..	..	..	..	1	1
Pennsylvania	..	2	8	7	8	25	11	36
Rhode Island	..	3	5	2	6	16	5	21
South Carolina	..	2	1	1	..	4	1	5
Tennessee	..	..	..	..	..	..	1	1
Texas	..	2	..	1	..	3	..	3
Utah	..	..	..	..	1	1	4	5
Vermont	..	..	2	..	3	5	..	5
Virginia	..	1	..	1	2	4	1	5
Washington	..	..	..	..	..	..	1	1
West Virginia	..	..	..	..	2	2	1	3
Wisconsin	..	2	..	1	3	6	1	7
Foreign Countries.								
Brazil	..	..	..	..	..	..	1	1
Central-America	..	..	..	..	1	1	..	1
Chile	..	..	..	..	..	..	1	1
Cuba	..	..	..	..	2	2	1	3
England	..	..	..	..	2	2	..	2
Japan	..	..	1	1	..	2	..	2
Mexico	..	..	..	..	..	..	1	1
New Brunswick	..	..	..	..	1	1	..	1
New So. Wales	..	1	..	..	..	1	..	1
Nova Scotia	..	..	1	..	..	1	1	2
Ontario	..	..	2	..	..	2	..	2
Porto Rico	..	..	..	..	..	..	1	1
Quebec	..	..	..	..	..	..	2	2
Spain	..	..	..	..	..	..	1	1
Turkey	..	..	..	..	1	1	2	3
Venezuela	..	..	..	..	..	..	1	1
Total	4	189	189	197	272	851	336	1187

Thirty-seven States of the Union, beside the District of Columbia and the Territory of New Mexico, are represented on our list of students. Of the total number of 1,187, 721 are from Massachusetts, or 60.7 per cent of the whole; 121 are from other New England States; 345 are from outside New England. Of these, 25 are from foreign countries.

A table showing the number of students in each year, from and including 1889, coming from each State or Territory and from each foreign country, may not be without interest and instruction: —

	1889.	1890.	1891.	1892.	1893.	1894.	1895.
States.							
Alabama	1	..	2	4	2	1	..
Arkansas	2	3	3	2	1	..	..
California	10	14	19	14	15	9	8
Colorado	6	4	7	7	5	8	7
Connecticut	36	31	30	27	30	29	27
Delaware	..	1	..	2	4	3	5
Dist. of Columbia	9	7	4	4	7	12	16
Florida	2	3	3	4	3	2	1
Georgia	1	2	2	3	3	2	2
Idaho	..	..	1	1	1	..	1
Illinois	33	34	32	40	39	36	42
Indiana	3	6	3	5	6	3	2
Iowa	4	9	10	10	13	10	12
Kansas	..	2	2	1	1	4	4
Kentucky	4	4	8	7	11	12	11
Louisiana	4	8	5	2	3	3	2
Maine	30	29	27	39	36	38	38
Maryland	4	7	7	6	4	4	9
Massachusetts	533	517	565	603	665	707	721
Michigan	13	16	13	10	7	8	7
Minnesota	10	12	13	13	11	9	5
Missouri	8	8	12	13	17	14	9
Montana	..	1	..	..	2	2	1
Nebraska	1	1	1	4	3	4	2
Nevada	..	1	3	3	2	2	..
New Hampshire	21	23	24	29	32	27	30
New Jersey	13	11	16	11	6	5	5
New Mexico	..	..	1	2	2	1	1
New York	25	40	40	50	52	59	64
North Carolina	2	1	1	1	..	..	..
Ohio	35	33	33	39	45	50	37
Oregon	2	1	1	2	1	1	1
Pennsylvania	23	22	26	25	31	37	36
Rhode Island	22	21	26	24	33	25	21
South Carolina	1	2	4	1	3	3	5
South Dakota	1	..	..	..	..	..	..
Tennessee	5	3	4	1	1	1	1
Texas	..	1	2	5	6	6	3
Utah	..	..	..	1	2	2	5
Vermont	4	4	5	4	5	3	5
Virginia	6	5	6	4	3	2	5
Washington	2	2	3	3	4	3	1
West Virginia	2	2	2	2	1	1	3
Wisconsin	9	10	7	9	11	6	7
Foreign Countries.							
Argentine Rep.	..	2	..	..	..	..	..
Belgium	..	..	..	1	1	1	..
Brazil	2	2	4	..	..	1	1
Bulgaria	1	1	1	1	1	..	..
Central America	..	..	1	1	1	..	1
Chile	..	..	..	..	..	1	1
Colombia	1	..	2	..	..	..	..
Cuba	..	..	..	..	1	1	3
England	..	2	1	1	1	..	2
France	1	1	1	1	1	..	..
Germany	..	..	..	..	2	1	..
Guatemala	1	..	..	1	..	..	..
Hawaiian Islands	1	4	4	2	2	..	..
Holland	..	..	2	2	2	2	..
Ireland	1	1	..	..	1	1	..
Japan	1	4	3	1	1	1	2
Mexico	1	1	1	1	1	1	1
New Brunswick	1	1	2	1	1	1	1
New South Wales	..	..	1	1	1	1	1
Nova Scotia	2	2	1	..	..	1	2
Ontario	1	1	2	2	4	4	2
Peru	1	3	1	..	..	..	..
Porto Rico	2	2	1	..	1	1	1
Quebec	1	4	4	5	5	2	2
Scotland	1	3	2	1	2	1	..
Spain	..	..	..	1	1	1	1
Trinidad	1	1	1	..	..	..	..
Turkey	2	1	2	1	..	1	3
Venezuela	..	.	1	..	1	1	1
Total	909	937	1,011	1,060	1,157	1,183	1,187

Residence of Massachusetts Students.

It has been said that 60.7 per cent of our students are from Massachusetts. All the counties of the State, except Dukes and Nantucket, send students to the Institute. One hundred and thirty-two cities and towns are borne on the lists, eight more than last year. The first column of the following table shows the number of cities and towns in each county sending pupils; the second column gives the aggregate number from each county. It appears that Middlesex sends two hundred and sixteen, and Suffolk two hundred and fifteen pupils; Essex comes third, with ninety-two; Norfolk, fourth, with sixty-seven. This is the first time since these statistics began to be compiled that Middlesex County has equalled Suffolk in the number of students at the Institute of Technology.

County.	No. of Towns.	No. of Students.	County.	No. of Towns.	No. of Students.
Barnstable . . .	6	10	Hampshire . . .	5	6
Berkshire . . .	4	13	Middlesex . . .	35	216
Bristol	7	27	Norfolk	18	67
Essex	20	92	Plymouth . . .	11	29
Franklin . . .	3	4	Suffolk	4	215
Hampden . . .	7	15	Worcester . . .	12	27
			Total	132	721

The following is a list of the towns, thirty-eight in number, which send four or more students to the Institute: —

Boston . . .	205	Waltham . .	9	Natick . . .	6
Newton . .	38	Lawrence . .	8	Pittsfield . .	6
Cambridge .	30	Plymouth . .	8	Quincy . . .	6
Brookline . .	22	Brockton . .	7	Reading . .	6
Somerville .	22	Chelsea . .	7	Concord . .	5
Newburyport	20	Framingham .	7	Fitchburg . .	5
Lynn . . .	18	Gloucester .	7	Barnstable .	4
Hyde Park .	16	Medford . .	7	Belmont . .	4
Lowell . . .	14	Springfield .	7	Danvers . .	4
Malden . .	10	Taunton . .	7	Mansfield . .	4
New Bedford	10	Watertown .	7	Milton . . .	4
Salem . . .	10	Arlington . .	6	Woburn . .	4
Melrose . .	9	Haverhill . .	6		

The following table exhibits for ten years the distribution of the total number of students among two classes: first, those students whose names are found upon the Catalogue of the year preceding; and secondly, those whose names appear upon the Catalogue of the year to which the statement relates.

Year.	(1) Total No. of Students.	(2) No. of Students in the Catalogue of the previous year who remain in the Institute.	(3) No. of New Students entering before issue of Catalogue.	(4) Of those in column (3) the following number are regular first-year Students.	(5) No. of New Students not of the regular first-year class.
1886–87	637	379	258	190	68
1887–88	720	396	324	229	95
1888–89	827	465	362	245	117
1889–90	909	557	352	255	97
1890–91	837	572	365	234	131
1891–92	1,011	624	387	258	129
1892–93	1,060	618	442	303	139
1893–94	1,157	701	456	301	155
1894–95	1,183	768	415	271	144
1895–96	1,187	778	409	266	143

Ages of Students on Entrance.

The next table exhibits the ages of our students upon entrance, after taking out those who are repeating the first

Period of Life.	1894–5.		1895–6.	
	Half-year Groups.	Yearly Groups.	Half-year Groups.	Yearly Groups.
16 to 16½ years . . .	2	—	5	—
16½ to 17 " . . .	10	12	4	9
17 to 17½ " . . .	20	—	28	—
17½ to 18 " . . .	27	47	23	51
18 to 18½ " . . .	45	—	38	—
18½ to 19 " . . .	67	112	49	87
19 to 19½ " . . .	37	—	42	—
19½ to 20 " . . .	23	60	23	65
20 to 20½ " . . .	16	—	19	—
20½ to 21 " . . .	5	21	16	35
21 to 22 " . . .	18	18	11	11
	270	270	258	258

year, and ten of unusual ages. These deductions leave two hundred and fifty-eight as the number of students whose ages have been made the subject of computation. The results appear in the following table in comparison with the corresponding results of 1894–95.

From the foregoing, it appears that the average age on entrance is eighteen years and ten months.

In this connection I present the ages, at graduation, of the class leaving us in May. The one hundred and forty-three members of the class were distributed among the different periods of life as follows: —

Between	20	and	20½	2
"	20½	"	21	9
"	21	"	21½	20
"	21½	"	22	25
"	22	"	23	34
"	23	"	24	21
"	24 and over			32
Total				143

Proportion of Regular and of Special Students.

The following table exhibits both the absolute number of regular and of special students, as by the Catalogue of each successive year since 1882, and the proportion existing between these two classes: —

Year.	No. of Regular Students.	No. of Special Students.	Total No. of Students.	Percentage.	
				Regular.	Special.
1882–83	219	149	368	60	40
1883–84	272	171	443	61	39
1884–85	368	211	579	64	36
1885–86	415	194	609	68	32
1886–87	442	195	637	69	31
1887–88	520	200	720	72	28
1888–89	590	237	827	71	29
1889–90	652	257	909	72	28
1890–91	658	279	937	70	30
1891–92	706	305	1,011	70	30
1892–93	774	286	1,060	73	27
1893–94	823	334	1,157	71	29
1894–95	835	348	1,183	71	29
1895–96	851	336	1,187	72	28

Women as Students at the Institute.

The number of women pursuing courses with us is seventy-five, as against fifty-eight last year. Of these, nine are graduates of colleges. Of the total number, seven are regular students of the fourth year; three of the second year; four of the first year. Sixty-one are special students. Of the ten regular students of the upper classes, five take Course IV., Architecture; two, Course V., Chemistry; one, Course VII., Biology; one, Course VIII., Physics; one, Course XII., Geology. Of the special students, twelve devote themselves to Chemistry; two to Physics; thirty-eight chiefly to Biology and allied subjects; five to Geology; one to Architecture; two to English, History, or Political Science; one to first-year subjects.

Graduates of Other Colleges.

The number of students who are graduates from this and other institutions is eighty. Of these, thirteen are our own graduates, of whom four are pursuing studies as candidates for advanced degrees; sixty-nine (including two who are also graduates of the Institute) are graduates of other institutions, pursuing courses of study with us, either as regular or as special students. Eleven are graduates of Harvard University; five of Smith College; four of Williams College; three, each, of Amherst College, Brown University, and the Sheffield Scientific School of Yale; two, each, of Maine State College, College of New Jersey (Princeton), Dartmouth College, and Yale University; while the following institutions are represented on our list by a single graduate each: Universities of California, Chicago, Oregon, Santiago, Venezuela, Vermont; Columbian, Cornell, Drake, Johns Hopkins, Northwestern, Wesleyan, Iowa and Louisiana State Universities; Colorado, Cumberland, Carreras, Central Turkey, Charleston, Dickinson, Hampden-Sidney, Haverford, Mt. Union, St. Johns, Spanish National, Trinity, Wooster, Iowa State Agricultural

Colleges, Massachusetts College of Pharmacy, Royal Military College, United States Military Academy, United States Naval Academy, Worcester Polytechnic Institute.

The graduates of the Institute who are candidates for advanced degrees are Messrs. Charles William Berry, the holder of the Swett fellowship, in Physics, now studying abroad; Frank Augustus Bourne, in Architecture; Herbert William Chamberlain, the holder of the Savage scholarship, in Architecture; and George Defren, in Chemistry. Of the seventy-six graduate students not candidates for advanced degrees, forty are regular students, — viz., eighteen in the fourth year; fifteen in the third; five in the second; two in the first. Of the thirty-eight graduates who are regular students in the three upper classes, eight take Civil Engineering; two, Mining Engineering; four, Mechanical Engineering; nine, Architecture; two, Chemistry; eleven, Electrical Engineering; and two, Chemical Engineering.

The Courses of Instruction.

The following table presents the numbers of the regular students in the second, third, and fourth years, by courses.

Year.	Civil Engineering.	Mechanical Engineering.	Mining Engineering and Metallurgy.	Architecture.	Chemistry.	Electrical Engineering.	Biology.	Physics.	General Course.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Total.
4th Year Class	27	32	11	22	15	50	3	4	6	6	4	3	6	189
3d " "	28	38	7	17	20	45	2	4	5	11	4	..	8	189
2d " "	33	48	7	28	24	31	2	3	3	8	2	..	8	197
Total . .	88	118	25	67	59	126	7	11	14	25	10	3	22	575

The following table shows the figures of the total line in the foregoing table, in comparison with the corresponding figures for the next ten preceding years: —

Year.	Civil Engineering.	Mechanical Engineering.	Mining Engineering and Metallurgy.	Architecture.	Chemistry.	Electrical Engineering.	Biology.	Physics.	General Course.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Total.
1885 . . .	44	74	26	10	23	41	4	1	5	..	..	..	..	228
1886 . . .	45	75	19	13	24	52	4	2	8	..	..	..	..	242
1887 . . .	50	89	16	18	23	61	5	6	14	..	..	..	..	282
1888 . . .	71	100	12	21	28	74	4	5	12	11	..	..	..	338
1889 . . .	79	99	14	30	29	91	9	5	12	14	6	..	..	388
1890 . . .	79	95	18	27	27	105	11	4	13	18	7	3	..	407
1891 . . .	81	104	17	33	23	108	11	5	19	28	9	3	..	441
1892 . . .	76	106	19	37	35	112	9	5	16	34	5	3	..	457
1893 . . .	78	97	22	50	39	141	4	10	19	31	10	2	8	511
1894 . . .	88	111	19	48	50	137	5	9	19	35	13	2	20	556*
1895 . . .	88	118	25	67	59	126	7	11	14	25	10	3	22	575

* Counted twice, two.

It will appear from the foregoing table that the course in Electrical Engineering remains the largest of the courses of the school. The courses in Mechanical and Civil Engineering follow in the order in which I name them. These three courses together embrace three hundred and thirty-two of the five hundred and seventy-five regular students, candidates for the degree, in the three upper classes. Of all the large courses, No. IV., Architecture, shows the greatest proportional increase of regular students; viz., from forty-eight to sixty-seven. This is the result of continuous efforts on the part of the Faculty, and especially of Professor Chandler, to place the Architectural course on as broad and systematic a foundation as any other in the school. This course will always, however, embrace a considerable number of college graduates and of young men who have had experience as draughtsmen and assistants in architects' offices, who are allowed to enter the department as special students, to get as nearly as possible what they require, without passing through the full course. The Chemical and Biological courses also contain considerable numbers of special students, often of advanced grade, some of them teachers or persons who have been engaged in professional practice.

The following table exhibits the number of persons who have graduated within each of the several courses at each succeeding year since the first diplomas were conferred: —

Year.	Civil Engineering.	Mechanical Engineering.	Mining Engineering.	Architecture.	Chemistry.	Metallurgy.	Electrical Engineering.	Natural History or Biology.	Physics.	General Course.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Total.
1868	6	1	6	..	..	..	..	..	..	1	..	..	..	..	14
1869	2	2	..	..	1	..	..	..	..	..	..	..	..	..	5
1870	4	2	2	..	1	..	..	..	..	1	..	..	..	..	10
1871	8	2	5	..	2	..	..	..	..	..	..	..	..	..	17
1872	3	1	5	..	3	..	..	..	..	..	..	..	..	..	12
1873	12	2	3	1	7	..	..	..	..	1	..	..	..	..	26
1874	10	4	1	1	..	..	..	..	..	2	..	..	..	..	18
1875	10	6	6	1	1	..	..	..	1	2	..	..	..	..	27
1876	12	9	7	..	5	1	..	2	3	4	..	..	..	..	43
1877	12	6	8	4	2	..	..	..	..	..	..	..	..	..	32
1878	8	2	2	3	3	..	..	..	..	1	..	..	..	..	19
1879	6	8	3	1	3	..	..	1	1	..	..	..	..	..	23
1880	3	..	3	..	1	..	..	..	..	1	..	..	..	..	8
1881	3	5	6	3	8	..	..	1	..	2	..	..	..	..	28
1882	2	5	5	3	6	..	..	1	1	1	..	..	..	..	24
1883	3	7	5	1	3	..	..	..	..	..	..	..	..	..	19
1884	5	6	13	..	12	..	..	..	..	..	..	..	..	..	36
1885	4	6	8	2	4	..	2	..	..	1	..	..	..	..	27
1886	9	23	7	1	7	..	10	1	..	1	..	..	..	..	59
1887	10	17	8	1	9	..	8	1	1	3	..	..	..	..	58
1888	11	25	4	5	10	..	17	3	1	1	..	..	..	..	77
1889	15	23	5	3	8	..	17	1	1	2	..	..	..	..	75
1890	25	27	3	5	13	..	18	3	2	6	..	..	..	..	102
1891	17	26	4	6	11	..	23	3	3	1	7	..	1	..	102
1892	22	26	4	13	7	..	36	6	1	7	4	6	1	..	133
1893	25	30	5	2	8	..	41	2	..	6	8	..	2	..	129
1894	21	31	4	13	11	..	33	1	3	5	12	3	..	..	137
1895	25	30	3	15	13	..	33	..	2	4	11	4	..	5	145*
Total	293	332	135	84	159	1	238	26	20	53	42	13	4	5	1,405
Deduct names counted twice															11
Net total															1,394

* Counted twice, two.

The following table shows, by classes and by courses, the number of regular students who have registered themselves as electing to distribute the required studies and exercises over the period of five years.

Year.	Total.	Course.												
		I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.
1st . .	4	..	..	..	..	..	..	..	..	..	..	..	..	..
2d . .	5	2	..	..	1	1	..	..	..	..	..	..	..	1
3d . .	11	..	1	1	1	1	5	..	..	1	..	..	..	1
4th . .	5	..	..	..	..	..	3	..	1	..	..	..	..	1
5th . .	10	..	4	1	1	..	2	..	..	..	..	..	2	..
	35	2	5	2	3	2	10	..	1	1	..	..	2	3

Classification of Special Students.

Our special students can, of course, not be classified systematically; but the following table exhibits the number of such students pursuing each particular branch of study:—

Applied Mechanics . . .	64	Language	157
Architecture	42	Mathematics	174
Biology	64	Mechanical Engineering .	62
Chemistry	129	Mining Engineering. . .	9
Civil Engineering . . .	40	Naval Architecture . . .	2
Drawing	135	Physics	158
Electrical Engineering . .	22	Political Science	62
English	105	Shopwork	57
Geology	47	Sanitary Engineering . .	5
History	84		

The following is the number of students, either regular or special, pursuing certain leading branches of study, in each of the four years, as follows:—

	First Year.	Second Year.	Third Year.	Fourth Year.	Total.
Mathematics . . .	324	272	206	79	881
Chemistry	348	62	79	48	537
English	291	247	18	13	569
French	197	79	40	18	334
Physics	..	284	274	141	699
German	73	174	163	10	420
Shopwork	12	118	45	39	214

Changes in the Faculty and the Corps of Instruction.

The most important change in the Faculty during the year on which I am now reporting, has been the resignation of Professor Drown, upon his appointment to the presidency of another institution. The history of the Institute of Technology is full of painful losses which it has sustained for the enrichment of other institutions. Harvard, Yale, Columbia, and now Lehigh, have in succession carried away from us some of our most valued instructors.

Professor Drown came to the Institute in 1885, having formerly been Professor of Mining Engineering in Lafayette College, Pa., and having served for twelve years as secretary of the American Institute of Mining Engineers. At the time of his appointment in the Institute of Technology, we congratulated ourselves very heartily upon the acquisition of so ripe a scholar and so experienced a teacher; we had yet to learn the full extent of our good fortune. For ten years Dr. Drown has been our Professor of Analytical Chemistry, and for five years has been at the head of the entire chemical department, with its large staff, its extensive laboratories, and its hundreds of pupils. His success in this important and difficult charge has been remarkable. Perfect harmony has existed. The considerable business of the department has been conducted with efficiency; the whole body of students have felt the influence of a calm spirit, a strong will, a clear intelligence, and a genial disposition, steadying, strengthening, and inspiring them in their work.

The chemical investigation into the potable waters of Massachusetts, which Professor Drown has carried on since 1887 on behalf of the State Board of Health, during which time fifteen thousand seven hundred complete analyses of water have been made in the laboratory under his direction, has not only increased Dr. Drown's scientific reputation, but has added prestige to the Institute. His mapping of the "Normal Chlorine" of the several regions of the Commonwealth con-

stitutes one of the most important of recent contributions to sanitary chemistry. As a member of the Faculty, Professor Drown's services to the Institute can never be adequately acknowledged. His unvarying courtesy, conciliatory disposition, and sympathetic feeling were admirably united to strength of purpose, clear thinking, and firm decision. Dr. Drown carries to his new field of labor the affectionate remembrance and hearty good wishes of all his late colleagues at the Institute of Technology.

The following named assistant professors have been advanced to the grade of associate professor: Messrs. Pope, Currier, Homer, Dippold, and Talbot. Deserved promotion has been given to six instructors: Messrs. Lodge, Woodbridge, and Clifford, Drs. Woods, Ripley, and Hough, who have been advanced to the grade of assistant professor.

Mr. Lodge was a student of Course III. in the class of 1879. During the school year 1879–80, he was assistant in the mining laboratory. Leaving the Institute, he went into professional practice, being engaged in mining, at first in Colorado, and afterward as superintendent of a silver mine in Nevada. From 1883 to 1885 he was head chemist of the North Chicago Rolling Mills, and was afterward connected with the South Chicago Works. In 1887 he became chemist of the Sloss Iron and Steel Company, of Birmingham, Alabama. In 1889 he returned to the Institute as Instructor in Mining Engineering and Metallurgy.

Mr. Woodbridge graduated from Williams College in 1873, and subsequently received his degree of Master of Arts from the same institution. In 1874 he came to the Institute of Technology as a student, and in 1883 became Instructor in Physics. Gradually he developed so high an interest in the special subject of warming and ventilating buildings that his work became more and more directed upon the scientific principles involved and the technical means to be used in controlling the temperature and the movement of air. When the Walker Building was erected in 1883, Mr. Woodbridge designed and supervised the very extensive sys-

tem through which that building has come to be known to many scientific men as the best ventilated public building in the world; the air in nearly all the rooms of the building being insensibly changed once in eleven minutes, while the air of the two great chemical laboratories is renewed every seven minutes. When the Engineering Building was erected in 1889, and again in 1892 when the Architectural Building was erected, Mr. Woodbridge acted gratuitously as the expert adviser and superintending engineer of the ventilating systems of these buildings. Gradually his work at the Institute has become more and more specialized; and new courses in heating and ventilating have been developed for the benefit of the engineers, the architects, and finally of the naval architects. Meanwhile Mr. Woodbridge has been entrusted with arrangements for the warming and ventilation of many of the most important buildings, including the Massachusetts State House Extension, the new State Houses of Maine and Rhode Island, the Boston Subway; and, finally, at the last session of Congress, he was appointed to study and report upon the ventilation of the Capitol at Washington. It is in recognition of the highly scientific character of Mr. Woodbridge's work in exact research that he has been promoted to be Assistant Professor of Heating and Ventilation.

Dr. Woods graduated at Wesleyan University in 1885, received the degree of A. M. for a year of graduate study, and during a few years following was engaged in teaching. In January, 1890, he came to the Institute to fill the place of one of our mathematical instructors who was leaving at that time. He remained at the Institute until May, 1891, when he went abroad to pursue his mathematical studies in Germany, and took his degree of Ph. D. at Göttingen in 1894. Last year he returned to the Institute as an instructor. At the opening of the present year he was appointed Assistant Professor of Mathematics.

Mr. Clifford graduated from the Institute of Technology, Course VI., in 1886, and was at once made Assistant in Physics. In 1888 he was appointed instructor, and the pres-

ent year has been promoted to the grade of Assistant Professor of Theoretical Physics.

Dr. Hough graduated at Johns Hopkins University. After three years spent in teaching in secondary schools, he returned to Johns Hopkins, and for four years pursued graduate studies in biology, obtaining his doctorate in 1893. He was for one year a junior assistant in physiology, and held the fellowship in animal physiology from 1892 to 1893. Dr. Hough came to the Institute as Instructor in Biology in the fall of the year last named.

Dr. Ripley graduated from the Institute course in Civil Engineering in 1890. Turning his attention to studies in economics, statistics, and sociology, he obtained a fellowship in Columbia College, where he took his degree of Ph. D. in 1892, with distinction. He at once returned to the Institute of Technology, becoming Instructor in Economics and Statistics, holding also a lectureship in Columbia, which, however, calls for only a small portion of his time. While assisting Dr. Dewey in the Department of Economics and Statistics, Dr. Ripley has developed courses in Sociology which have already attained a high educational value.

The fact that, of the six instructors thus introduced into the Faculty, three received the bachelor's degree from other institutions, while four have received higher degrees, fairly represents the effort which is making, not only to give our instruction a highly educational value, irrespective of technical accomplishments and acquirements, but also to secure liberality and breadth of character by bringing in men who represent the training and culture of other institutions. It may be interesting to the Corporation to learn that, of the present instructing staff, ten received their bachelor's degrees, whether in arts or in science or in philosophy, at Harvard College; two in the Lawrence Scientific School; four received their bachelor's degree from the Sheffield Scientific School; four from Amherst College; three from Johns Hopkins University; two from Bowdoin College; and one each from Boston University, Columbia College,

Iowa State College, Wesleyan University, Williams College, University of Virginia, U. S. Military Academy, Lafayette College, University of Illinois, University of Vermont, Pennsylvania State College, University of Minnesota, New Hampshire College of Agriculture and the Mechanic Arts. Six received their first degrees in arts or in science at foreign colleges or universities. In all, twenty-five other colleges and universities are represented by forty-four graduates on the instructing staff of the Institute. In addition to the foregoing, nine of our own graduates, now engaged in the work of instruction here, have taken higher degrees at other institutions, chiefly abroad, so that it may be said that fifty-three of our instructors have had an experience extending to graduation in some university or college beside the Institute, and that the training and culture of twenty-nine institutions of the higher learning are represented on our lists.

No appointment has been made of a successor to Dr. Drown. Professor Crafts, to whom the Corporation would, with great satisfaction, commit the charge of the entire Chemical Department, entertains the feeling that he can be more useful to the Institute by confining himself to his work in organic chemistry. Nevertheless, Professor Crafts has allowed the President to confer freely with him regarding the interests of the department as a whole; and has been at much pains — which are here gratefully acknowledged — to prevent the loss of Dr. Drown from being too painfully felt. Dr. Talbot has, at the request of the Executive Committee, undertaken to conduct the business of the Chemical Department, the purchase and distribution of supplies, the accounts, etc., for all the laboratories. Otherwise, the department has been without a single responsible head, as for the past five years under Dr. Drown; and the several professors and instructors have reported directly to the President, who has done whatever he could to strengthen their hands, and furnish the means for carrying on their work to the best effect. It is, perhaps, not to be regretted that for a year, at any rate,

this added responsibility should be thrown upon the gentlemen in charge of the several laboratories and of the different branches of the chemical service of the Institute.

Among Instructors the following changes have occurred during the year: —

Dr. Samuel P. Mulliken has been appointed Instructor in Organic Chemistry. Dr. Mulliken graduated from the Institute, with the class of 1887, in the Department of Chemistry. He was Assistant in Chemistry in the University of Cincinnati, 1887–88. He then went to Germany for advanced study, taking his doctor's degree at Leipsic in 1890. He was Fellow in Chemistry at Clark University, 1890–91; Associate in Chemistry at Bryn Mawr, 1891–92; Instructor in Organic Chemistry at Clark University, 1892–94; Research Assistant with Dr. Wolcott Gibbs at Newport, 1894–95.

Justus Erhardt, the newly appointed Instructor in Modern Languages, graduated at the Istituto Technico of Bologna in 1888, and has since then been engaged in teaching.

Henry Fay and George W. Rolfe have been appointed Instructors in Analytical Chemistry. Dr. Fay graduated at Lafayette College in 1889, received the degree of A. M. from the same institution in 1892, and attained the doctorate at Johns Hopkins University in 1895. In the intervals of academic work, Dr. Fay has been engaged in professional practice. Mr. Rolfe graduated at Harvard College in 1885, and took his A. M. degree there in 1886. Since that time he has been engaged in professional practice at the West, and on sugar plantations in Cuba, with the exception of one year spent in teaching.

Henry E. Crampton, Jr., appointed Instructor in Biology, graduated from Columbia College in 1893, and was, for two years following, Assistant in Biology in that institution.

Harry W. Gardner, appointed Instructor in Architecture, graduated at the Institute, with the class of 1894, from the Department of Architecture, and passed the intervening year in professional practice.

The following Assistants have been appointed Instructors:

L. Kimball Russell, S. B., in General Chemistry; F. Jewett Moore, Ph. D., in Analytical Chemistry; Charles L. Norton, S. B., in Physics; Simeon C. Keith, Jr., S. B., in Biology; Frederick H. Keyes, S. B., in Mechanical Engineering; Kilburn S. Sweet, S. B., in Civil Engineering; Ervin Kenison, S. B., in Mechanical Drawing; W. Felton Brown, in Free-hand Drawing. Messrs. Norton, Keith, Keyes, Kenison, and Sweet graduated from the Institute in 1893. Mr. Russell graduated in 1886. Dr. Moore graduated from Amherst College in 1889; was assistant in Chemistry in that institution in 1889–90; student at Heidelberg, 1890–93, taking his doctor's degree in the latter year; instructor at Cornell University, 1893–94. He came to the Institute of Technology last year as Assistant in Chemistry. Mr. Brown comes to us from the École des Beaux Arts, Paris, where he studied for four years under the best masters.

The following named Instructors have resigned their work at the Institute: Dr. Thomas Evans, Organic Chemistry; Mr. Herbert R. Moody, Analytical Chemistry; Mr. Charles M. Faunce, Mechanical Drawing and Descriptive Geometry; Mr. Robert S. Shedd, Architecture. These gentlemen resigned their positions to enter professional practice, except Mr. Shedd and Mr. Faunce, who, I deeply regret to say, were compelled to leave the Institute by reason of ill health. Mr. Shedd was a student at the Institute in the "partial course" in architecture, 1888–90; was Assistant in Architecture, 1892–94; and was appointed Instructor in the latter year.

The following gentlemen have been appointed Assistants: Samuel C. Prescott, S. B., in Biology; Franklin H. Robbins, S. B., in Mechanical Drawing; Harold K. Barrows, S. B., in Civil Engineering; James F. Norris, Ph.D., in Organic Chemistry; Walter S. Williams, S. B., in Industrial Chemistry; Charles A. Meserve, S. B., in Sanitary Chemistry; Frederick W. Howe, S. B., and Charles R. Walker, S. B., in General Chemistry; William J. Drisko, S. B., and Henry A. Holdrege, S. B., in Physics; Alexander Moseley, S. B., Jesse H. Bourne, S. B., Carl H. Clark, S. B., and Fred A. Hannah, S. B., in Me-

chanical Engineering; Ira G. Studley, in Machine Tool Work. All of these are graduates of the Institute, and of the class of 1895, except Dr. Norris, who took his doctor's degree last summer from Johns Hopkins University, Mr. Howe, who graduated from the New Hampshire College of Agriculture and the Mechanic Arts, class of 1894, and has had one year of professional practice, Mr. Moseley, who graduated from the Institute in 1891, and has since been engaged in practice, but has now decided to adopt teaching as his profession, Messrs. Prescott and Robbins, who were of the Institute class of 1894, and Mr. Studley, who was a special student with us in shopwork only.

The following Assistants have terminated their connection with the Institute to enter professional practice: Barron P. Du Bois, S. B., William W. Crosby, S. B., Frank D. Richardson, S. B., and Thomas G. Richards, S. B., in Mechanical Engineering; Edward M. Hunt, S. B., in Civil Engineering; Leslie R. Moore, S. B., in Industrial Chemistry; Walter E. Piper, S. B., in General Chemistry; and Edward P. Hutchinson, in Machine Tool Work.

Statistics of the Corps of Instructors.

The Catalogue of 1895–96 shows the number of instructors of all grades to be one hundred and twenty-one, inclusive of those concerned with the mechanic arts, but exclusive of those who are announced as lecturers for the year only. The addition of these raises the total to one hundred and forty-seven. The following table shows the distribution among the several classes of instructors, in comparison with last year: —

	1894–95	1895–96
Professors	20	19
Associate Professors	5	10
Assistant Professors	17	18
Instructors	52	53
Assistants	21	21
Lecturers	22	26
Total	137	147

The instructing staff for the year 1895–96 is distributed as follows among the several departments of the school: —

	Civil Engineering.	Mechanical Eng. and App. Mechanics.	Mining Engineering and Metallurgy.	Naval Architecture.	Architecture.	Chemistry.	Physics and Electrical Engineering.	Biology, Zoölogy, Etc.	Mineralogy, Geology, and Geography.	English, History, and Political Science.	Language.	Mathematics.	Drawing and Descriptive Geometry.	Military Tactics.	Mechanic Arts.
Professors . . . . (19)	1	1	1	1	2	1	2	1	1	2	1	4	..	1	..
Associate Professors (10)	3	1	1	..	1	2	..	..	..	1	1	..	..	..	..
Assistant Professors (18)	..	3	1	..	..	3	3	1	1	1	1	3	1	..	..
Instructors . . . . (53)	4	6	..	1	2	11	6	3	1	3	4	4	5	..	3
Assistants . . . . (21)	2	6	..	..	..	6	2	1	..	..	..	..	1	..	3
Total . . . (121)	10	17	3	2	5	23	13	6	3	7	7	11	7	1	6
Lecturers . . . . (26)	1	..	1	..	5	6	12	1	..	..	..	..	..	..	..
Total . . . (147)	11	17	4	2	10	29	25	7	3	7	7	11	7	1	6

At the annual meeting of the American Association of Agricultural Colleges and Experiment Stations, held this year in Denver, we were so fortunate as to be represented by our colleague, Hon. Frank A. Hill, Secretary of the Massachusetts State Board of Education. The Association is steadily making progress in the discussion of the problems which confront the scientific and technical schools of the country.

At the invitation of the management of the Massachusetts Charitable Mechanics' Association, with which the Institute of Technology has maintained special relations ever since its organization, an exhibit of our work and methods was entered at the Triennial Fair of the Association, beginning October 1. That at a very slight expense the exhibit of the Institute was made at once so pleasing and instructive, was wholly due to the

energy and good taste of Professor Merrill, of the Department of Mechanical Engineering, who kindly undertook the task. We were also invited to make an exhibit at the Atlanta Exposition; but the great cost of the representation of our work at Chicago served to deter the Executive Committee from undertaking an enterprise so formidable as a general exhibition of the organization and work of the school. Through the kind offices of Professor Sedgwick, however, who visited Atlanta as one of the jury of awards, a number of students' drawings, and several large illustrated volumes showing precisely the course of instruction in our main departments, were neatly installed at a slight expense.

The Manufacturers' Mutual Fire Insurance Company has presented to the Institute a machine for determining the coefficient of friction; and Mr. Edward Atkinson has given a pyrometer, with reference to undertaking certain important special investigations.

Mr. Thomas Gaffield, of this city, has presented to the Institute his collections relating to the manufacture of glass. Mr. Gaffield has long been known as an authority on this subject, and his collection of materials has extended over many years. His gift comprises a considerable library, containing the literature of the subject, as well as large and varied collections, chemical, mineralogical, metallurgical, and mechanical. The library contains two hundred and sixty-one volumes dealing with glass and kindred subjects. These include a number of old treatises which are of great interest in the history of the subject. There are also six volumes on precious stones. Mr. Gaffield has been especially interested in the effects of light upon glass; and the library contains thirty-four volumes having reference to this subject. Perhaps the most generally interesting and valuable part of the collection is composed of sixty-three volumes on the manufacture and history of works of art in glass and in porcelain. Many of these are beautifully illustrated with colored plates, and are of high value. Especially worthy of mention are two large folios, Delange et Borneman, "Recueil de Faïences Italiennes de

XV., XVI., XVII. siècles," 1889, and Warrington, "History of Stained Glass," 1848; also Deville, "Histoire de l'art de verrerie," 1873; Fortnum, "Maiolica in South Kensington Museum," 1873; and Jacquemart, "Histoire de la Céramique," 1875. The works just mentioned, and others of great artistic merit, will be placed in the library of the Department of Architecture.

On the practical side, Mr. Gaffield's collection includes sets of glass-workers' tools, models of furnaces and glass pots, samples of materials used in glass-making, samples of glass-blowers' work, specimens of old cathedral glass, and of mirror, ground, and plate glass. There are, also, several hundred specimens which show the results of Mr. Gaffield's study of the varying action of sunlight upon different sorts of glass. Besides the above are specimens showing the action of sand-blast, of glue and mucilage, and of hydrofluoric acid. A special case has been constructed to display this collection in the Department of Chemistry. In addition to these gifts to the library and to the chemical department. Mr. Gaffield has presented to the Department of Geology a valuable collection of minerals.

The Library.

In addition to the heavy loss sustained by the school in the resignation of Professor Drown, the Institute has lost its accomplished librarian, Mr. Clement W. Andrews, whose work in promoting the growth of our library and in arranging our unusually large collection of scientific works and periodicals, has brought him the deserved honor of appointment to the chief librarianship of the new Crerar Library of Chicago, which, it is understood, will be entirely devoted to the literature of science. While all who have known his unstinted service to the Institute must feel regret at the loss of an officer so valuable and so efficient, the Faculty did not withhold their congratulations to Mr. Andrews upon his advancement to one of the highest positions in his profession. Mr. Andrews' work at the Institute has been all that could be desired; and

he will long be gratefully remembered by those with whom he has been associated here. The choice of a successor to Mr. Andrews was not an easy one. Merely an accomplished man, trained in modern library methods, would not answer all our requirements. A special knowledge of scientific and technical literature, and a thorough appreciation of the work of the school in all that is peculiar and characteristic of it, are essential to the proper conduct of that office. While our library does not rank with the great libraries in respect to the number of volumes, yet there are few anywhere which approach in completeness its scientific collections, and especially its periodical literature in technology. In the last respect the library is pre-eminent, receiving, in one or another department of the school, five hundred and three periodicals, exclusive of annuals. After careful consideration, the Executive Committee offered the position of librarian to Dr. Robert P. Bigelow, Instructor in the Department of Biology. Dr. Bigelow, after some hesitation at the sacrifice of professional study involved, accepted the position, and assumed charge of the office on the first of September. He also succeeds Mr. Andrews as Secretary of the Society of Arts, and Editor of the Technology Quarterly.

The total accessions to the libraries of the Institute during the year are as follows:

By purchase	1,583
" gift	2,198
" binding	626
Total accessions	4,407

The net accessions of volumes and of pamphlets in each department is exhibited in the following table, together with the total number of volumes and pamphlets in each library.

The practice of receiving books for inspection, having been found to be of great advantage, has been continued, and space in the bookcases has been found for the display of these new books. The total number received for inspection during the year is 253, of which 133 were purchased and the remainder returned to the dealers sending them.

Net Accessions.

Library.	Volumes added.	Pamphlets added.	Total* Volumes.	Total † Pamphlets.
General { Mathematics, Modern Languages, Military Science }	418	267	4,232	2,835
Engineering and Naval Architecture	626	342	6,050	2,702
Mining	136	37	1,518	275
Architectural	265	33	1,647	171
Chemical	424	76	6,229	1,386
Biological	56	54	1,668	331
Physical	437	46	4,798	632
Political Science	593	450	7,357	2,837
English	176	1	2,014	36
Geological	53	106	1,573	704
Margaret Cheney Room	6	1	568	13
Total	3,190	1,413	37,654	11,922

* Including volumes of bound pamphlets.
† Including pamphlets bound together in volumes, and maps and diagrams.

The total number of orders for the purchase of books given during the year is 1,406. Duplicate orders to the number of 98 were received by the librarian from heads of departments; 39 of these were accepted, and the rest returned to the departments. Of those returned, only 12 were reordered. The number of cards added to the main catalogue is 3,132, making the total number in the catalogue 34,871. For every card added to this catalogue a duplicate card has to be added to the catalogue of the department to which the book belongs, and frequently an additional reference card is sent to the catalogue of an allied department, so that during the year

there have probably been written altogether 6,400 catalogue cards. The accuracy with which the books have been recorded is shown by the fact that Mr. Andrews, in comparing the catalogue and old order-slips, while making out his lists for the Crerar Library, found less than twenty errors in our catalogue of nearly thirty-five thousand cards.

The Institute has been fortunate during the year in the receipt of a large number of gifts to the library, many of which are worthy of special mention:

From Mrs. William B. Rogers we have received 6 volumes.

From Dr. Henry P. Quincy, 8 volumes.

From the American Book Co., 16 volumes.

From Professor Cross, 19 volumes.

From Professor Drown 55 volumes, including 18 volumes of the American Journal of Science, 14 volumes of the Engineering and Mining Journal, and 5 volumes of Monatshefte der Chemie, 1880-1884, first edition.

The Institute has received by bequest, from the library of the late Arthur Rotch, 84 volumes of architectural books, many of them of very great value.

The largest contribution from a single person is from Mrs. Henry Draper, who has presented to the Institute during the past year 235 volumes, chiefly on architecture, all valuable and many of them rare. Among these are a complete set of Ruskin's Works, Édition de Luxe, 26 volumes; Wicar, Tableaux, bas-reliefs et camées de la Galerie de Florence, 4 volumes, large folio, 1789–1803; Paris, Académie des Sciences, Comptes Rendus, 26 volumes; Penot and Chipiez, History of Art; San Marco in Venezia, 12 volumes of plates and 2 of text; Palustre, La Renaissance en France, 3 volumes; Letarouilly, Le Vatican, 2 volumes; and Conder, Landscape Gardening in Japan, 2 volumes.

Summer Schools in the Field.

Mining Engineering and Metallurgy. — As the members of the Corporation know, the summer school of mining engineering and the summer school of metallurgy are carried on in alternate years. This was the metallurgical year. Professor Hofman took charge of the school, and conducted a party of five to various works in New Jersey and Pennsylvania. When an establishment was visited, each student made careful observations of certain portions of the process, which had been assigned to him. Later in the day all the members of the school held a session and compared results, writing up complete notes of the process, each one contributing his share. The works thus studied were those of the Orford Copper Company, Balback Smelting and Refining Company, Passaic Zinc Company, the Benjamin Atha and Illingworth Company, the Lackawanna Iron and Steel Company, the North Lebanon Furnaces, the Cornwall ore banks, the Coleman Iron Company, the Pennsylvania Bolt and Nut Company, the Pennsylvania Steel Company, the Everett Furnaces, the Broad Top Coal Field, the Cambria Iron Company, which comprise a variety of iron and steel works, as well as copper, zinc, lead, and silver smelting works, and also some coal mines. The proprietors of these works received the students most hospitably, and in a very generous way permitted them freely to inspect and study their operations.

Geodesy, Topography, and Hydraulic Engineering. — The summer school for field work in geodesy, topography, and hydraulics was held during the month of June at Keeseville, N. Y., the location being the same as that for the summer schools of 1893 and 1894. Twenty students from the third-year class were in attendance. The work was conducted by Professors Burton and Porter, and Mr. Robbins, of the Civil Engineering Department. In addition, Mr. George C. Whipple, of the class of '89, and Mr. S. H. Thorndike, of the class of '95, both graduates in Civil Engineering, were engaged for special instruction. The plane-table survey of the surrounding

country was extended so as to embrace a total area of seven square miles, the area covered in this year's work being more than equal to that of the two previous years put together. The base line and all the angles in the system of triangulation were re-measured this year. In the base line measurement the temperature of the 100-meter steel tape was determined for the first time by means of the thermophone, an instrument recently invented by Mr. Whipple and Mr. H. E. Warren, the latter a graduate in Electrical Engineering. The thermophone used was one which had been especially devised for this work, and calibrated for the steel tape used, and the results attained were satisfactory in the highest degree. Another use of the thermophone was made at the summer school, in the determination of the temperature of the water of Lake Champlain at different depths. The temperatures were taken at points in the lake where the water was 250 or more feet in depth. A steam-launch was used in this work, and an apparatus was especially devised for taking these deep soundings with rapidity and accuracy. The greatest depth found was 396 feet. The instruction in the use of the thermophone was given by Mr. Whipple. Tables and diagrams illustrating these experiments will soon be published in full in the "Technology Quarterly." In addition to the above work, a true meridian line was established and permanently marked, and observations for time and latitude were taken. The hydraulic field work was not essentially different from that of last year. Measurements of the discharge of the Au Sable River and of the mill-flumes in Keeseville were made with floats and meters, the meters being rated on Augur Lake. Owing to the absence of instructors of the Geological Department, there was no field work in geology this year. In other respects, the work was very complete and successful.

Architecture. — The summer school of architecture was held this year, as last, at Salem; and the special subject chosen for consideration was colonial architecture, of which so many choice and beautiful examples are to be found in that city and the immediate vicinity. The kindness with which the

class, comprising seventeen students, was received by the people of Salem cannot be adequately acknowledged. The Essex Institute gave the use of Plummer Hall as a head-quarters for the class and for evening drawing. Several of the choicest residences of the city opened their doors day after day to students, who were permitted to make studies and measured drawings of hallways, stair-cases, mantelpieces, and old furniture. The hospitality, in many forms, offered to this class of Institute students was far beyond what could have been asked or expected.

Summer Courses at the Institute.

In the President's Report of December, 1894, reference was made to the fact that a limited amount of instruction in the laboratories and lecture-rooms of the Institute, by members of the instructing staff, had been introduced tentatively during the vacation of that year. The results of the experiment were found sufficiently satisfactory to justify the offering of a somewhat larger number of courses during the summer of 1895. While the attendance was not so large as was expected, it is believed that enough good was accomplished to repay the time and effort of the instructors in charge. The committee of the Faculty, under the chairmanship of Professor Crafts, which arranged for the holding of these courses during the summer, has, since the opening of the new academic year, been carefully studying the results, with a view to making recommendations as to whether the system shall be continued and be made permanent, and if so, as to the best methods to be pursued. The experiment is an interesting one and well worthy of consideration. As was stated last year, the summer classes have the character of private instruction, and are conducted without expense to the Institute. While receiving the Faculty's sanction, they are carried on without supervision or assumption of responsibility on the part of the Faculty. The subjects treated in these courses are Mathematics, General Chemistry, Analyt-

ical Chemistry, Organic Analysis and Organic Preparations, Physics and Physical Measurements, Biology, Bacteriology, Drawing, Descriptive Geometry, Orders of Architecture, Architectural Design, French, and German. Most of the courses announced were taken by a sufficient number of students to compensate the instructors for their time and labor. It will require at least another year to determine the question whether there is a real and permanent demand for such a system.

The classes of students for whose benefit this summer instruction was originally designed were four. First, those who, on coming to the Institute, may desire to obtain advanced standing. For a single example, a graduate of a classical college coming to the Institute to study architecture or engineering, may, during the five or six weeks occupied by the courses in mechanical drawing, take the entire first-year work in that subject. Second, those who may desire to make-up "conditions" under the instruction of trained teachers, rather than through their undirected study at home. Third, those of our own students who may desire to anticipate some of the work of the coming year, either as a means of enabling them to take additional studies, or laboratory or field work, or in order to make their work lighter during term time. Fourth, still another class in contemplation in organizing these summer courses were those persons, especially teachers, living in the vicinity of Boston, who may desire to obtain the advantage of a limited amount of work within the laboratories and lecture-rooms of the Institute. It was the supposed needs of the four classes just pointed out which caused the Faculty, two years ago, to authorize those instructors who desired to do so to undertake this enterprise and offer instruction in the rooms of the Institute. As I said, the experiment has had a certain degree of success, without any drawbacks. It will require at least another year to ascertain whether there is enough in these summer courses to justify their being accepted as a permanent part of our system. Should this be so, it will become a question worthy

of our consideration whether the whole care and charge of the instruction should be assumed by the Institute.

During the present term the Faculty have adopted two new rules, affecting both the school day and the school year. These changes are believed to be of a nature to promote the successful conduct of our work and to minister to the convenience of our students. Let me first speak of the change in the school day. Heretofore the rule has been to open at 9 o'clock. Class exercises were continued until 1, when a recess was taken until 2.15, at which time exercises were resumed for two additional hours, the school day closing at 4.15. It will thus be seen that the school day consisted of six hours of possible recitation or laboratory work. The recent development of our curriculum has made the traditional arrangement seem wasteful and inconvenient, and the Faculty have accordingly adopted a rule by which the school day begins as heretofore at 9 o'clock and continues until 5, with regular one-hour periods. On Saturday, school exercises cease at 1. It thus appears that there are now, on ordinary days, eight hours of possible laboratory, or drawing or class-room work. There are, however, no more recitations or exercises on this account, the whole effect of the change being to give a greater freedom in the assignment of hours and a better use of the laboratories, drawing-rooms, and recitation-rooms. But, while there are thus eight hours of possible school exercises, it is provided that the hour, 1 to 2, shall be used only for those few and generally small classes which cannot otherwise find a place in the tabular view. Secondly, it is provided that no student shall have exercises during both the noon-hours; that is, from 12 to 1, and from 1 to 2. The keeping open of the laboratories and drawing-rooms until 5 o'clock is a change long desired by our students.

In regard to the school year, the change has been in the nature of lengthening it by some days, in order to allow a better arrangement for the Christmas vacation, and also to secure an intermission in the second half of the year. It is provided that the school year shall begin on the first Wednes-

day after September 25; that the Christmas vacation shall consist of the first half, or the last half, of Christmas week, according as Christmas Day shall fall within the former or within the latter period; and that there shall be an intermission of the same duration, and bearing the same relation to April 19th, now a holiday under the law of the State. The number of actual school days during the school year remaining unchanged, the effect of the new rules is to cause the school to begin two days later and to close one week later, than heretofore.

Military Department. — Captain Bigelow has conducted the Military Department of the Institute during the year with eminent success. He has made this course of instruction thoroughly respected by the students, and has infused a spirit of promptitude, attention, and diligence such as never before pervaded the department. The difficult question of excuse from drill on various accounts has been treated with excellent judgment, with the result that the number of excuses has been unprecedentedly small. The most important changes in this branch of instruction during the year have been the discontinuance of the practice of drilling one-half the class at a time, and the abandonment of the two-battalion system. The corps of cadets is now organized as a single battalion with four companies.

The regular theoretical and practical examinations held at the beginning of the present school year, with a view to the selection of officers for the battalion, open to all first-year students, were attended by forty-eight members of the class of 1899, representing twenty-five different schools. The statistics of these examinations may not be without interest as bearing on the relative success in military instruction attained by the High Schools of Boston and Massachusetts, compared with those of other sections. Four Boston schools were represented by twelve students, who attained an average mark of 7.3 on a scale of 12. Thirteen schools of Massachusetts outside of Boston were represented by twenty-seven students, who attained an average of 7.5. From the East, outside

of Massachusetts, and from the South, appeared four students, representing three schools, who attained an average mark of 8.2. From the West five students presented themselves, representing five schools. These attained an average mark of 8.4. To compare Massachusetts with other states in this respect, we have seventeen of our schools represented by thirty-nine students, at these examinations, who attained an average mark of 7.4. From the other states came nine students, representing eight schools, who attained an average mark of 8.3. Captain Bigelow has also collected information regarding the previous military training of all the students of the first-year class except three. It appears that 125 had such previous experience; while 134 never drilled before coming to the Institute. Of the 125 having had previous experience, 43 served as field, staff, or company officers; 27, as non-commissioned officers; 55, as privates. Of the same 125, 27 had military training through one year or less; 26, through a second year or a part thereof; 36, through a third year or a part thereof; 36, through more than three years. The total number of students taking drill is 262. Eight have been excused on account of disability and take the theoretical course in military science, making the total in this department 270.

Courses I. and XI. — Civil and Sanitary Engineering. — Few changes of importance have been made in the courses of study. The transfer of integral calculus to the second year has rendered it possible to move forward into the third year the applied mechanics hitherto given in the fourth year, so that the course in mechanics follows that in physics without any interval, and is given in one year, instead of being distributed over two. The time left free in the fourth year has not yet been definitely assigned to other work, since this time will not become available until 1897–98. In the Geodetic Option, the time given to physical laboratory work has been increased, while that given to bridges has been diminished, this change being in the line of greater specialization. There are no students taking this option the present year. Of the thirty-one students taking most of the studies of the fourth

year, twenty-two are taking the first or General Option, while nine are taking the Railroad Option. While it is not expected that any large number of students will ever elect to follow the Geodetic Option, owing to the relatively small number of opportunities for young men in this line of work, and the tendency of our students to follow the more distinctly practical studies in preference to the more purely scientific ones, it is yet highly desirable that we should be in a position to offer the best in this line of engineering as well as in others. Few studies afford a better training in logical reasoning, in analysis, and in careful numerical computation, than geodesy and astronomy; and the young man who does good work in these lines will be apt to succeed in other branches. I would therefore again urge the desirability of our having a separate small building, on firm ground, in the country, suitable for the special work of this option, equipped with the necessary instruments. The transit instrument used in the alignment of the Hoosac Tunnel has been so reconstructed and modified during the past year that it serves now as an excellent astronomical transit and zenith telescope, and is amply sufficient for our needs. This instrument, while available for field work, cannot, however, be satisfactorily used in our course of instruction at the Institute until a firmer foundation can be built for it than is consistent with the situation of the present buildings. The expenditure of about one thousand dollars for the separate building, and the additional instruments alluded to, would enable us to meet all possible needs in this direction for some time to come.

In connection with the development of the geodetic work, reference should again be made to the fact that at the summer school the ingenious new instrument, the thermophone, recently invented by two of our graduates, was applied for the first time in determining the temperature of the steel tape used in measuring the base-line. This interesting application of the instrument has been already noticed in the account of the summer school. It may be well to call attention to the fact, that since this department has given special attention to

the development of the work in geodesy, it has made several distinct and original contributions to the science. First came the improved apparatus for the measurement of base lines with the steel tape, developed in 1891 by Messrs. Bradley and Campbell; then came the use of electricity in measuring the exact average temperature of the tape and so determining its precise length; and lastly, comes the application of the thermophone to this same problem. Professor Burton is at present preparing a paper describing this work in detail, and giving the results attained at our various summer schools.

As a further assistance in the geodetic and topographical work, Professor Burton was authorized to expend a considerable sum of money, during his summer abroad, in the purchase of a collection of modern topographical maps on large scales, of the different countries of Europe, which will be used in connection with the lectures on cartography in the course in topographical drawing. These charts have been selected with reference to the illustration of the best methods of topographical representation, and make a collection almost unique, and probably unsurpassed in the country. In addition to the thermophone, a level-trier has been added to the instrument equipment, for testing the accuracy of level bubbles.

In the Course in Sanitary Engineering, a new subject of instruction, hydraulic machinery has been introduced in the second term of the fourth year. The hydraulic equipment of the department has been increased by the purchase of two new current meters, a Fteley meter, similar to the one already in use, and a Price acoustic meter, the latest type of hand instrument. We now have five meters, in addition to the Darcy-Ritter tube. This addition to the number of instruments has been rendered necessary, not only by the increase in the number of students in this department, but by the fact that students in three other courses receive instruction in hydraulic field-work. Measurements have been made this fall at Lowell, in the Boott and Merrimac flumes, through the courtesy of the Proprietors of Locks and Canals. In the hydraulic labor-

atory valuable experiments were made in determining coefficients for the new weir (mentioned in my last report), and in investigating the loss of head at diaphragms. No large pieces of apparatus have been installed since my last report, but some additions are contemplated during the coming year.

During the past year, in addition to the regular instruction in the department, special lecturers were engaged as follows: Mr. H. G. Prout, Editor of the "Railroad Gazette," on Steel Rails; General Roy Stone, Chief of the Department of Road Inquiry, at Washington, on Highway Legislation; Mr. I. B. Potter, of New York, on Country Roads; and Mr. Henry Manley, Assistant City Engineer, Boston, on Street Pavements. The lectures of Mr. Blodgett, on Railroad Signals, were attended as usual by the students in the Railroad Option. Excursions have been made to several points of engineering interest, and acknowledgments are again due to President Tuttle, of the Boston and Maine Railroad, and to General Manager W. H. Barnes, of the Boston and Albany Railroad, for courtesies extended to the classes. Notes have been printed during the past year, on Hydraulic Measurements and on Warped Surfaces, both by Professor Porter. A new edition of Professor Allen's notes on Railroad Engineering, for the third year, has also been issued.

Professor Swain adds the following note: "The demand for graduates in Civil and Sanitary Engineering during the past year has been unusually large. It is a fact worthy of remark that in these, the older branches of the engineering profession, — branches that are supposed by many to be overcrowded, — there is a steady and increasing demand for more men than the school can supply. Considering the great development which is taking place, and which must continue, in transportation, in municipal work of all kinds, and in problems involving the public health, such demands for trained men are only natural, and must be subject to much less fluctuation than the ordinary vicissitudes of business. Last June we graduated twenty-eight men in the departments of

Civil and Sanitary Engineering. At last accounts, all of these were employed, while many had had several opportunities which they were obliged to reject; and the professors in the department have had numerous applications for men to which they have been obliged to reply that no men were available. Of the twenty-eight graduates alluded to, at last accounts four were in railroad work, three in bridge and structural work, six in hydraulic work, four in sanitary work, five in general municipal work (one a city engineer), three in highway construction, two in general practice, one an assistant at the Institute, and one temporarily employed. Mr. Lyon, one of our instructors, has had charge, during the summer, of the construction of highways and other works in the town of Hopedale, and many of the students of the third and fourth years have been employed."

Course II. Mechanical Engineering. — The following apparatus has been added to the Steam Laboratory : —

A set of four landings and an iron ladder erected outside the Engineering Building, beside the new iron chimney of the boiler-house, will enable us to make observations of the temperature and composition of the escaping gases, as well as of the draught at different points in the stack, and thus to study experimentally the laws of chimney draught.

A new pair of Crosby steam engine indicators, with their latest improvements.

Apparatus for the measurement of the flow of steam in large pipes.

A large locomotive Hancock inspirator, presented by the Hancock Inspirator Company.

A large locomotive Hogue injector, presented by the Hogue Injector Company.

A pair of exact indicator rigs designed in such a way as to be suitable for use with any locomotive. These rigs were used in a set of locomotive tests for the thesis work of two fourth-year students in Mechanical Engineering.

There has been loaned to the department for the remainder of the school year the Marsh compound pump, with a capacity

of 800 gallons per minute, used for the electric fountain at the recent fair of the Massachusetts Charitable Mechanics' Association.

Three brass water-meters have been loaned to the department by the Metropolitan Company.

A very handsome sectioned model of the Buckeye engine valve-gear has been presented to the department by the Buckeye Engine Company. Besides the above should be mentioned the acquisition, through the kindness of City-Engineer Jackson, Mr. Desmond Fitzgerald, of the Corporation, and Mr. E. D. Leavitt, of a complete set of blue-prints of the detail drawings of the new triple expansion Leavitt engine at the Chestnut Hill pumping-station.

The classes have now increased so much that we are in great need of more large apparatus in the laboratory. It would be very advantageous if we could have, as one such piece of apparatus, a twenty horse-power gas-engine for experimental purposes. During the last school year we were fortunate enough to secure the privilege of having the fourth-year students in Mechanical and Electrical Engineering and Naval Architecture, ninety in all, make, as a portion of their regular laboratory work, a test of the new pumping plant at Chestnut Hill, including the boiler and the triple-expansion engine recently built by Mr. Leavitt to pump water from Chestnut Hill Reservoir to Fisher Hill Reservoir, and thus supply the high service of the city of Boston. The work included tests of the boilers and the engine, and also determinations, by means of weir measurements at Fisher Hill, of the amount of water pumped. It was very carefully conducted under the direction of Prof. E. F. Miller. As a consequence of the skill with which the whole test was executed, we have been offered the use of several pumping plants for a similar purpose.

The following apparatus has been added to the laboratory of Applied Mechanics, viz: —

A small torsion testing-machine, for wires up to one-half inch diameter, enabling us to determine the shearing

modulus of elasticity, and the torsional strength of such wire as is used in the springs of steam-engine indicators, and for other purposes.

A pair of cast-iron skewbacks, weighing about 2,500 pounds each, to be used in testing the strength of brick arches of practical size; and eventually, to form part of a machine, of about 400,000 pounds capacity, for testing arches.

A new and very delicate weighing device has been added to the cement-machine referred to in the last report.

Some additional apparatus has been constructed for measuring stretch on large specimens.

The following series of tests have been or are being carried on by means of the 300,000 pounds Emery machine: —

A series of tests of the strength of spruce columns.

A series of tests to determine the crushing strength, at right angles to the grain, of yellow pine, oak, spruce, maple, and hemlock.

A series of tests of the strength of yellow pine and spruce columns resting against a wooden bolster at one end.

A series of tests on a set of bolted joints in tension, planned, made, and presented by the Boston Bridge Works, to cover a number of practical cases.

A series of tests, now in progress, on sets of bolted joints in steel plate, so planned as to form a part of a systematic investigation of what is the ultimate compressive bearing pressure in a riveted joint. This set is planned by ourselves and is very nicely made and fitted.

Tests were made with the 100,000 pounds transverse machine as follows: —

A series of tests of the strength of timber-headers of a variety of lengths.

Tests of two timber-trusses built of 8-inch by 10-inch timbers.

This last has led to a series of tests, now in progress, on the strength of triangular wooden trusses made of 6-inch by 8-inch timber, with a variety of joints, and with the rafters inclined at a variety of angles.

A revised edition of the Notes on Friction by Professor Lanza was prepared last summer, and has been printed. A description of the new cement machine, including the latest improvement, has been published in the "Bricklayer" by Professor Miller.

An important addition to the publications of the Institute has been undertaken during the year, in presenting, in the Technology Quarterly, the results of tests made in the Engineering Laboratories. This publication was begun largely in consequence of the recommendation made March 14th, 1894, by the visiting committee of the Corporation, under the chairmanship of Mr. Mills, as follows: "Many of the results are capable of being presented to the profession in such a way as to be a great credit to the Institute. It is certainly true of this department, and is probably true of many other departments of the Institute, that a considerable knowledge is attained yearly which the engineering profession is in need of; and it would be valuable to the Institute and to the profession if experimental class work and thesis work were arranged in order to attain such additional knowledge, and provision were made for the prompt publication of such results as are especially valuable as contributions to the knowledge of the profession, by the Massachusetts Institute of Technology." The first instalment appeared in Vol. VII., No. 2, of the Quarterly, covering forty-one closely printed pages. Of these tables, the visiting committee say, in their report of May 24, 1895: "The results given are an addition to professional knowledge on steel, wrought iron and cast iron tension, also tension of iron and copper wire, and a beginning on phosphor bronze and aluminum; also, on compression of cast and wrought iron, and resistance to torsion of wrought iron and steel, and on the strength of manilla and cotton ropes; and a very valuable addition on the strength of large wooden beams." The second part appeared in Vol. VIII., No. 1, covering twenty-eight pages. The third part of these results will appear in Vol. VIII. No. 3; and it is expected that such tables will form a regular feature of the Quarterly, hereafter.

Course III., Mining Engineering and Metallurgy. — As already stated, Mr. Lodge has been promoted to be Assistant Professor of Mining Engineering and Metallurgy, in recognition of his untiring devotion to the advancement of the students, as well as of the assistance he has rendered towards carrying on the mining and metallurgical laboratories with the greatest economy consistent with highest efficiency.

The number of students in the course is about the same this year as last, but the number of candidates for the degree is larger. During the last two years it has been somewhat difficult to place our graduates, on account of the hard times; but now that the tide has turned, there are not enough to meet the calls made upon us. Professor Richards states that he has had eight applications since September in excess of the number of men available.

During the summer Professor Richards made an extended trip, visiting all the principal mining regions in the United States, where concentration works are carried on. The tour was undertaken with the purpose of obtaining the latest data upon American methods of concentration. To secure the best results, Professor Richards was accompanied by a skilled assistant. A large amount of valuable material has been obtained and is now being worked up. In addition to this, several lines of research, to develop experimentally the fundamental principles of ore-dressing, are being carried on in the laboratories. Two assistants have been especially engaged for that purpose. All this work is to be embodied in a book upon American ore-dressing. The present body of students and the laboratories, in their equipment and methods, are deriving much advantage from this direction of Professor Richards' studies and efforts during the past year upon the problems of ore-dressing. Some of the most marked advances which have occurred in recent years have been made under this impulse. The latest inventions for reworking tailings, for the further extraction of the precious metals, have been brought into use; the cupelling and copper-refining furnace is being reconstructed upon better lines than ever before; and

all the new ideas and principles of ore-dressing are being embodied in the course of instruction, as fast as they can be put into shape.

Professor Hofman, besides his regular lecture courses, continues his work upon the subject-catalogue in the library, and upon the fourth year memoirs on professional objects, towards which the former directly contributes. The students of this department enjoy a great advantage from reading professional works in German with Professor Hofman. Under his charge some of the students have been working out methods for determining the fusibility of refractory and non-refractory clays. In the experiments the leading refractory clays of the country and a large number of brick and tile clays have been subjected to fire tests. Professor Hofman read a paper upon the mining and metallurgical laboratories of the Institute before the Society for the Promotion of Engineering Education, at the meeting held last August.

The department library is steadily growing by the purchase of standard books as they appear, and by continuing the files of the current periodicals. A new case is just now being put in to keep up with this growth. The valuable and beautiful Swedish collections, illustrating the processes of manufacturing iron at the four great establishments, Horndal, Österby, Söderfors, and Ankarsrum, are now complete. Mr. Henry M. Howe, of the class of 1871, who delivers each year a course of lectures on the metallurgy of copper, has, during the year, received the medal of the Franklin Institute of Philadelphia, usually given only for mechanical engineering; and the Bessemer gold medal from England, the latter being the highest distinction known to metallurgists. Since I wrote the foregoing, Mr. Howe has received from Germany the gold medal of the *Verein zur Beförderung des Gewerbefleisses*, the chief metallurgical honor of that country. All these tributes have come to Mr. Howe in consequence of his work upon Steel, which is now the standard authority in all lands.

Course IV., Architecture. — The Architectural Department continues its steady gain from year to year. Nothing could

show better that its courses of study are well in accord with the times than the great success last winter of its students in the two competitions inaugurated by the Beaux Arts Society of Architecture in New York, the first of which was mentioned in my last Report. In a fair contest with all the leading schools and draughtsmen's clubs in the country, Institute men bore off both the gold medals, as well as a first or second mention for each other of our entries. The library has been largely increased this past year. We have come into possession of the books of the Rotch bequest; and Mrs. Draper has continued her donations, now embracing several hundred volumes, many of them rare and costly. We have also to thank Professor van Daell for his gift of "Antiquités de la France," and Messrs. Bates and Guild and Mr. Ross Turner for various photographs.

At the present time, so great has been the growth of the department, we are handicapped for space, both in the library and in the fourth-year drawing-room. It is of the utmost importance that this want be met before another year. The graduating class in the study of their theses need twice the space for drawing-boards, reference-books, etc., allotted to the other classes. The next year's class will be still larger. Added to this, we have to care for the graduate students, with their still more important theses, requiring every facility of working space, and the readiest access to the library. The library has been growing much faster than seemed possible when the present room was first devoted to it. It has been so liberally aided by donations that now it stands unsurpassed as a working library in all except space for the best use of the books. The fourth-year class, with the graduate students and the library, should each have an entire floor; at present they have a floor together. If the needed space cannot be found elsewhere, I see no other way, within our present walls, than to sacrifice the museum and exhibition-room in the basement, and make of it the recitation-room for that department. But this would be a step so much to be regretted that we may well look around in every direction before considering the details of this scheme.

Courses V. and X., Chemistry and Chemical Engineering. — The number of students in the analytical laboratory this year is 112, distributed among the courses as follows: Fourth year, Mining Engineering, 10; Chemistry, 2; third year, Mining Engineering, 9; Chemistry, 30; Biology, 4; Physics, 1; Sanitary Engineering, 3; second year, Civil Engineering, 1; Mechanical Engineering, 1; Chemistry, 33; Biology, 6; Physics, 4; Chemical Engineering, 8.

One corner of the analytical laboratory has been partitioned off to serve as an office and private laboratory for Professor Talbot. This has been done with a sacrifice of but three working places for students, and makes possible a closer contact of instructor and students, which has long been desired. The room formerly occupied by Professor Talbot as a private laboratory is now needed for the instructors' use.

With the apparently increasing number of students electing the Course in Chemistry, the accommodations in the analytical laboratory must soon prove to be very inadequate. After the students have chosen their courses in January, the number of required places will be known. It is a requisite to proper chemical manipulation that each student shall have a reasonable desk space, and sufficient closet-room for the suitable storage of his apparatus. This it will be impossible to give, if the desks, originally designed for a single student, have to be divided and assigned to two students. This it has been already found necessary to do in some instances; but it has so far been possible to assign to each student of Course V. an entire desk for his own use. Room 39 is now utilized for the laboratory course of molecular weight determinations, formerly crowded into the small laboratory, Room 46 A. The course is in charge of Dr. Fay; and the larger space, which can be utilized for apparatus, contributes materially to the efficiency of the instruction. The smaller room, 39 A, formerly Dr. Drown's office, is now used as a much needed recitation-room for small classes, though without fittings for this purpose. Under the direction of Mr. Rolfe, a laboratory has been fitted up in a portion of Room 32, for the optical and

chemical analysis of sugars, starches, etc. Mr. Rolfe's training and practical experience on sugar plantations at Solidad and Parque Alto in Cuba, and with the Charles Pope Glucose Company, has fitted him to conduct this course with unusual breadth of view, emphasizing both the theoretical and practical sides in such a way as to make it of peculiar value to our students. The course should compare very favorably with similar courses given in any other institution. One of our graduate students is at present conducting thesis work under Mr. Rolfe's direction. The equipment of the Kidder Lecture Hall with electric lights has added much to its usefulness, both for evening lectures and when the lectures are illustrated with the lantern.

The work in Sanitary Chemistry, which was at first a special branch of analytical chemistry, has expanded during the last few years in a remarkable degree, and now brings into its scope some of the latest methods of biological science, while it is intimately associated with engineering. In connection with the analyses of potable waters for the State Board of Health, the students of the Courses in Chemistry, Biology, and Sanitary Engineering, have an opportunity to become familiar with this new branch of inquiry in its practical operation on a very large scale. Notes on this subject, with directions for the proper interpretation of results, were printed last winter, and notes on kindred topics are now in type. This subject gives an unusually interesting example of the value, for educational purposes, of a completely developed technical method of investigation. The interest in this course is shown by ever-increasing demands for increased time in the curriculum, and for enlarged space in the laboratories. The latter demand can scarcely be met with our present accommodation. Of special importance, moreover, to the value of this study is the testimony of students who desire to take research-work in it, and of graduate students from this and from other institutions who come to our laboratories to make investigations. Several papers on sanitary work have been published, or are in preparation. One investigation of importance upon

the theory of the nutrition of the ground (soil fitted for vegetation) was begun by the first class in Sanitary Engineering in 1890, and was completed last summer by Mr. Rolfe. Investigations of this class can be carried on by the small or great contributions of a number of workers under proper direction; and the course has prospered under the indefatigable supervision of Mrs. Richards. One of the assistants, Mr. Meserve, a graduate of last year, divides his time between sanitary chemistry and gas analysis and oil testing.

The policy of the Institute, in view of its function as a technical school, has been to give training of a higher character than mere routine practice of technical analysis affords; and whenever a subject is capable of a complete theoretical and practical treatment, it has been put in charge of an assistant professor, or an instructor, who has usually qualified himself for this branch of teaching by special studies in the laboratories of Europe. Dr. Gill has successfully directed the study of Gas Analysis (five lectures and fifteen hours laboratory work) given to the chemists and chemical engineers. This course treats of the analysis of chimney gases. The lectures consider also the question of fuels, and the means for the prevention of smoke, as stokers, smokeless furnaces, and gas-firing. The department has been the recipient, during the past year, of a valuable set of high-temperature thermometers, for determining the temperature of flue-gases and feed-water, from the Hohmann and Maurer Company of Brooklyn, N. Y. During the past year Dr. Gill has also offered a course in the Analysis and Testing of Oils, given in the fourth year to the chemists and chemical engineers. It embraces twenty-five hours' work in the laboratory, and a series of five lectures, and includes the determination of specific gravity, viscosity, and friction; also of flashing and firing points, and the liability to spontaneous combustion. Thus attention is paid to the examination of oils, both from the point of view of the engineer and from that of the insurance inspector. Methods for the complete analysis of oils are also given. Another branch of analytical

chemistry has been essentially modified since the appointment of Mr. Rolfe. The instruction in sugar analysis, given by Mr. Rolfe, comprises four lectures and laboratory exercises. The student is made familiar with the use of different kinds of polariscopes, and their construction; and is taught how to standardize sugar scales in rotary degrees, by the use of quartz plates. Determinations are made of sugars and syrups according to the best methods in use commercially, and the general problem of determining the specific rotary power of any substance is taken up. A class of ten students takes this course.

In the sugar laboratory radical changes have been made. Instead of converting the whole place into a dark-room, the object has been obtained by enclosing each instrument in a wooden-hood. This arrangement is conformable to the usual practice, and gives obvious advantages as to cleanliness, convenience of working, and inspection of work. Facilities for lighting scales of instruments have been arranged which obviate the dirt and danger of constantly lighting matches. Advantage has also been taken of the alterations made in the analytical laboratory to have an old laboratory bench transferred and set up in the sugar laboratory; this has proved a great convenience. The expenditure of a small amount in the repair of old instruments, and the purchase of other instruments, has resulted in fairly equipping the laboratory for work. It is now possible for three students at a time to work comfortably and rapidly.

In Textile Coloring, Mr. J. W. Smith has given the usual course of fifteen lectures and seventy-five hours' laboratory work to fourteen students taking this fourth-year option. This system of instruction illustrates all the chemical principles involved in dyeing, and their practical application under the direction of Mr. Smith has given this branch of industrial chemistry a high reputation. Forty students have taken the third-year option of laboratory instruction in industrial chemistry. The work is carried on, as in the metallurgical department, on a sufficiently large scale to give a fair idea of

factory work. The object of the instruction in this laboratory is to train the pupils in methods of carrying out technical processes where the results must be obtained at the least expense. The economy must be not only one of materials, but should also include saving in labor, time, fuel, and plant or apparatus necessary. To attain this result the student is required to examine his materials, testing all acids, etc., calculate the amount of each ingredient required, the best quantity of water for solution, and the size of apparatus best suited for the work. The quantity of material handled in each experiment may vary from one to fifty pounds. Students taking this option also make a few experiments on dyeing cotton, wool, and silk, and bleaching cotton. Mr. Smith remarks that at some future time the addition of a filter-press, built on the model of large filter-presses in use, will be of great service.

Organic Chemistry. — The importance of the training to be derived from the study of this most rapidly progressing branch of chemistry has become more fully recognized. The chief work of the chemical students in the fourth year is now in the organic laboratory; and some problem in this field usually forms the subject of the students' theses. Every effort has been made to find such topics as may fit the skill of the individual students, and encourage their efforts by the production of positive results worthy of a place among the records of science. The task is by no means easy, by reason of the short time allotted to research in the crowded curriculum of the school. Original investigations can be taken up with greater hope of success by graduate students, who, following the usual custom of European laboratories, give their whole time to a single subject. Dr. Noyes has this year been ably seconded in the direction of the laboratories by Dr. Norris and Dr. Mulliken. Dr. Noyes adds the following remarks: —

"The course of organic laboratory instruction has, it is believed, been materially improved during the past year by the introduction of a new special course of experiment on the detection and separation of the various classes of organic

substances. Cyclostyled notes — to be printed during the present year — have been prepared to accompany the course. In general a distinct gradual improvement, in both the quality and the quantity of work accomplished, is noticeable from year to year, as the courses of instruction become more systematized. The results of thesis work were also rather more satisfactory during the past year. During the second term sixteen students made investigations in the organic laboratory, and presented theses, of which number, thirteen were accepted by the Faculty as satisfactory. Abstracts of five of these theses have been already published, as well as of two investigations in theoretical chemistry made by graduate students. It seems imperative to call attention to the fact that the limit of accommodation as to the number of students has been reached in the organic laboratory. The laboratory has places for twenty students, and of these at this time nineteen are occupied. The present third-year class of the Course in Chemistry, however, consists of thirty-one students ; and it is to be expected that about that number will apply for admission to the organic laboratory at the beginning of next year, for the accessions from other institutions have usually fully compensated the few withdrawals during the third year. Moreover, the present second-year class consists of thirty-three members; so it is not merely a question of provision for one year."

The usual number of additions have been made to the Chemical Library during the past year. The efficiency of this valuable adjunct has been materially increased by the appointment of an assistant librarian who is constantly in attendance. This was rendered necessary partly by the rapid growth of the library, and partly by the withdrawal of Mr. Andrews, who, in addition to his work in the general library of the Institute, had for many years continued his special supervision of the chemical library, which dated back to the period before he became Institute Librarian. It did not seem desirable to ask Dr. Bigelow, who has succeeded Mr. Andrews in the librarianship, to assume any special relation to the chemical

library, which, in his case, would have lacked the traditional character which belonged to Mr. Andrews' connection with that library, and which, in the rapidly extending work of the Librarian's office, it would be increasingly difficult to maintain. Among the gifts to the chemical library the past year, the most notable is that already mentioned in speaking of Mr. Gaffield's gifts to the Institute.

INDUSTRIAL CHEMISTRY. — In Industrial Chemistry, the usual course of lectures has been given by Dr. Thorp to fifty-six students, the largest class for some years. As heretofore, certain subjects have been presented by chemists outside of the Institute, each speaking of his special work with the minute acquaintance given by industrial experience. The following is the list of special lecturers in this department: Mr. Frank G. Stantial, on Sulphuric Acid; Mr. Charles D. Jenkins, on Illuminating Gas, and on Pottery and Tiles; Mr. Louis J. Schiller, on Sugar and Sugar Refining; Mr. Arthur D. Little, on Paper; Mr. Webster Norris, on Rubber. It is also intended to arrange for the customary visits of the class to chemical works and manufacturing establishments. The collection of samples, illustrating the subjects treated in this course, has been enriched by Mr. Gaffield's gift of specimens of glass, glass-workers' tools, and models of glass-furnaces, already spoken of. A suitable room, with cases for the proper display of our large collection of samples, would add much to the efficiency of the work.

No changes worthy of special note have occurred in the Course in Chemical Engineering during the past year. The loss of Professor Drown is felt with especial severity here, as he had taken a particular interest in the development of this branch of instruction, so far as the chemical side was concerned. The work on the engineering side is undergoing gradual progressive development.

In the "Technology Quarterly" for April, 1895, the following announcement was made, under the title, "Review of American Chemical Research," by Professor Noyes, as editor:

"The purpose of this publication, which is hereafter to

appear serially in this journal, is to present in a concise form a review as complete as possible of all original work having a chemical bearing published in the United States after the beginning of the year 1895. It is believed that such a compilation will prove of more than usual value in the case of the research work of this country by reason of the fact that so large a proportion of it is published in other than chemical journals, and thus fails to become incorporated with the rest of the science, and also because the abstracts of American chemical literature published in foreign journals are very incomplete.

"The execution of the plan has been made possible by the cordial co-operation of members of the instructing staff of the Institute of Technology. The following is a list of the present abstracters: C. W. Andrews, Chemistry of Sugar; W. O. Crosby, Geological and Mineralogical Chemistry; A. H. Gill, Gas Analysis, Fuels, Oils, and Apparatus; H. M. Goodwin, Physical Chemistry; H. O. Hofman, Metallurgical Chemistry and Assaying; A. A. Noyes, General and Organic Chemistry; E. H. Richards, Sanitary and Agricultural Chemistry; J. W. Smith, Dyeing and Bleaching; H. P. Talbot, Inorganic and Analytical Chemistry; F. H. Thorp, Technical Chemistry."

The work here outlined has been successfully conducted since that time, during three issues of the Quarterly, and is expected to prove of much interest and value.

The following list includes the principal publications by members of the Chemical Department during the past year:

Theoretical Chemistry.

A. A. Noyes and C. G. Abbot: Prüfung der Prinzipe der Löslichkeitsbeeinflussung.

A. A. Noyes and W. T. Hall: Die Geschwindigkeit der Hydrolyse des Salicins durch Säuren.

A. A. Noyes: Geschwindigkeit der Reaktion zwischen Zinnchlorür und Eisenchlorid. Eine Reaktion dritter Ordnung.

A. A. Noyes and W. R. Whitney: Kryoscopische Untersuchungen mit Aluminaten und Boraten von Alkalimetallen.

A. A. Noyes and W. O. Scott: Beitrag zur Kenntniss der Geschwindigkeit von polymolekularen Reaktionen.

Organic Chemistry.

George Defren: Ueber die Darstellung des p-Aethyltoluols.

A. A. Noyes and R. M. Ellis: Synthesis of Diphenylbiphenyl and its Identification as Benzerythrene.

A. A. Noyes and J. T. Dorrance: The Electrolytic Reduction of Para Nitro Compounds in Sulphuric Acid Solution.

A. A. Noyes and W. H. Watkins: Occurrence of Trimethylene Glycol as a By-Product in the Glycerine Manufacture.

Sanitary Chemistry.

T. M. Drown: The Mineral Contents of Deep Wells in the Vicinity of Boston. Report to the State Board of Health as Chemist.

Ellen H. Richards: Notes upon Water Analysis, prepared for the students of the M. I. T. Notes upon Sanitary Chemistry, prepared for the students of M. I. T.

Ellen H. Richards and J. W. Ellms: The Coloring Matter of Natural Waters.

A. H. Gill: A Modification of Hinman's Gas Explosion Pipette; Notes upon the Determination of Nitrites in Potable Water; A Short Handbook of Oil Analysis, prepared for students of the M. I. T. An Improved Pipette for the Absorption of Illuminants from Gaseous Mixtures.

A. H. Gill and S. P. Hunt: The Determination of Methane and Hydrogen by Explosion.

George W. Rolfe: Report of Chemical Work on Waring's Process of Purifying Sewage.

Courses VI. and VIII, Electrical Engineering and Physics. — The work in Physics and Electrical Engineering has been performed during the past year under difficulties arising from various causes beyond the control of any one. The necessity for the exercise of unusual economy, an instructing force

inadequate for the largely increased number of students, and rooms not altogether suitable for the work laid out, — these necessarily prevented any striking development of the department. But though at the time there was much that seemed discouraging, and though, measured by our ideals, we did less than we could wish, yet, on looking back over the year, it is evident that solid progress has been made, in spite of all drawbacks and deficiencies. One new laboratory has been opened, the Physico-Chemical Laboratory, an account of which was given in the President's Report for 1894. The instruction given therein has been very successful; and during the coming term this laboratory will be opened to students in the Course in Chemistry, as well as to those in Physics. The courses already established have been improved; and several new short special courses have been added. Through the liberal appropriation for apparatus and supplies which was provided to the department by the Executive Committee, we were able to make very material improvement in the apparatus of the laboratories of general physics, electrical measurements, and electrical engineering, so that we begin the present year with much better facilities than ever before.

The increased requirements in mathematics for admission to the Institute, as was intended, have affected, not only the more advanced mathematical work, but likewise all professional work depending upon mathematics. This allows us to begin the instruction in theoretical electricity a term earlier than heretofore, a change which in its turn has involved certain corresponding changes in the lectures in physics given to all students in the second year. The lectures on electricity in that course have to come much earlier than formerly, so that the lectures on optics come later, the order of the two subjects being reversed. Professor Cross felt some doubt as to the success of this plan; but in practice he finds that it has worked satisfactorily. The additional mathematical knowledge possessed by the class at the beginning of the second year also allows a distinct advance to be made in the

grade of the course in second-year physics, a matter of some importance on account of the fundamental position of these lectures in our scheme of instruction.

Several changes have been made among the "lecturers for the current year." As in previous years, the Course on Railway Signalling was given by Mr. George W. Blodgett, '73, Electrician of the Boston and Albany Railroad., and that on Telephone Engineering by Mr. H. V. Hayes, '85, Electrical Engineer of the American Bell Telephone Company. But, on account of removal from the city, Mr. J. P. B. Fiske, '89, was unable to continue to deliver the course on Electromotors, and Mr. W. C. Fish, '87, Superintendent of the General Electric Company's works at Lynn, assumed that duty. The lectures on the Design of Dynamo-Electric Machinery were given by Mr. H. M. Hobart, '89, of the General Electric Company, Mr. Parshall, who was to have taken charge of them, being abroad on business. As this is likely to be the case during the present year, Mr. Hobart will continue to deliver these lectures. Three new courses, by gentlemen actively engaged in professional life, have been added, — one, by Mr. Hollis French, '89, upon Electrical Engineering Practice and Specifications, which is intended to teach the student the proper manner of dealing with the practical problems that arise in laying out and completing large work in electrical engineering; a second, by Mr. Howard C. Forbes, '91, upon Commercial Electrical Testing, designed to teach the manner of conducting such work economically and accurately; and a third, by Mr. Odin B. Roberts, '88, on the Nature and Function of Patents for Inventions, designed to teach those fundamental principles of patent law and practice which should be understood by any one having to deal with the study of novel inventions and their applications. Besides these longer courses, one or more lectures were delivered by each of the following gentlemen: Mr. C. A. George, of the Boston Municipal Fire Alarm Telegraph Service, on Municipal Fire Alarm Systems; Mr. C. J. H. Woodbury, of the American Bell Telephone Company, on Electricity

in its Relation to Fire Risks; Mr. W. S. Moody, of the General Electric Company, on Alternating Current Apparatus; Mr. E. E. Cary, of the Beacon Incandescent Lamp Company, on the Manufacture of Incandescent Lamps; and Professor Elihu Thomson, on Recent Developments in Applied Electricity.

I must again allude to the lack of room, a matter to which attention was called in the President's Report for 1894. The difficulty was serious last year, with forty students in the fourth-year class. During the present year, with over sixty such students, it is much more difficult to carry on the thesis work, and keep the instruction on the existing scale, and up to the present standard. Nor is this difficulty confined to the laboratories. There is at times an extreme pressure upon the lecture and recitation rooms.

Reference was made in the last President's Report to the need of an additional plant of dynamo-machinery in the laboratory. That need still exists, and is greater than ever. From its current appropriation for apparatus the department has been able to add considerably to its facilities in this direction; but the desirability of larger and more extensive apparatus than has thus been supplied cannot be overstated. This Institute was the pioneer in this branch of engineering education, as in so many others; but if it is to maintain its present place, it is imperative that some further facilities in this direction shall be placed at our disposal.

Course VII. Biology. — There remains but one drawback to the steadily-increasing usefulness of this department, and that is a painful lack of room. One hundred and three regular or special students of the Institute, besides thirty-four senior students of the Boston Normal Schools of Gymnastics and Cookery, making a total of one hundred and thirty-seven, are under instruction in the single room to which the work of the department is restricted. Of these the number doing laboratory work is one hundred and twenty-five. The several classes of the present term are attended as follows: General Biology, 38 students; Comparative Anatomy, 10; Anthropology, 16; Physiology and Hygiene, 19; History of the

Inductive Sciences, 12; Physiology of the Senses, 3; Microscopic Anatomy, 6; Physiological Laboratory, 8; Comparative Physiology, 8; Theoretical Biology, 13; Bacteriology and Micro-organisms of Fermentations, 28. The growth of interest in the last-mentioned subject, and its practical importance, have made necessary large additions to equipment and stock, and the same thing is true all along the line. Within the last three years the change in this direction has been very great, so that if to-day an adequate building were available for the uses of this department, it could almost immediately be furnished with a good working equipment at small additional cost.

The class in bacteriology and the micro-organisms of fermentations includes this year eight senior chemists and four seniors in Sanitary Engineering. The increasing practical importance of a familiarity with these subjects to both professions is likely to make this class still larger in the near future. Nowhere, perhaps, is the need of proper laboratory accommodations more keenly felt than in these subjects, which, for securing the best results, ought to have quiet, dust-free rooms, but must now be pursued in the same room which is used, at other hours, for classes in physiology, general biology, zoölogy, and botany.

The course in anthropology has long formed a stepping-stone, for students in the Courses in Biology and in General Studies, from zoölogy to sociology and political economy. It is now given jointly by Professor Sedgwick, of the Department of Biology, and Assistant Professor Ripley, of the Department of General Studies, most of the burden of instruction falling upon the latter.

The course in general biology, required of all beginners as well as of those who intend to go far in the subject, and attended by numerous teachers, is given, as heretofore, by Professor Sedgwick. The courses in physiology for senior students are in charge of Assistant Professor Hough; and have become so valuable that many professional teachers, as well as the regular students of Course VII., have sought admission

to the classes. For example, the briefer course in physiology and hygiene, originally intended for the senior students of the General Course, is attended this year by ten teachers in active service in the public schools of Boston and vicinity. Dr. Bigelow's place on the instructing staff of this department has been taken by Mr. Henry E. Crampton, Jr., of Columbia College.

A prominent feature of this department has become its contribution to the educational forces of the State in the training of teachers. Not only have many of the regular or special students of the department adopted teaching as a profession, but within the last three years a large number of teachers actually engaged in their profession have embraced the opportunities offered by the Institute. The number of professional teachers in attendance last year, in this department alone, was twenty-five, and already in the first half of the present year it has risen to thirty-three.

During the year Professor Sedgwick has published an enlarged and revised edition of his text-book on "General Biology" (with Prof. E. B. Wilson of Columbia College); a paper "On the Bacterial Contents of Certain Ground Waters, especially Deep Wells" (with S. C. Prescott, S. B.); a paper "On the Influence of Variations in the Composition of Culture Media upon the Development of Water Bacteria" (with S. C. Prescott, S. B.); a paper "On the Epidemic of Typhoid Fever in Marlborough, Mass., apparently Due to Infected Skimmed-Milk," — so far as is known the first case of the kind reported in America; and an address upon "The American College as a Moral Force," delivered before the American Institute of Instruction in 1894. Assistant Professor Hough has also published an important physiological paper upon "The Escape of the Heart from Vagus Inhibition." Professor Sedgwick continues to act as Biologist to the State Board of Health, and has lately served as a member of the Jury of Awards at the Atlanta Exposition, having been assigned to the Committee on "Liberal Arts," and the sub-committees on 'Hygiene and Sanitation" and "Technical Education."

For several years the Institute has enjoyed the use of an investigator's private laboratory in the Marine Biological Laboratory at Wood's Holl, the gift of Mrs. William B. Rogers. During the season of 1895 this table was occupied, with great advantage, by Dr. Bigelow, Instructor in Biology, and Mr. Clarence W. Perley, a fourth-year student.

Course IX., General Studies. — The work of the General Course has been carried on the past year with unabated interest on the part of both teachers and scholars. The new course in anthropology already mentioned has developed to a degree which makes it one of the most satisfactory of all the studies in this department. Professor Ripley is showing high quality in his work, both as an investigator and as a teacher.

Mr. George A. Gardner, of the Corporation, has made two valuable gifts to this department during the year, which largely increase its collection of anthropological material. The first of these comprise thirty racial masks, made and colored from life by Dr. Finsch, of Bremen, during voyages in the Pacific and in Asia. The second gift, which has not yet arrived from France, consists of a series of reproductions from the famous collection of busts of primitive races now in the Museum of Natural History at Paris. This latter collection is composed of representatives of the several African races, thus supplementing the Finsch masks, which are taken from the Asiatic and Polynesian types almost exclusively. These busts were all made from life by experts during the explorations on the "Astrolabe," "Zelée," and "Favorite." They are especially valuable as they show the head form, while the Finsch masks only indicate the features and the color of the skin. It is the intention of the department to establish a small anthropological laboratory for the prosecution of studies especially directed upon the elucidation of sociological problems. Two students will make their graduation theses this year in researches upon the students at the Institute. The work will be carried on by the co-operation of the Departments of Biology and of General Studies.

The English department recognizes the fact that its first

practical duty is to train the student to write sound and effective English, so that composition may become one of the useful instruments in his technical life. The work of some of the students in technical memoirs prepared in other departments has for several years been corrected by the teachers of English. The success of this has been so marked that it is earnestly desired to extend the plan. A beginning of work in another direction has been made by combining with the composition drill of first-year students, the criticism and correction of translations which the department of Modern Languages caused to be made for that purpose. It is strongly felt by the department, however, that of equal importance with this direct practical training in composition is the awakening of the minds of the students to the value and the meaning of literature. The interest which has been shown by the second-year students in the course in English literature, which is required of the whole class, has been particularly gratifying. The time allotted to this is insufficient, especially in the first term; and less can be done than should be done. In general, the attitude of the students toward broadening and liberalizing branches seems to be gratifyingly intelligent and cordial, — a fact which is of especial importance under circumstances so inevitably tending to concentrate attention upon purely technical subjects.

In History, Professor Currier shows an increasing strength in dealing with the weighty burden which Professor Levermore's resignation threw upon him.

The appointment of an additional instructor has enabled the department of Modern Languages to divide the classes in French and German into smaller sections, to the very great advantage of the students. It is much to be desired that further progress should be made in the same direction, when the means of the Institute will permit.

The lectures on Business Law, given by Louis D. Brandeis, Esq., of the Suffolk Bar, have proved a notable and most useful feature in our course of instruction. For Mr. Brandeis's convenience, it has been arranged to give this course

in alternate years, to students of the third and fourth year classes. The lectures have been attended by large numbers of students beside those on whom the course was obligatory, and the greatest interest has been manifested by all in the instruction given. Mr. Brandeis has, it seems to me, to a remarkable extent overcome the difficulties attending a course in such a subject given in a scientific school, where the time at command is closely limited. He has made use to the utmost of the special aptitude which students of technology and science possess for dealing with concrete cases, and has built up a course of instruction which is unique.

Course XII., Geology. — During the year 1894–1895, the aggregate number of names upon the lists of the classes taught in the Department of Geology was three hundred and ninety-nine. All of the specialized and advanced courses enumerated in the Catalogue have been given.

The amount of work being performed in the geological laboratory at the present time is much greater than it has ever been before. There are at the present time four students in the fourth year of the Course in Geology taking advanced work. The mild and favorable weather of the autumn has enabled the instructors to carry on the work in the field to a more satisfactory extent than it has been done in some other years. Professor Crosby conducted a party of twelve students through the noted mineral localities of northern New York and Canada, during three weeks of last summer. Besides valuable additions to the mineral collections of the Institute, and the practical experience of the students, many interesting geological studies were made of localities which afforded excellent opportunities. Mr. A. W. Grabau, of the fourth year in the Department of Geology, spent eight weeks last summer in a careful and detailed study of one of the most interesting fossiliferous regions in the State of New York, viz., Eighteen Mile Creek; and he has brought to the Institute important additions to its collections. During the year a number of donations of specimens have been received, the most important being the one by Mr. Thomas Gaffield,

of exceedingly choice and rare minerals and crystals as already mentioned. The work of so arranging the collection for instruction in palæontology that each student in the class may be supplied with a tray of representative specimens giving an epitome of the structure and classification, has been carried on successfully. At the present time there are ninety-eight trays which have been in part prepared for this work; but there are still vacancies to be filled as opportunity is presented for obtaining suitable specimens. The usefulness of the distinctly geological work of the department is limited by the cramped condition in which the collections and library are at the present time. The room in which the instruction in blowpipe analysis is given is far from satisfactory, being too small for the classes, and not easily ventilated.

Course XIII., Naval Architecture. — The first class, numbering five, was graduated from this department last June. It may be interesting to give the titles of the theses presented for graduation. They were:—

The Stability of the Oil-steamship "Maverick;" involving an inclining experiment to determine the location of the centre of gravity, and calculation of stability during the process of loading or unloading.

The Design of an Ocean Tow-boat; consisting of the collection, arrangement, and use in design of information concerning the use and construction of tow-boats.

Tests on the Steamship "Brookline;" a trip to Jamaica and return, during which a continuous three days' test was made at sea on the engine and boilers of the steamship, with determinations of steam and coal consumption.

The development of the course during the past year has been mainly internal, extending and improving the material and methods of teaching. Systematic instruction will be given this year on ventilation of ships and adjustment of compasses. The need of additional space is more keenly felt as the number of students in the department increases, and as material accumulates. Material improvement in kind and amount of work may be expected when adequate space is

available. A model of the steamship "Gloucester," of which the department has a complete set of drawings, has been made with a view to giving students practice in laying out plating.

Professor Peabody, the head of the department, during the summer vacation made an extensive tour of shipyards and engine works, both governmental and private, in England and France, and inspected many of the latest and best examples of naval architecture, in process of construction and in commission. A large number of photographs of all types of naval vessels, old and new, were obtained, to be used as illustrations. In view of the fact that our students have, during the last five years, been engaged in calculating the stresses produced in the frame of the engine and in the hull of the ship by the action of the reciprocating parts of the engine, it is of interest to observe that, when visiting an important shipbuilding and engineering company on the Clyde last summer, Professor Peabody found that, in designing the engines for a large "torpedo destroyer," the officers of the company had reached the conclusion that it was highly important, and even necessary, to bring this element into their calculations. In speaking of our course in Naval Architecture, it may not be inappropriate to refer to the great triumph in yacht building achieved during the past year by Mr. Nathaniel G. Herreshoff, of the Institute class of 1870, in the design and construction of the "Defender."

Two of our number have died during the year. Hon. Alexander H. Rice joined the Corporation in 1863, and from that time onwards was an interested and active member. He served on various committees, and gave freely of his time and strength to the welfare of the school, whose objects he heartily appreciated and whose success he labored to promote. Mr. Cheney joined the Corporation in 1882. Although his extensive financial relations prevented his giving any considerable attention to the business of the Institute, he showed his sincere interest in its welfare by a generous bequest in his will. The lapse of time has not diminished, but has, the rather, increased our sense of the loss sustained in the death

of our colleague, Mr. Henry Saltonstall, of which I spoke to the Corporation a year ago. The longer we go without his cheering presence, his splendid enthusiasm, his high moral courage, and his masterly grasp of business, the more painfully we feel the want of them. Surely no school ever had a wiser, braver, stronger friend and counselor!

Commonwealth of Massachusetts.

IN THE YEAR ONE THOUSAND EIGHT HUNDRED AND NINETY-FIVE.

Resolve in favor of the Massachusetts Institute of Technology.

Resolved, That there shall be paid annually, for the term of six years, from the treasury of the Commonwealth to the treasurer of the Massachusetts Institute of Technology, the sum of twenty-five thousand dollars, to be so paid and allowed from the first day of January in the year eighteen hundred and ninety-six, to be expended under the direction of said corporation for the general purposes of said Institute.

Resolved, That in addition to the amount provided for above, there shall be paid annually, for the term of six years, from the treasury of the Commonwealth to the treasurer of the Massachusetts Institute of Technology, the sum of two thousand dollars, to be so paid and allowed from the first day of January in the year eighteen hundred and ninety-six, to be expended for ten free scholarships, under the direction of the State Board of Education; said scholarships to be awarded only to graduates of the Massachusetts public schools.

HOUSE OF REPRESENTATIVES, *April* 12, 1895.

Passed G. VON L. MEYER, *Speaker.*

IN SENATE, *April* 16, 1895.

Passed WILLIAM M. BUTLER, *President,*

APRIL 17, 1895.

Approved, F. T. GREENHALGE.

TREASURER'S REPORT.

STATEMENT OF THE TREASURER.

THE treasurer submits the annual statement of the financial affairs of the Institute for the year ending September 30th, 1895.

The year closes with an excess of expenditure over current income of nearly $16,000. The receipts from students' fees have increased about $5,700, but this is for the most part offset by the increased expenditure made necessary by the larger number of students.

The percentage of return upon investments has fallen from five per centum last year to four and three-quarters per centum this year. This is unavoidable, since the return on all thoroughly good securities is now less than it was on investments made at an earlier time.

The value at which the buildings have stood on the books has long been known to be above their real worth, and this year, in view of the greatly reduced valuation made by the Board of Underwriters, it has seemed best to make a corresponding reduction in the valuation in our books. Accordingly, a reduction of over $195,000 has been so made. This, of course, has no effect on the real value of the property, but it makes the figures correspond much more closely with the actual facts.

The Institute has during the year received a number of liberal bequests and gifts.

Under the will of Mr. Arthur Rotch $40,000 were received for the architectural department. Of this sum $25,000 are given for the general purposes of the department, and the remainder for special objects.

From the estate of Mrs. Augustus Lowell $5,000 were received, which by the vote of the executive committee, have been invested and constitute the "Katharine B. Lowell Fund."

Five thousand dollars were given by Mrs. Mary E. Atkins to found the "Elisha Atkins Scholarship."

Under the will of Mrs. Betsey F. M. Nichols the Institute received $5,000 to establish the "Nichols Scholarship" in memory of the late Professor Nichols, to whose ability and devotion the Institute owes so much. Another bequest was that of forty shares of The Molsons Bank, Montreal, valued at $3,000, from the late T. Sterry Hunt.

The executors of the will of Mrs. Catherine P. Perkins have paid $7,500 in addition to the large sums previously received, and similarly a further payment of $10,598.73 has been made under the will of William J. Walker. Five hundred dollars more have been received from the William Perry estate.

In addition to the above bequests, final payments under the subscription of 1892 were made, amounting together to $7,500. Mrs. William B. Rogers gave $200 for the purchase of periodicals; and other gifts, amounting in the aggregate to $925, were received.

Another satisfactory matter is the saving in coal which has been made this year. This amounts to about $1,500, and can be mainly traced to the improvements made in the new boiler house. This saving was predicted, and it is satisfactory to find the prediction verified.

Owing to the bequests and gifts above mentioned, the property of the Institute has increased during the past year in spite of the excess of expenditure over current income, and it has therefore been possible to pay off $70,000 of the debt, which has thus been reduced from $220,000 to $150,000.

SECURITIES SOLD OR PAID. GENERAL FUND.		
2,000 Bur. & Mo. River R. R. 6s. non-exempt	2,000.00	
27 Shares Brookline Gas Co.	2,430.00	
		4,430.00
RECEIVED SECURITIES. GENERAL FUND.		
40 Shares The Molsons Bank, Montreal, par 50	3,000.00	
PURCHASE OF SECURITIES. GENERAL FUND.		
2,000 Bur. & Mo. River R. R. 6s. exempt .	2,310.00	
3,000 Illinois Central R. R. 4s.	3,053.58	
PURCHASE OF SECURITIES, WM. B. ROGERS MEMORIAL FUND.		
Scrip. K. C. Memphis & Birmingham R. R. $80 General mortgage 4s. . . . . 160 Income 5s.	66.40	

GEORGE WIGGLESWORTH, TREASURER, *in account with*
GENERAL STATEMENT OF RECEIPTS AND DISBURSEMENTS
Dr.

Cash balance Sept. 29, 1894		24,725.56
From Augustus Lowell for Lowell Courses	6,000.00	
" " " " C. Kastner's salary	2,500.00	
" " " " School of Design	500.00	
		9,000.00
RECEIPTS FOR CURRENT EXPENSES.		
Income of funds for salaries	4,161.00	
" " " " scholarships (students' fees)	4,050.00	
" " " " " " " 1894	450.00	
" " " " Joy "	200.00	
" " " " Swett "	400.00	
" " " " Savage " $592.83; 1894, $207.17	800.00	
" " " " Library	237.50	
" " " " general purposes	9,853.82	
" " Rogers Memorial Fund	9,688.25	
	217,813.00	
Students' fees	5,541.08	
State Agricultural Fund	7,000.00	
State Endowment Fund	8,255.78	
Laboratory supplies and breakages	11,632.31	
Rents, per Table (page 86)	1,125.00	
Gifts	3,262.30	
Interest	1,200.00	
Pope Fund for Highway Engineering	1,162.07	
" " " " used 1894	125.00	
Letter-Box Fund, $61.75, used of 1894, $63.25	1,150.00	
Boston University	3,204.70	
Sale printed Lecture Notes		
Profit and Loss, expenses more than income	15,935.29	307,247.10
BEQUESTS FOR SPECIAL PURPOSES, ETC.		
Increase James H. Mirrlees Fund,	2.10	
" Elisha Thacher Loring Fund,	28.15	
" Richard Perkins Fund,	153.45	
" Charlotte B. Richardson Fund,	1,694.99	
" Charles Lewis Flint Fund,	24.56	
" Thomas Sherwin Fund,	12.50	
" Farnsworth Fund,	12.50	
" W. F. Huntington Fund,	22.39	
" Susan Upham Fund,	51.75	
" W. B. Rogers Fund (additional $85.00)	156.60	
Susan E. Dorr Fund (additional, $1,541.73)	1,646.05	
Rotch Architectural Fund	25,000.00	
Rotch Arch. Library "	5,000.00	
Arthur Rotch Prize "	5,000,00	
Arthur Rotch "Special" Prize Fund	5,000.00	
T. Sterry Hunt Fund	3,118.75	
Elisha Atkins "	5,197.92	
Nichols Fund	5,098.96	57,220.67
GIFTS AND BEQUESTS FOR GENERAL PURPOSES.		
Subscriptions of 1892 (additional)	7,500.00	
Catherine P. Perkins Legacy (additional)	7,500.00	
William J. Walker Legacy (additional)	10,598.73	
Katharine B. Lowell Fund	5,000.00	
William Perry Estate (additional)	500.00	31,098.73
SECURITIES SOLD OR PAID. GENERAL FUND, page 77		4,430.00
SUNDRIES.		
Income credited to Bond Premium Acc't	393.96	
Income credited to Rogers Bond Premium Acc't	400.00	
Boston Art Student's Asso. on acc't	666.67	1,460.63
		$435,182.69

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

FOR THE YEAR ENDING SEPTEMBER 30, 1895.

Cr.

Paid for Lowell Courses	6,000.00	
" " Charles Kastner's salary	2,500.00	
" " Expense Lowell School of Design	500.00	
		9,000.00
EXPENSES.		
Salaries, per Table (page 86)	203,641.87	
" paid from the Pope Fund	599.78	
Lecturers and Supplies paid from the Pope Fund	1,762.29	
Scholarships paid from Swett Fund	400.00	
" " " Savage "	800.00	
Repairs, per Table (page 87)	8,476.47	
General Expenses, per Table (page 87)	12.629.46	
Expenses on Boiler House	6.723.84	
Fuel	9,427.08	
Water	1,828.00	
Gas	2,159 80	
Printing and Advertising	2,590.48	
" Lecture Notes	2,620.66	
" Annual Catalogues and Reports	3,487.60	
Rents paid Boston & Albany R. R. Co.	180.00	
" " Natural History Society	300.00	
Laboratory Supplies and Libraries, per Table (page 86)	32,874.95	
Society of Arts	1,595.98	
Photographs and Casts, Rotch Fund	557.46	
Interest 4.75 per cent on funds not in stocks and bonds	5,191.38	
Interest paid A. Lowell, Trustee	1.000.00	
" " on Mortgage Notes	8,500.00	
		307,247.10
SECURITIES BOUGHT OR RECEIVED AS LEGACIES. GENERAL ACCOUNT.		
40 Shares The Molsons Bank, Montreal	3,000.00	
2,000 Burlington & Missouri R. R. 6s., exempt	2,310.00	
3,000 Illinois Central R. R. 4s.	3,053.58	
		8,363.58
PURCHASE OF SECURITIES WM. B. ROGERS MEMORIAL FUND.		
Scrip K. C. Memphis & Birmingham R. R.		66.40
SUNDRIES.		
Notes Payable	70,000.00	
Students' Deposits	50.00	
Pope Fund, 1894, used	1,162.07	
Scholarship Funds, 1894, used	657.17	
Letter-Box Fund, 1894, used	63.25	
Students' Notes	830.50	
Profit and Loss, per contra. (See page 78)	15,935.29	
		88,698.28
Cash balance, Sept. 30, 1895		21,807.33
		$435,182.69

The following account exhibits the property held by the Institute, as per Treasurer's books, Sept. 30, 1895 : —

INVESTMENT OF THE W. B. ROGERS MEMORIAL FUND.

$50,000.00	Saginaw & Western R. R. 6s.	1913	50,000.00	
30,000.00	Burlington & Mo. River R. R. 4s.	1910	25,787.50	
27,000.00	Kansas City Belt R. R. 6s.	1916	27,000.00	
16,000.00	Kansas City, Clinton & Springfield R. R. 5s.	1925	16,000.00	
7,000.00	Omaha & Southwestern R. R. 8s.	1896	7,000.00	
5,400.00	Republican Valley R. R. 6s.	1919	5,400.00	
4,000.00	Cin., Ind., St. Louis & Chicago R. R. 6s.	1920	4,000.00	
2,000.00	Ottawa, Oswego & Fox River R. R. 8s.	1900	2,000.00	
2,000.00	Kansas City, Fort Scott & Gulf R. R. 7s.	1908	2,000.00	
3,000.00	Kansas City, Memphis & Birmingham R. R.			
	1,000 General Mortgage 4s.	1934		
	2,000 Income 5s.	1934		
			2,221.40	
1,000.00	Lincoln & Northwestern R. R. 7s.	1910	1,000.00	
1,000.00	Atchinson & Nebraska R. R. 7s.	1908	1,000.00	
42,000.00	Chicago, Burlington & Quincy R. R. Conv. 5s.	1903	40,820.00	
35,000.00	Fort Street Union Depot 4½s.	1941	34,825.00	
24,000.00	Rome, Watertown & Ogdensburg R. R. 5s.	1922	24.000.00	
	Advances to Bond Premium account.		8,171.41	
	Bonds			251,225.31

INVESTMENT OF THE JOY SCHOLARSHIP FUND.

	Massachusetts Hospital Life Insurance Co.	5,000.00	
	Deposits in Savings Banks	3,555.83	
			8,555.83

INVESTMENT SWETT SCHOLARSHIP FUND.

	Massachusetts Hospital Life Insurance Co.	10,000.00

INVESTMENTS, GENERAL ACCOUNT.

$14,000.00	Bur. & Mo. River (Neb.) R. R. 6s. non-exempt	1918	14,000.00	
2,000.00	Bur. & Mo. River (Neb.) R. R. 6s. exempt	1918	2,000,00	
6,000.00	Chicago, Burlington & Quincy R. R. 4s.	1922	5,100.00	
3,000.00	Milwaukee & St. Paul R. R. 7 3-10	1898	3,000.00	
4,000.00	Chicago, Burlington & Northern R. R. 5s.	1926	4,000.00	
2,000.00	Kansas City, Fort Scott & Gulf R. R. 7s.	1908	2,000.00	
1,000.00	Union Pacific R. R. 6s.	1898	1,000.00	
3,000.00	Hannibal & St. Joseph R. R. 6s.	1911	3,000.00	
15,000.00	Chicago, Burlington & Quincy R. R. Conv. 5s.	1903	15,000.00	
6,000.00	West End Street Ry. 5s.	1902	6,000.00	
2,000.00	Brookline Gas Light Co. 5s.	1913	2,000.00	
35,000.00	Fitchburg R. R. 5s.	1903	35,000.00	
65,000.00	Boston & Maine R. R. 4½s.	1944	65,000.00	
26,000.00	Am. Dock & Improvement Co. 5s.	1921	26,000.00	
3,000.00	Illinois Central R. R. 4s.	1951	3,000.00	
	Advances to Bond Premium account		5.511.24	
	Bonds			191,611.24
	Amount carried up			$461,392.38

Amount brought up					461,392.38
STOCKS.					
SHARES.					
148 Boston & Albany R. R.	par	100	29,933.00		
194 Morris & Essex R. R.	"	50	14,690.00		
40 New York & Harlem R. R.	"	50	5,000.00		
85 Pittsburg, Fort Wayne & C. R. R.	"	100	12,380.00		
12 Cocheco Manufacturing Co.	"	500	6,000.00		
56 Hamilton Woolen Co.	"	100	5,390.00		
59 Everett Mills	"	100	5,310.00		
31 Great Falls Manufacturing Co.	"	100	3,472.00		
6 Manchester Mills	"	100	660.00		
2 Dwight Manufacturing Co.	"	500	1,600.00		
1 Merrimack Manufacturing Co.	"	1000	1,015.00		
1 Laconia Co.	"	400	605.00		
2 Pepperell Manufacturing Co.	"	500	2,300.00		
10 Lowell Bleachery	"	100	975.00		
27 Essex Co.	"	50	4,050.00		
158 Pennsylvania Coal Co.	"	50	23,160.50		
15 Consolidated Gas Co., New York	"	100	1,447.50		
7 Lowell Gas Light Co.	"	100	1,610.00		
40 Cambridge Gas Light Co.	"	100	7,000.00		
7 Lawrence Gas Light Co.	"	100	882.00		
55 Old Boston National Bank	"	100	5,510.50		
15 Merchants' National Bank	"	100	2,220.00		
25 New England National Bank	"	100	3,875.00		
25 Atlantic National Bank	"	100	2,875.00		
10 National Union Bank	"	100	1,240.00		
25 National Bank of the Republic	"	100	3,625.00		
40 The Molsons Bank, Montreal	"	50	3,000.00		
					150,325.50
REAL ESTATE.					
Rogers Building				200,000.00	
Walker "				150,000.00	
Land on Garrison Street			50,840.00		
Workshops " "			30,000.00		
				80,840.00	
Land on Trinity Place			76,315.69		
Engineering B'ld'g, Trinity Place			90,000.00		
				166,315.69	
Gymnasium Building				7,967.85	
Architects' "				57,857.10	
Lot No. 2 Trinity Place				137,241.60	
Clarendon St. Land and Building				142,762.94	
House No. 34 Commonwealth Ave.				30,000.00	
					972,985.18
Equipment, Engineering Building				16,555.24	
" Workshops				20,628.56	
					37,183.80
SUNDRIES.					
Notes Receivable				1,500.00	
Boston Art Students' Association				13,666.66	
Students' Notes				3,733.00	
Cash Balance, Sept. 30, 1895				21,807.33	
					40,706.99
					$1,662,593.85

The foregoing Property represents the following Funds and Balances, and is answerable for the same.

The income of the following is used for the general purposes of the Institute:

William Barton Rogers Memorial Fund	250,225.00	
Richard Perkins Fund	50,000.00	
George Bucknam Dorr Fund	49,573.47	
Martha Ann Edwards "	30,000.00	
Nathaniel C. Nash "	10,000.00	
Sidney Bartlett "	10,000.00	
Robert E. Rogers "	7,680.77	
Albion K. P. Welch "	5,000.00	
Stanton Blake "	5,000.00	
McGregor "	2,500.00	
Katharine B. Lowell "	5,000.00	
		424,979.24

The income of the following is used towards paying salaries: —

Nathaniel Thayer, for Professorship of Physics	25,000.00	
Jas. Hayward, for Professorship of Engineering	18,800.00	
William P. Mason, " Geology	18,800.00	
Henry B. Rogers, for General Salaries	25,000.00	
		87,600.00

SCHOLARSHIP TRUSTS.

Richard Perkins Fund	52,857.69	
James Savage Fund	13,073.51	
Susan H. Swett Fund	10,182.95	
William Barton Rogers Fund	10,358.87	
Joy Fund	8,555.83	
Elisha Thacher Loring Fund	5,357.54	
Charles Lewis Flint Fund	5,278.49	
Thomas Sherwin Fund	5,012.50	
Farnsworth Fund	5,012.50	
James H. Mirrlees Fund	2,677.88	
William F. Huntington Fund	5,230.72	
Susan Upham Fund	1,141.12	
Susan E. Dorr Fund	2,557.56	
T. Sterry Hunt Fund	3,118.75	
Elisha Atkins Fund	5,197.92	
Nichols Fund	5,098.96	
		140,712.79

OTHER TRUSTS.

Charlotte Billings Richardson, Industrial Chemistry Fund	37,378.78
Charles Lewis Flint, Library Fund	5,000.00
Rotch Architectural Fund	25,000.00
Rotch Arch. Library Fund	5,000.00
Arthur Rotch Prize Fund	5,000.00
Arthur Rotch "Special" Prize Fund	5,000.00
Letter-Box Fund, balance	59.12

MISCELLANEOUS.

Notes Payable	150,000.00	
Students' Deposits	600.00	
Martha Ann Edwards Legacy, 1893	98,452.89	
T. O. H. P. Burnham " "	20,000.00	
Catherine P. Perkins " "	96,213.00	
William J. Walker " 1894	21,136.00	
M. I. T. Stock Account	540,462.03	
		926,863.92
		$1,662,593.85

Comparative Statement of Funds, etc.

	Sept. 29, 1894.	Sept. 30, 1895.
Trusts for general purposes	456,007.24	424,979.24
" " Salaries	87,600.00	87,600.00
" " Scholarships	125,844.28	140,712.79
" " Library	5,000.00	5,000.00
Charlotte B. Richardson Ind. Chem. Fund	35,683.79	37,378.78
Albert A. Pope Street Building and Highway Engineering Fund	1,162.07	
Letter-Box Fund	122.37	59.12
Notes Payable	220,000.00	150,000.00
Students' Deposits	650.00	600.00
Subscription of 1887	123,500.00	
" " 1892	121,250.00	
Martha Ann Edwards Legacy	98,452.89	98,452.89
T. O. H. P. Burnham "	20,000.00	20,000.00
Catherine P. Perkins "	88,713.00	96,213.00
William J. Walker "	10,537.27	21,136.00
Rotch Architectural Fund		25,000.00
Rotch Architectural Library Fund		5,000.00
Arthur Rotch Prize Fund		5,000 00
Arthur Rotch "Special" Prize Fund		5,000.00
M. I. T. Stock Account	473,167.20	540,462.03
	$1,867,690.11	$1,662,593.85
Increase		
Consisting of: —		
Bequests for Special Purposes, etc. See page 76		57,220.67
Gifts and Bequests for General Purposes. See page 76		31,098.73
		$88,319.40
Less Expenses more than income	15,935.29	
" Boiler House acct., 1894, charged off	25.20	
" Emery Testing Machine, charged off	10,000.00	
" Scholarship Funds, 1894, used	657.17	
" Letter-Box Fund, 1894, used	63.25	
" Pope Fund, 1894, used	1,162.07	
" Loss on Sale of Brookline Gas Co. Stock	270.00	
" Students' Deposits		28,112.98
" Notes Payable paid		50.00
		70,000.00
		98,162.98
In view of the greatly reduced valuation of the buildings, made by the Board of Underwriters, it has seemed best to make a large reduction in the valuation at which the buildings have been carried on our books, viz.:		
Rogers Building, reduced		115,726.88
Walker Building, "		40,492.44
Engineering Building, "		16,616.87
Workshops "		22,416.49
Total reduction		$195,252.68

INCOME FROM GENERAL INVESTMENTS, AND APPLICATION THEREOF.

Applied to Salaries	4,161.00	From Dividends, Bank Stocks	1,479.17
" " Scholarships	4,050.00	" State Tax returned on Bank Stocks	236.58
" " " James Savage Fund	592.83	" Bonds	9,123.92
" " Library	237.50	" Dividends, Railroad Stocks	2,678.00
" " General Purposes	9,853.82	" " Coal and Gas Stocks	1,910.00
" " Increase of Funds	2,556.94	" " Manufacturing Stocks	1,227.00
" " Advances to Bond Premiums	393.96	" Interest allowed on Funds not in Bonds and Stocks @ 4¾ %	5,191.38
	$21,846.05		$21,846.05

INCOME FROM WILLIAM BARTON ROGERS MEMORIAL FUND, AND APPLICATION THEREOF.

Paid Massachusetts Institute of Technology .	9,688.25	Received Income from Railroad Bonds . . .	10,088.25
Credited to Advances Bond Premiums . . .	400.00		
	$10,088.25		$10,088.25

DETAILS OF SOME ITEMS IN TREASURER'S CASH ACCOUNT.

Rents.

Huntington Hall, for Lowell Lectures		3,500.00	
Lowell School of Design		1,800.00	
Chauncy Hall School, for Gymnasium		500.00	
State Board of Health, for use of Laboratories		750.00	
Boston Water Works " " " "		66.67	
Land and Building, Clarendon St., on account		2,625.00	
34 Commonwealth Avenue, 1 year	2,200.00		
less Annuity under Will	1,000.00		
less Tax and Repairs	397 90		
	1,397.90		
		802.10	
Use of Rooms and Gymnasium		1,588.54	11,632.31

Department Supplies.

Chemistry	10,352.20	
Physics	5,242.46	
Mining	1,853.16	
Mechanical Engineering	2,561.57	
Naval Architecture	444.22	
Applied Mechanics	1,450.18	
Civil Engineering	2,878.12	
Biology	2,149.36	
Geology	666.13	
Architecture	1,593.32	
Drawing	32.16	
Mathematics	98.85	
English	980.93	
Workshops	1,252.37	
Modern Languages	185.19	
Periodicals	1,134.73	
		32,874.95

Salaries.

Instruction	168,026.12	
Administration	18,465.64	
Labor	17,150.11	
		$203.641.87

Repairs.

Department Improvements: —			
Chemistry	979.41		
Physics	506.74		
Mining	389.92		
Biology	378.91		
Workshops	350.87		
Architecture	231.66		
Civil Engineering	226.61		
Applied Mechanics	220.19		
English	219.73		
Mechanical Engineering	210.86		
Geology	51.39		
Drawing	21.70		
Mathematics	11.87		
Naval Architecture	.63		
		3,800.49	
Sundries		785.91	
Steam Fitting		607.13	
Rogers Building		1,440.55	
Walker "		453.37	
Engineering Building		416.81	
Gymnasium "		315.68	
Architectural "		79.38	
Lowell School of Design		59.60	
Boiler, Tools, etc.		406.93	
General Library		110.62	
			$8,476 47

General Expenses.

Fire Insurance	2,442.70	
Stationery and Office Supplies	1,461.97	
Postage	1,347.00	
Entrance Examinations	684.95	
Washing	639.14	
Sundries	699.36	
Janitor's Supplies: Brushes, Pails, etc.	437.92	
Diplomas, Commissions and Expense of Drill	441.50	
Express Charges, Teaming, etc.	406.76	
Paints, Varnish, etc.	371.04	
Lowell School of Design	295.98	
Books, Supplies, etc., for General Library	287.84	
Furniture	265.63	
Ice	249.53	
Examination Books	225.16	
Circular Saw for Workshops	223.37	
Electric Lighting: —		
Power 342.09		
Wiring, etc. 545.68		
	887.77	
Gymnasium Supplies	184.23	
Card Case for Library	135 00	
Amount carried forward	$11,686.85	

Amount brought forward		11,686.85	
Military Dept.		115.00	
Window Shades		104.53	
Engine Room Supplies: —			
Oil	176.84		
Cotton Waste	18.72		
Sundries	33.23		
		228.79	
Telephone & Telegraph Co.		97.85	
Glass		96.88	
Type-Writing Machines		170.00	
Union Safe Deposit Vaults		50.00	
Fire Hose		40.56	
Safe, Sec'y's Office		20.00	
Legal Fees		19.00	
			$12,629.46

BOSTON, Nov. 29th, 1895.

An examination of the accounts of the Treasurer of the MASSACHUSETTS INSTITUTE OF TECHNOLOGY for the year ending Sept. 30, 1895, has been made, and they are found to be correctly cast, and with proper vouchers. The ledger balances agree with the trial balance. We have verified the evidences of personal property held by the Institute.

FREDERIC W. LINCOLN,
JAMES P. TOLMAN,
CHARLES C. JACKSON,
Auditing Committee.