MASSACHUSETTS

INSTITUTE OF TECHNOLOGY.

ANNUAL REPORT

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DECEMBER 12, 1894.

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To The Corporation of the Massachusetts Institute of Technology:

THE year upon which I now have the honor to report has, on the whole, been one of prosperity. In May, the largest class in the history of the School was graduated; in September, the Institute opened with the largest number of students ever upon its register. The courses of instruction have been still further diversified and improved; and considerable additions have been made to the apparatus of instruction. We have been fortunate in everything except in the matter of our finances, and of the severe losses which the Corporation has suffered through the decease of three valued members.

The number of students, this year, is 1,183, as against a registration of 1,157, last year. This is not a little remarkable, since several causes have been operating which appeared to threaten a very considerable falling off in our numbers. The first of these was found in the hard times, which continued until after the opening of the school year, seriously affecting the incomes of all classes in the community. The influence of such a cause is especially felt in the Institute of Technology, since an unusually large proportion of our students come from families of moderate means; and no small part of our constituency consists of those who would never even consider the possibility of going first to a classical college and then to a professional school. Indeed, so serious has been the pressure of the times that a number of students who had gone so far as to register at the opening of the school, were obliged to withdraw, upon finding that they could not make the financial arrangements to enable them to stay.

The second cause which contributed to check the normal rate of increase at the Institute, this year, is found in the advanced requirements in mathematics, by which applicants were, for the first time, obliged to present either Advanced

Algebra or Solid Geometry. Some of the schools, as well as some young men fitting themselves for the Institute by their own exertions, were unable to meet this requirement on such brief notice; and the effect was to throw not a few back into the entering class of 1895. The range of this effect is illustrated in the fact that the number of persons taking the preliminary examinations in June last, with reference to entrance next year, was just fifty per cent greater than in June, 1893.

The third cause which might have been looked to for producing a falling off in the attendance at the Institute was to be found in the rapid increase of schools, not only in the immediate vicinity of Boston, but in every part of the country from which we draw our students, which are offering courses of instruction more or less like those given here. That increase is indeed remarkable. It has been stated that not less than one hundred colleges and universities in the United States are to-day offering technical instruction. There is now not a State in the Union without an institution in which more or less of a course in Engineering is laid out. Some of these are classical institutions of long standing and high repute, which are as rapidly as possible transforming themselves to meet the wants of the age. If, indeed, "imitation is the sincerest flattery," those who originated the earlier schools of science and technology have reason to pray that their heads may not be turned, as one classical college after another throws overboard studies and exercises which thirty years ago were declared to be absolutely essential to mental discipline and culture, without which no one could become a thoroughly educated and cultivated man, to make room for studies and exercises which, even down to recent days, have been stigmatized as interested, mercenary, and of a base flavor. Certainly the surviving founders of the Massachusetts Institute of Technology, who, from 1857 to 1865, supported President Rogers and Dr. Jacob Bigelow in the demand for an educational system better adapted to the wants of modern life than the mediæval and monastic culture

then alone offered to the aspiring student, have reason to rejoice that the battle of the New Education is won.

It is not infrequently the fate of those who have led in reforms to be sacrificed to the very greatness of the success achieved, to be buried under the mighty pile whose foundations they laid deep under ground. It is, indeed, a law of social life at which we may not repine, that the laborer of the eleventh hour often reaps an equal reward with those who have borne the burden and heat of the day; and we might, therefore, not unnaturally have looked to see, in the general, the almost universal, adoption of the methods of laboratory instruction and practice first developed here at the Institute of Technology, the beginning of a decline in the relative importance and influence of this school. But such a result I, for one, do not anticipate or fear. The greater and the more widely spread the desire for scientific education, the greater, I believe, will be the need of an institution which is prepared to lead in the development of such instruction; the larger will be the constituency to which the Institute of Technology will appeal; the more numerous will be the young men who, having made up their minds to seek such instruction, will determine to get it in its highest and best form. While the institutions which are so rapidly taking up the methods of scientific and technical instruction do well thus to answer the demands of the age, they cannot hope at the beginning to afford their students all, or nearly all, the advantages and facilities which in the older schools of science and technology have been the accumulation of many years, or are the fruit of careful study and long experience. Much of this can be transplanted; much of it cannot. Scientific and technical schools can no more be improvised than can universities and schools of classical culture. More than one first crop must be "ploughed under," in experiments upon the adaptation of the soil and the climate to the seed sown. Even when a moderate degree of success has been attained, it still remains for time and experience to perfect the system. There has been no year during the whole life of the Institute of

Technology when its own work has not been, in an appreciable measure, better done than in the year immediately preceding. Only through continuous experience, closely studied and interpreted; only through adaptations almost insensibly accomplished; only through consultation and comparison of results carried on year after year, — can the highest results in this department of effort be obtained. Take our department of Architecture, for example. I do not hesitate to say that no school in the United States, beginning at the present time, though in the possession of unlimited means, could in five years work itself up to the point of giving such instruction as we are giving to-day; and by the end of those five years, the Institute of Technology, granted only fair fortune, will be far ahead of its present position.

For these reasons I have no fear of any decline in the relative importance or influence of our school. There will be as much need of leadership in this department of education as ever, even as in the early days when the Faculty of the Institute of Technology first developed the laboratory of General Chemistry, the laboratory of General Physics, the laboratory of Economic Metallurgy, the laboratory of Applied Mechanics, and the laboratories of Steam, Hydraulic, and Electrical Engineering. And the more highly the educational value of scientific study and practice is appreciated, the whole land over, the larger, and not the smaller, will be the number of those who will desire to obtain that instruction and training under the very best conditions.

The Graduating Class.

The school year of 1893–94 closed fortunately, on the 29th of May. Of the 137 members of the class, 21 graduated in Civil Engineering, 31 in Mechanical Engineering, 4 in Mining Engineering, 13 in Architecture, 11 in Chemistry, 33 in Electrical Engineering, 1 in Biology, 3 in Physics, 12 in Chemical Engineering, 3 in Sanitary Engineering, while 5 graduated from the department of General Studies.

The Entering Class.

The registration of this year, as by the catalogue now in press, amounts to 1,183 against 1,157 twelve months ago, a gain of 26. The following table exhibits the number of students in the school each year, from the opening of the Institute to the present time: —

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

Students by Classes.

The aggregate number of students for 1894–95 is divided among the several classes as follows: —

Graduate students, candidates for advanced degrees	5
Regular students, Fourth Year	153
" " Third "	186
" " Second "	215
" " First "	276
Special students	348
Total	1,183

Comparison with the corresponding figures of last year shows that there has been an increase of 3 among the graduate students, candidates for advanced degrees; among the regular students in the fourth year of 7; in the third year of

28; in the second year of 8; and among the special students of 14. There has been a decrease of 34 in the regular students of the first year.

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	5		5
Fourth Year	153	49	202
Third Year	186	111	297
Second Year	215	144	359
First Year	276	44	320
Total	835	348	1,183

Statistics of Examinations.

Of the 1,183 students of the present year, 415 were not connected with the school in 1893–94; 14 had been connected with the Institute at some previous time, and returned to resume their places in the school; 42 were admitted provisionally without examination; 29 were admitted by examination as special students; 71 were admitted on the presentation of diplomas or certificates from other institutions of college grade.

Excluding from consideration those who were admitted, but have not in fact entered the school, 61 in number, the following was the final result of the examinations held in June and September: —

Admitted clear	190	
" on one condition	40	
" on two conditions	22	
" on more than two conditions	7	
		259
Rejected		28
		287

The statistics show this to have been the best examination ever held.

Examination at Distant Points.

In addition to the entrance examinations held at Boston in June and September, examinations were also conducted in June at Belmont (Cal.), Buffalo, Chicago, Cincinnati, Cleveland, Colorado Springs, Denver, Des Moines, Detroit, Easthampton (Mass.), Exeter (N. H.), Louisville, New York, Philadelphia, Pittsburgh, Poughkeepsie, St. Paul, and Washington.

Residence of Students.

Thirty-seven States of the Union, besides the District of Columbia and the Territories of Utah and New Mexico, are represented on our list of students. Of the total number of

States.	Candidates for Advanced Degrees.	Fourth Year.	Third Year.	Second Year.	First Year.	All Regular Students.	Special Students.	Total.
Alabama	..	..	1	..	..	1	..	1
California	..	3	2	..	2	7	2	9
Colorado	..	2	..	1	2	5	3	8
Connecticut	..	4	4	9	6	23	6	29
Delaware	1	..	1	2	..	3	..	3
Dist. of Columbia	..	..	2	2	6	10	2	12
Florida	..	..	1	..	..	1	1	2
Georgia	..	..	..	..	..	..	2	2
Illinois	..	3	11	8	6	28	8	36
Indiana	..	1	..	..	1	2	1	3
Iowa	..	4	1	..	1	6	4	10
Kansas	..	..	..	..	4	4	..	4
Kentucky	..	1	..	4	4	9	3	12
Louisiana	..	1	1	..	..	2	1	3
Maine	..	5	7	5	11	28	10	38
Maryland	..	1	1	..	..	2	2	4
Massachusetts	1	91	107	134	179	511	196	707
Michigan	..	1	1	..	1	3	5	8
Minnesota	1	1	1	3	1	6	3	9
Missouri	..	1	2	3	3	9	5	14
Montana	..	..	..	1	..	1	1	2
Nebraska	..	2	1	..	1	4	..	4
Nevada	..	1	..	..	..	1	1	2
New Hampshire	1	5	8	4	6	23	4	27
New Jersey	..	..	..	..	3	3	2	5
New Mexico	..	..	1	..	..	1	..	1
New York	..	3	12	11	14	40	19	59
Ohio	..	7	6	6	7	26	24	50
Oregon	..	..	..	1	..	1	..	1
Pennsylvania	..	6	4	7	8	25	12	37
Rhode Island	1	6	3	7	4	20	5	25
South Carolina	..	..	1	..	1	2	1	3
Tennessee	..	..	..	..	..	..	1	1
Texas	..	..	3	..	1	4	2	6
Utah	..	..	..	..	..	..	2	2
Vermont	..	..	..	1	1	2	1	3
Virginia	..	..	..	..	..	..	2	2
Washington	..	..	..	..	..	..	3	3
West Virginia	..	..	..	..	..	..	1	1
Wisconsin	..	..	2	2	..	4	2	6
Foreign Countries.								
Belgium	..	..	1	..	..	1	..	1
Brazil	..	..	..	..	1	1	..	1
Chile	..	..	..	..	..	..	1	1
Cuba	..	..	..	..	..	..	1	1
Germany	..	..	1	..	..	1	..	1
Holland	..	2	..	..	..	2	..	2
Ireland	..	1	..	..	..	1	..	1
Japan	..	..	..	1	..	1	..	1
Mexico	..	..	..	..	..	..	1	1
New Brunswick	..	1	..	..	..	1	..	1
New So. Wales	..	..	..	..	..	..	1	1
Nova Scotia	..	..	..	..	..	..	1	1
Ontario	..	..	..	2	..	2	2	4
Porto Rico	..	..	..	..	1	1	..	1
Quebec	..	..	1	1	..	2	..	2
Scotland	..	..	..	..	..	..	1	1
Spain	..	..	..	..	..	..	1	1
Turkey	..	..	..	..	..	..	1	1
Venezuela	..	..	..	..	..	..	1	1
Total	5	153	186	215	276	835	348	1183

1,183, 707 are from Massachusetts, or 59.8 per cent of the whole; 122 are from other New England States; 354 are from outside New England. Of these, 24 are from foreign countries.

A table showing the number of students in each year from and including 1888, coming from each State or Territory and from each foreign country, may not be without interest and instruction: —

	1888.	1889.	1890.	1891.	1892.	1893.	1894.
States.							
Alabama	..	1	..	2	4	2	1
Arkansas	2	2	3	3	2	1	..
California	13	10	14	19	14	15	9
Colorado	2	6	4	7	7	5	8
Connecticut	28	36	31	30	27	30	29
Delaware	..	..	1	..	2	4	3
Dist. of Columbia	9	9	7	4	4	7	12
Florida	..	2	3	3	4	3	2
Georgia	1	1	2	2	3	3	2
Idaho	..	..	..	1	1	1	..
Illinois	37	33	34	32	40	39	36
Indiana	1	3	6	5	5	6	3
Iowa	6	4	9	10	10	13	10
Kansas	..	..	2	2	1	1	4
Kentucky	3	4	4	8	7	11	12
Louisiana	2	4	8	5	2	3	3
Maine	26	30	29	27	39	36	38
Maryland	4	4	7	7	6	4	4
Massachusetts	494	533	517	565	603	665	707
Michigan	12	13	16	13	10	7	8
Minnesota	8	10	12	13	13	11	9
Missouri	7	8	8	12	13	17	14
Montana	..	..	1	..	..	2	2
Nebraska	2	1	1	1	4	3	4
Nevada	..	..	1	3	3	2	2
New Hampshire	24	21	23	24	29	32	27
New Jersey	8	13	11	16	11	6	5
New Mexico	2	..	..	1	2	2	1
New York	31	25	40	40	50	52	59
North Carolina	1	2	1	1	1	..	..
Ohio	23	35	33	33	39	45	50
Oregon	1	2	1	1	2	1	1
Pennsylvania	18	23	22	26	25	31	37
Rhode Island	22	22	21	26	24	33	25
South Carolina	..	1	2	4	1	3	3
South Dakota	1	1	..	..	..	..	..
Tennessee	3	5	3	4	1	1	1
Texas	2	..	1	2	5	6	6
Utah	..	..	..	..	1	2	2
Vermont	5	4	4	5	4	5	3
Virginia	4	6	5	6	4	3	2
Washington	..	2	2	3	3	1	3
West Virginia	..	2	2	2	2	1	1
Wisconsin	7	9	10	7	9	11	6
Wyoming	1	..	..	..	..	..	..
Foreign Countries.							
Argentine Rep.	..	..	2	..	..	..	..
Belgium	..	..	..	..	1	1	1
Brazil	2	2	2	4	..	..	1
Bulgaria	..	1	1	1	1	1	..
Central America	..	..	..	1	1	1	..
Chile	..	..	..	..	..	..	1
Colombia	..	1	..	2	..	..	..
Cuba	..	..	..	..	..	1	1
England	..	..	2	1	1	1	..
France	..	1	1	1	1	1	..
Germany	..	..	..	..	..	2	1
Greece	1	..	..	..	..	..	..
Guatemala	1	1	..	..	1	..	..
Hawaiian Islands	1	1	4	4	2	2	..
Holland	..	..	..	2	2	2	2
Ireland	1	1	1	..	..	1	1
Japan	..	1	4	3	1	1	1
Mexico	..	1	1	1	1	1	1
New Brunswick	1	1	1	2	1	1	1
New South Wales	..	..	..	1	1	1	1
Nova Scotia	..	2	2	1	..	..	1
Ontario	2	1	1	2	2	4	4
Peru	2	1	3	1	..	..	..
Porto Rico	2	2	2	1	..	1	1
Quebec	1	1	4	4	5	5	2
Scotland	1	1	3	2	1	2	1
Spain	..	..	..	..	1	1	1
Trinidad	1	1	1	1	..	..	..
Turkey	1	2	1	2	1	..	1
Venezuela	..	..	..	1	..	1	1
Total	827	900	937	1,011	1,066	1,157	1,183

Residence of Massachusetts Students.

It has been said that 59.8 per cent of our students are from Massachusetts. All the counties of the State, except the

small counties of Dukes and Nantucket, send students to the Institute. One hundred and twenty-four cities and towns are borne on the lists, nine more than last year. The first column of the following table shows the number of cities and towns in each county sending pupils to the Institute; the second column gives the aggregate number from each county. It appears that Suffolk sends 215 and Middlesex 201 pupils; Essex comes third, with 87; Norfolk fourth, with 74.

County.	No. of Towns.	No. of Students.	County.	No. of Towns	No of Students.
Barnstable . .	7	9	Hampshire . . .	4	4
Berkshire . . .	5	14	Middlesex . . .	29	201
Bristol	7	27	Norfolk	17	74
Essex	19	87	Plymouth . . .	12	33
Franklin . . .	4	4	Suffolk	4	215
Hampden . . .	5	16	Worcester . . .	11	23
Total . . .	47	157	Total	124	707

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

Boston . . .	202	Springfield .	9	Medford . .	6
Newton . .	34	Framingham .	8	Reading . .	6
Cambridge .	28	Lawrence . .	8	Salem . . .	6
Brookline . .	26	Plymouth . .	8	Arlington . .	5
Newburyport	22	Watertown .	8	Gloucester .	5
Hyde Park .	17	Brockton . .	7	Quincy . . .	5
Lynn . . .	17	Fitchburg . .	7	Wakefield .	5
Somerville .	17	Melrose . .	7	Belmont . .	4
Lowell . . .	15	Natick . . .	7	Foxboro' . .	4
Chelsea . .	11	Pittsfield . .	7	Lincoln . .	4
Waltham . .	11	Taunton . .	7	Weymouth .	4
New Bedford	10	Concord . .	6	Woburn . .	4
Malden . .	9	Haverhill . .	6		

It may be interesting to note the number of students coming to us from the chief cities of the United States, distant or near, outside Massachusetts, — Albany, 1; Atlanta, 2; Baltimore, 1; Bangor, 6; Brooklyn, 11; Buffalo, 9; Charleston, 2;

Chicago, 21; Cincinnati, 13; Cleveland, 7; Columbus, Ohio, 1; Dayton, 6; Denver, 3; Des Moines, 3; Detroit, 7; Evanston, Ill., 5; Exeter, 2; Hartford, 6; Indianapolis, 2; Louisville, 6; Manchester, N. H., 2; Milwaukee, 2; Minneapolis, 4; Montreal, 2; Nashville, 1; New Haven, 1; New Orleans, 1; New York, 16; Norwich, 5; Omaha, 3; Pawtucket, 3; Philadelphia, 8; Pittsburgh, 7; Portland, Me., 17; Portsmouth, N. H., 5; Poughkeepsie, 3; Providence, 18; Rochester, 2; St. Louis, 11; St. Paul, 5; San Francisco, 6; Toledo, 4; Troy, 2; Utica, 4; Washington, D. C., 12; Wilmington, Del., 4.

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
1885–86	609	369	240	177	63
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	937	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

It appears from the foregoing that the number of students remaining over from last year to this has been increased by sixty-seven, while the number registered for the first time is smaller by forty-one, making the net increase, as stated, twenty-six.

* In addition five students are repeating the first year.

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 year, and nine of unusual ages. These deductions leave two hundred and seventy 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 1893–94.

Period of Life.	1893–94.		1894–95.	
	Half-year Groups.	Yearly Groups.	Half-year Groups.	Yearly Groups.
16 to 16½ years	1	–	2	–
16½ to 17 "	2	3	10	12
17 to 17½ "	23	–	20	–
17½ to 18 "	56	79	27	47
18 to 18½ "	48	–	45	–
18½ to 19 "	47	95	67	112
19 to 19½ "	51	–	37	–
19½ to 20 "	30	81	23	60
20 to 20½ "	9	–	16	–
20½ to 21 "	9	18	5	21
21 to 22 "	8	8	18	18
	284	284	270	270

From the foregoing, it appears that the average age on entrance is the same as last year; namely, eighteen years and nine months.

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

Between 20 and 20½	3
" 20½ " 21	6
" 21 " 21½	18
" 21½ " 22	16
" 22 " 23	46
" 23 " 24	27
24 and over	21
Total	137

It is significant of the character of a large class of our "special students" that of the three hundred and forty-eight, sixty-four are twenty-five years of age, or over.

In this immediate connection I desire to refer to statements recently made regarding the preparation of students entering this and other scientific and technical schools. At the October meeting of the New England Association of Colleges and Preparatory Schools, President Eliot, Chairman of "The Committee of Ten," spoke as follows: —

"It is the plain fact that the scientific and technological schools of this country — I have in mind no particular school, and my remark would apply just as well to the Lawrence Scientific School, or to the Sheffield Scientific School, as to the Institute of Technology — have admitted young men by hundreds who have never accomplished anything like the course of instruction provided in any one of the programmes recommended by the Committee of Ten. The committee, I am sure, would unanimously desire that the scientific and technological schools should raise their requirements for admission until these schools should give a real support to secondary education. At present they are eating into the secondary schools. They receive secondary-school pupils one year, and even two years, before they have finished a fair secondary-school course."

I am not confident that I gather the exact purport of these words. President Eliot may not have intended to intimate that students entering scientific and technological schools are, in point of preparation, far behind those entering classical colleges; but it was thus I understood his words on hearing them, at the time; and it is with that meaning they have generally been received and commented on. This certainly is the significance which a casual reader of the official report of the proceedings would be likely to give them. From such an opinion I should be compelled to express my dissent very strenuously.

It is unquestionably true that the range of studies upon which this and other scientific and technical schools conduct

entrance examinations is smaller than that upon which examinations are held for admission to classical colleges, in general; but it does not follow from this, alone, that the virtual amount of preparation, the real training given to the powers of the pupil, and his actual capability for doing good work, are less in the one case than in the other. At the Institute of Technology students enter at the average age of eighteen years and nine or ten months; indeed, if instances of exceptional ages had not been excluded from the comparison, the average, this year, would have been raised to nineteen years. This is fully equal to the age at which students enter the great majority of classical colleges in this country. It is higher than at many colleges. It only lacks two or three months of reaching the point at which students enter Harvard, whose requirements have long been known to be beyond those of any other classical college. Nor is there any reason, so far as I am advised, for supposing, in respect to the large majority of pupils entering scientific and technical schools, that they did not begin study as early in life, and keep it up as long and as constantly, as did the pupils entering the classical colleges. If, now, the age of entrance is substantially the same at the scientific schools and at the colleges, and if the pupils entering must be presumed to have been on substantially the same terms as to the amount of attendance at school up to that age, it would seem not unfair to draw the conclusion that our students have had substantially the same amount of mental training and discipline, though they may not have prepared themselves for examination upon as wide a range of subjects. If they did not study as many things as those who were fitting themselves for classical colleges, may they not have fitted themselves better on the narrower line of subjects? If they have not been as much crammed, may they not have been as well trained? If they have been at school as long, why should we suppose that they have not done as much studying? And if they have done as much studying, why should we assume that they have derived any less advantage from it? I do not see how, in the face of such

statistics as those given on page 15, one can escape the conclusion that students on coming here have substantially the same amount of actual, virtual, mental preparation as students entering college, unless he is prepared to make one or both of two assumptions; namely, that the men going to scientific and technical schools are possessed of less native capability, or that they are less industrious and faithful students. I trust there is no champion of the so-called liberal studies who would show himself so illiberal as to venture to make either of the foregoing assumptions.

It is unquestionably true that pupils sometimes "cut across lots" from the fitting schools to the schools of science and technology, just as they do from the fitting schools to most of the classical colleges. There is no way, which would not amount to absolute tyranny, by which this can be prevented; indeed, it is not always a thing which one would desire to prevent. Instances will occur where a young man who is pressed for time or means may well resort to such a course. The valedictorian of my class in college entered from no school at all, to speak of, with probably a smaller amount of preparation than any other member; and the present year it has come to my knowledge that a young man, who had become dissatisfied with his progress in preparation for college, made up certain of his studies outside the school, and, on offering himself, a year in advance, at one of our most distinguished universities, passed the best examination of all the applicants for admission. This "cutting across lots" is a thing which it is impossible in instances to prevent, and, in my judgment, undesirable to attempt to prevent. In general, I do not believe that a comparison, fairly made, between students of scientific and technical schools and students of colleges, as to the amount of actual preparation respectively received by them, would result to the disadvantage of the former class.

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

Women as Students at the Institute.

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

Graduates of Other Colleges.

The number of students who are graduates from this and other institutions is seventy-two. Of these, ten are our own graduates, of whom five are pursuing studies as candidates for advanced degrees; sixty-three are graduates of other institutions, pursuing courses of study with us, either as regular or as special students. Twenty-two are graduates of Harvard University; three, each, of Yale University, Williams and Smith Colleges; two, each, of Johns Hopkins and Brown Universities, Dartmouth College, the Sheffield Scientific School of Yale University, and the United States Military Academy at West Point: while the following institutions, universities or colleges, are represented on our list by a single graduate each, — Trinity College, (Dublin), University of Göttingen, Charleston College, University of Chicago, Havana, Iowa State Agricultural College, Iowa State University, Northwestern University, Centre, Lafayette, Oberlin, Wellesley, Universities of Minnesota, Western of Pennsylvania, Venezuela, California, Santiago, Oregon, Louisiana, Columbian; New Hampshire College of Agriculture & Mechanic Arts; Mt. St. Mary's, Hahnemann, Amherst, National Deaf Mute College.

The candidates for advanced degrees are Messrs. J. A. Meyer, Jr., of the class of '91, in Architecture; Messrs. C. G. Abbot, H. B. du Pont, F. M. Mann, and W. O. Scott, of the class of '94, in Physics, Chemical Engineering, Architecture, and Chemistry, respectively. Mr. A. E. Leach, of the class of '86, in Chemical Engineering, and Mr. C. R. Boss, of the class of '94, in General Studies, are now taking special work in Chemistry; Prof. Walter Barrows, of the Michigan State Agricultural College, and a graduate of the Institute in '74, is spending a part of his winter vacation in biological work in the laboratories of the Institute. Of the sixty-seven not candidates for advanced degrees, thirty are regular students, — namely, fourteen in the fourth year; fourteen in the third

year; two in the second year: the remaining thirty-seven are special students. Of the thirty graduates who are regular students in the three upper classes, eight take Civil Engineering; one, Mining Engineering; one, Mechanical Engineering; seven, Architecture; two, Chemistry; nine, Electrical Engineering; one, Naval Architecture; one, both Electrical and 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	26	36	3	13	13	36	..	2	4	11	4	2	5	155*
3d " "	31	27	8	16	16	58	2	4	7	7	4	..	6	186
2d " "	31	48	8	19	21	43	3	3	8	17	5	..	9	215
Total . . .	88	111	19	48	50	137	5	9	19	35	13	2	20	556*

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

* Counted twice, two.

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 *

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-six of the five hundred and fifty-four regular students, candidates for the degree, in the three upper classes. In the case of Course IV., Architecture, the number of regular students fails to measure the importance of the department to the school, inasmuch as that course embraces 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. Thus, the number of special students in Architecture in the three upper classes, the present year, is sixty-one, which, added to the forty-eight regular students, makes the total number one hundred and nine. 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.

* Counted twice, two.

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	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
Total	268	302	132	69	146	1	205	26	18	49	31	9	4	1,260
Deduct names counted twice														8
Net total														1,252

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.												Course Undetermined.
		I.	II.	III.	IV.	V.	VI.	VII.	IX.	X.	XI.	XII.	XIII.	
First	4	..	..	..	..	1	..	..	1	..	..	..	..	2
Second	11	1	3	1	..	..	3	..	2	..	..	..	1	..
Third	12	..	1	1	2	..	5	1	1	..	..	..	1	..
Fourth	6	..	3	..	..	..	1	..	..	..	..	2	..	..
Fifth	12	2	3	..	3	..	2	..	..	1	1	..	..	..
	45	3	10	2	5	1	11	1	4	1	1	2	2	2

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	66	Language	180
Architecture	61	Mathematics	194
Biology	31	Mechanical Engineering	76
Chemistry	146	Mining Engineering	18
Civil Engineering	38	Naval Architecture	3
Drawing	165	Physics	178
Electrical Engineering	28	Political Science	61
English	109	Shopwork	56
Geology	55	Sanitary Chemistry	2
History	79		

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	319	292	196	48	855
Chemistry	363	89	69	49	570
English	302	264	11	9	586
French	196	88	36	17	337
Physics	..	309	264	87	660
German	79	219	163	2	463
Shopwork	9	123	37	53	222

In my last report I mentioned the agreement, sanctioned by the Executive Committee of the Corporation, by which the classes of the Boston Normal School of Gymnastics, supported by Mrs. Mary Hemenway, were to receive their instruction in Chemistry, Physics, and Biology at the Institute of Technology, but without being registered as students of the Institute. That arrangement, which had been entered upon at the date of my last report, was carried through with satisfaction to the officers of the Normal School of Gymnastics and to the Faculty of the Institute. The pupils thus brought to us were found to be of exceptional capacity, of great zeal in the pursuit of knowledge, and strictly attentive to our rules and requirements. The number thus receiving tuition was fifty. The eminent and large-hearted philanthropist to whose benefactions the school owes its foundation and endowment, having died during the year, the executors of her will have, in carrying out her expressed purpose, continued the arrangement for the current year. The classes now receiving tuition number sixty-four, including eight advanced students of the Normal School of Cookery, who have been admitted by a similar arrangement.

Scholarships.

Although the scholarship resources of the Institute were largely increased by the Perkins bequest of $50,000, in 1887, and by the action of the State in 1888, providing for twenty free students, from as many senatorial districts, the need of further provision in this direction is still painfully felt, especially during the present period of general financial distress. The total income applied to scholarships during the school year, 1893–94, was as follows: the Swett Fellowship, $400; the Savage Fellowship, $400; 20 State scholarships, $4,000; Perkins Fund, $2,350; Rogers Fund, $400; the Sherwin, Farnsworth, Flint, Huntington, Joy, and Loring scholarships, $225 each; the Mirrlees scholarship, $125. In addition to these amounts, the rental of letter-boxes yielded $187.50,

which was applied to the same object. The profits of the Co-operative Society and other minor receipts, to the amount of $462.50 and $500, respectively, were also used.

Students' notes were accepted by the Treasurer for tuition fees to the amount of $2,250. The practice of accepting notes had been discontinued since the establishment of the Perkins scholarships; but last year it appeared necessary to resume it or to leave a number of excellent students entirely unable to continue their work at the Institute. In addition to the two Fellowships, free tuition was granted to five graduates of the Institute, as usual. Since the year closed, a second free-scholarship has been established by Mrs. Mary E. Atkins, to be known as the Elisha Atkins scholarship. The bequest of the late Prof. Sterry Hunt, amounting to $3,000, will become available by next year. The total number of applicants for scholarship assistance, the present year, was 100. About $18,000 would have been required to provide for all the thoroughly deserving cases, instead of the $10,000 available.

It is much to be desired that scholarships should be created in the several towns regularly sending pupils to the Institute, as a reward for thoroughness of preparation, and as a means of helping poor young men to get the education for which their resources may be inadequate. We already have a Milton High School scholarship, founded by the residents of that town; and the Sherwin and Flint scholarships are primarily for the benefit of the graduates of the English High School of Boston. We ought to have a scholarship established for every town in the Boston Basin, and for such places as Cambridge, Somerville, Lynn, Newton, and Brookline, two or three.

Changes in the Faculty and the Corps of Instructors.

With exception of the professorship of Military Science, the appointment to which rests with the War Department,

the changes in the Faculty during the past year have been altogether in the nature of promotions to, or within, that body, no loss having occurred by death or resignation. Associate Professor Despradelle has been appointed to a full professorship. Mr. Fred L. Bardwell has been made Assistant Professor of General Chemistry. Dr. Augustus H. Gill and Dr. Arthur A. Noyes have been made Assistant Professors of Gas Analysis and of Organic Chemistry, respectively.

Mr. Bardwell graduated at the Institute in 1884, became assistant in General Chemistry, the same year, and was appointed instructor in 1886. For eight years he has been in immediate charge of the laboratory of General Chemistry. This very responsible and laborious position demands a teacher of unusual gifts. The work in this laboratory constitutes the first experience which the new students have with experimental manipulation and observation; and their success in subsequent studies must be largely influenced by the training they receive here. Professor Bardwell combines enthusiasm for his subject and zeal as a teacher with good judgment, ready tact, and infinite patience in dealing with new students. The increasing good results of this training during the first year may in large measure be attributed to his faithful work.

Dr. Augustus H. Gill graduated at the Institute also in the class of 1884, and became, first, assistant, and then instructor, in the Chemical Department. He subsequently spent two years in the University of Leipsic, where he obtained his doctorate in 1890. On his return from Europe he resumed his duties at the Institute, and has devoted his time almost exclusively to his special subject, gas analysis. Dr. Gill has brought this important branch of chemical investigation to what is believed to be an unsurpassed degree of efficiency, as regards both instruction and equipment. His classes include not only the men in the chemical course, but nearly all the students of engineering, to whom a knowledge of the composition of furnace and flue gases is a matter of great economic importance. Dr. Gill has also charge of the

fourth-year classes in Applied Chemistry in the Course in Chemical Engineering.

Dr. Arthur A. Noyes graduated at the Institute in 1886; continuing his studies for an additional year, he obtained the degree of Master of Science, and became an assistant in Analytical Chemistry. In 1888, he went to Europe and studied under Ostwald at Leipsic, obtaining his doctorate in 1890. Returning to the Institute in that year, he was appointed instructor in Analytical Chemistry. The following year he was transferred to the department of Organic Chemistry, where he has served the Institute with distinguished success. Dr. Noyes has made the comparatively new subject of Physical Chemistry his special study, and is already one of the best authorities on this subject in the country. His teaching is characterized by rare scholarship and suggestiveness.

Lieutenant Hawthorne having been relieved, at his own request, from further service at the Institute, Capt. John Bigelow, Jr., of the Tenth United States Cavalry, was assigned to duty as Professor of Military Science and Tactics. Captain Bigelow's scholarly tastes have been manifested in an important treatise, "The Principles of Strategy," illustrated mainly from American campaigns. His military record is, briefly, as follows: — He was graduated from West Point in 1877, and commissioned Second Lieutenant of the Tenth Cavalry. He served in Texas from 1877, to the close of 1879, when he was assigned to duty as Instructor in the Department of Modern Languages at West Point. In 1884, Lieutenant Bigelow rejoined his regiment in Texas; and in the spring of 1885, removed with it to Arizona, where he took part in the operations known as the Geronimo campaign. In 1887, Lieutenant Bigelow was ordered to Washington, where he remained for two years as Adjutant-General of the militia of the District of Columbia. Since that time he has been on duty in the field in the Department of Dakota. He was appointed First Lieutenant in 1883; and Captain, in 1893. Captain Bigelow has taken up his work here with the highest zeal and intelligence, and has already succeeded in making this department of in-

struction far more popular than ever before, as is evidenced by the fact that many members of the upper classes have attended his lectures.

In the Modern Language Department, while there has been no change in the number of teachers regularly engaged, there has been a change in the *personnel*, Assistant Professor Vogel having returned from a year of foreign study and relieved Mr. Meyer in the charge of the classes taught by him very successfully last year. It is much to be desired that the number of instructors in this department should be increased; but, as the finances of the Institute did not allow this to be done the present year, a slight degree of relief was afforded to the instructing staff by the engagement of Mr. Blume to take the class in Spanish twice a week through the year.

In the Mathematical Department, the only change in the instructing staff has been through the return of Dr. Frederick S. Woods from three years of foreign study, relieving Dr. Metzler in the charge of the classes conducted by him. Dr. Woods, who was actively engaged as an instructor in Mathematics at the Institute during the years 1889–91, has spent most of his time abroad in studying with Prof. Felix Klein, at the University of Göttingen, taking his degree there last spring. The department is much to be congratulated on the re-accession of this ripe scholar and painstaking teacher. It is exceedingly desirable that, as soon as the financial resources of the Institute make it possible, an additional instructor in Mathematics should be appointed. The entire time of an additional instructor could be used to excellent advantage in providing for a needed increase in the number of sections of the larger classes, and in giving opportunity for further extension and differentiation of such special courses in Mathematics as are imperatively required for the proper development of the technical departments of the school.

In the Physical Department, the past year has witnessed the withdrawal of one who has been for six years a faithful worker in this department, Edward Collins, Jr., of the class of 1888; and the return from Germany of Dr. Harry M. Goodwin.

Mr. Goodwin graduated with great distinction from the Institute in 1890, and for the two succeeding years remained as assistant in Physics. For the last two years he has pursued his studies at the University of Leipsic, from which he has received the degree of Ph.D., *summa cum laude*. The special work to which this accomplished scholar will devote himself at the Institute will be mentioned in the remarks upon the changes in the courses of instruction.

In the Department of History, Mr. Edson L. Whitney has resigned. His place has been taken by Mr. John Osborne Sumner, a graduate of Harvard College in the class of 1887. Mr. Sumner has spent five years in European study and travel, devoting himself chiefly to mediæval history, literature, and art. At Harvard he had paid special attention to the history of the United States. He is, therefore, peculiarly well qualified for the two subjects assigned to him here; namely, the political history of England and the United States, and the history and literature of the Renaissance and the Reformation. In the latter subject Mr. Sumner teaches, not only the students of the Course in General Studies, but the students in the fourth year of the Course in Architecture, where that subject is immediately connected with their professional work; also those in the Course in Biology. To broad and sound scholarship, Mr. Sumner adds enthusiastic interest in his work, and excellent results may be anticipated from his teaching. Mr. Robert S. Ball has resigned his instructorship in Mechanical Engineering, to engage in professional practice. Dr. William H. Walker, a graduate of the University of Göttingen, has been appointed Instructor in Analytical Chemistry.

The following assistants have been appointed instructors: in the department of Civil Engineering, Mr. J. P. Lyon; in the department of Mechanical Engineering, Messrs. C. E. Fuller, W. A. Johnston, and C. F. Park; in Architecture, Mr. R. S. Shedd; in General Chemistry, Mr. H. R. Moody; and in Mechanical Drawing and Descriptive Geometry, Mr. C. M. Faunce.

The following new assistants have been appointed: George

B. Haven, Samuel G. Reed, and Thomas G. Richards, in Mechanical Engineering; Edward M. Hunt and Frank P. McKibben, in Civil Engineering; F. Jewett Moore, Ph.D., in Analytical Chemistry; Leslie R. Moore, in Industrial Chemistry; Joseph W. Phelan and Walter E. Piper, in General Chemistry; W. Felton Brown, in Freehand Drawing; Minot A. Bridgham, in Woodwork; and Everett H. Masters, in Forging.

Messrs. Oscar W. Pickering, in General Chemistry; Fred A. Wilson and Phillips P. Bourne, in Mechanical Engineering; Otho W. McD. Cushing, in Freehand Drawing; Jesse F. Johnson, in Industrial Chemistry; Gorham Dana and James A. Emery, in Civil Engineering; Henry W. Nichols, in Geology; Clarence M. Brockway, in Woodwork; and William H. Lambirth, in Machine Tool Work, have terminated their connection with the Institute.

Statistics of the Corps of Instructors.

The catalogue of 1894–95 shows the number of instructors of all grades to be one hundred and fifteen, 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 thirty-seven. The following table shows the distribution among the several classes of instructors, with the gain or loss since last year: —

	1893–94.	1894–95.
Professors	19	20
Associate Professors	6	5
Assistant Professors	14	17
Instructors	52	52
Assistants	26	21
Lecturers	27	22
Total	144	137

The reduction in numbers, from 1893–94, is due to the fact that last year, in consequence of the death of Professor Norton and the resignation of Professor Levermore, we called in an extraordinary number of lecturers from the outside.

There appears, likewise, to be a smaller number regularly engaged in the work of teaching. This is due to the return from Europe of two of our young instructors who last year were absent, yet borne upon the roll, while their places were supplied by substitutes.

The instructing staff for the year 1894-95 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 . . . . (20)	1	1	1	1	2	2	2	1	1	2	1	4	..	1	..
Associate Professors (5)	3	1	1	..	..	..	..	..	..	..	..	..	..	..	..
Assistant Professors (17)	..	3	..	..	1	5	1	..	1	1	2	2	1	..	..
Instructors . . . . (52)	3	5	1	1	2	11	7	2	1	4	3	5	4	..	3
Assistants . . . . (21)	3	6	..	..	..	5	1	1	..	..	..	..	2	..	3
Total. . . . (115)	10	16	3	2	5	23	11	4	3	7	6	11	7	1	6
Lecturers . . . . (22)	1	..	1	..	5	5	7	3	..	..	..	..	..	..	..
Total. . . . (137)	11	16	4	2	10	28	18	7	3	7	6	11	7	1	6

In connection with these references to the Faculty and the corps of instructors, it may be interesting to note that, at the Columbian Exposition at Chicago last year, a Society for the Promotion of Engineering Education was organized, Professors Lanza, Swain, Burton, Porter, and Allen participating in the movement and presenting papers on the subject, Professor Allen acting as Secretary. On that occasion Prof. De Volson Wood was elected President, he being the oldest teacher of Civil Engineering in the country, with a service approaching fifty years. In the meeting held at Brooklyn in

August of this year, there were present Professors Lanza, Swain, Tyler, Porter, and Allen, and also Instructors Stanwood and Robbins. Four papers from the Institute were presented. At the close of the meeting, Professor Swain, the head of our department of Civil Engineering, was elected President for the ensuing year. I may also mention that Professor Swain was appointed by the Mayor a member of the Subway Commission for the City of Boston.

Examinations.

A change of very great importance in the general system of the instruction at the Institute has taken the direction of doing away with a large part of the examinations heretofore conducted. It has long been within the discretion of members of the Faculty to dispense with examinations in the third and fourth years, in such subjects as they might select for that purpose; and this discretion has been availed of to no inconsiderable extent, final marks in those subjects being given upon the strength of the term's work in class-room or drawing-room. But with respect to all the subjects taught in the first year, and to nearly all taught in the second year, examinations have been held at the close of the half-year, and again at the close of the year. The results of these examinations, qualified always to a certain extent by the daily and weekly record of the student, have determined his standing and chiefly made up his record.

This system has not been entirely satisfactory to our teachers, although the evils of examinations are often grossly overstated in public discussion. But the Faculty have not until the last year seen their way clear to institute a reform, or rather to make an advance in this direction. At the beginning of the second half-year, however, — namely, in January, 1894, — an announcement was made that in all but three studies of the first, and in most of the studies of the second year, the students' records would be made up from the results of current work, final examinations being dispensed

with. It was announced that this scheme was adopted only tentatively; and that the Faculty would be governed by their observation of its effects in dealing with the question for the future. So admirably, however, did the change work in respect to the half-year, that, at the beginning of the present session, the Faculty decided to make it permanent.

The Faculty wish to have it distinctly understood that they neither purpose nor desire, so far as they are at present informed, to dispense with all examinations. They believe that the mental attitude of examination is one which the student should learn upon occasion to take. They believe that it is a good thing for a young scholar to be at times required to pull himself together, review his subject, and come up prepared to be examined upon the whole length and breadth of it. This is something which he may be called upon to do in subsequent professional study or after life; and the Faculty believe that the students of the Institute should, from the first, and all through, have this as a part of their training; but they also believe that in the past there have been too many examinations, and that the occurrence of these, at the end of each half-year, has brought too severe a nervous strain upon the students, and especially upon those who were of an anxious and excitable temperament. The reduction of examinations to one-half or less of the former number will suffice to retain in the student the habit of examination, and teach him to get-up all of a subject for a searching review, and at the same time reduce the pressure of the closing weeks of the term to a point which will not be excessive.

The Faculty were well aware, before they took this important step, that it meant a great deal more work for the instructors. The system of final examinations cannot fail to diminish the intentness with which a teacher follows his several pupils from day to day, and from week to week, as to the degree of their progress and efficiency. No matter how conscientious a teacher may be, if an examination is coming, in which he can test the attainments and capabilities of his pupils, he will watch their current work with much less

of closeness and scrutiny. If, on the other hand, the student's standing is to be determined, in the grand result, by the performance of his daily tasks, every instructor must feel under a great urgency to note, each time, as carefully as possible, the character of each student's work, so that at the end he may be prepared to report with justice. In a word, the abolition of examinations transfers the strain from the student to the teacher. All this the Faculty and the corps of instructors fully understood and appreciated when they undertook the new system; and they were glad to take the additional labor upon themselves, in order to afford relief to their pupils. The readiness with which the Faculty made the change in respect to final examinations is not to be compared with the readiness with which they continued the system after trial; our teachers are, indeed, enthusiastic in their commendation of the results. Perhaps the best field for the experiment was in the first-year Chemistry, which constitutes one of the severer courses of that year. Here the results were notably fortunate, the number of students receiving "Credits" being largely increased, while the number of failures was largely diminished. The students knew from the beginning that they were every day making their own record; and that no cramming or grand effort toward the close of the term would suffice to make good any degree of neglect or inattention during the earlier part of the course. This rendered them anxious from the first to understand all the matters brought before them, and caused them to resort to the teacher for explanation or for additional information, if they were not satisfied that they had really got hold of the subject. On the other hand, Professor Pope and his associates threw themselves into the work with energy and enthusiasm, determined to make the scheme a success, and carefully looking after every student who, from any cause, seemed to be dropping behind in his studies.

But, while the system of dispensing with final examinations for a great part of the subjects taken, has thus been shown to be successful, provided students and teachers co-operate to

make it so, it ought to be very strongly and positively stated that such a system would be ruinous to the scholarship of any institution where a high standing was not continuously maintained, and where teachers were not scrupulous and conscientious in giving marks. Where laxity in these respects exists, the adoption of this scheme would be fraught with the greatest danger. Even the most indulgent or indolent instructor finds himself keyed up to a certain degree of judicial severity on the occasion of a semi-annual examination; and he cannot possibly allow inattentive or unfaithful students to pass from one class to another without at least knowing that he does so. Remove this safeguard from the instructor; and the tendency to looseness, easy good-nature, and unfaithfulness in teaching will be multiplied many fold. The Corporation, however, need feel no anxiety regarding the result at the Institute of Technology. The standard of scholarship here has ever been maintained with absolute honesty and unwavering fidelity.

In this immediate connection, the Corporation will be interested to learn that the Faculty have abolished the "Honor" mark at examinations and in reports of term-standing. The Faculty have been moved to this by the feeling that some young men, after mastering their subject as far as would really be needed for scholarly, or for subsequent professional, purposes, have been prompted, by too keen an ambition for a conspicuous record, to exert themselves unduly. The abolition of "Honors" leaves the "Credit" mark the highest given. This means that the student has done well; and well is enough.

Official Advisers.

Another step which has been taken for the benefit, as is hoped, of our students, during the past year, has been the institution of a system by which each new student, on coming to the Institute, whether as a first-year student or to enter one of the upper classes, receives a note from the

office of the Secretary, informing him that some member of the Faculty or staff of instruction, named therein, has been asked to act as his adviser. The number of students thus introduced to an individual member of the instructing staff averages between four and five. The system was put into operation at the middle of the last school-year, and was again brought into use at the beginning of the present year. The Faculty do not look to it for any very great effect. It is not intended that the advisers thus constituted shall become in any sense the guardians of the students assigned to them; nor does the Faculty by this action assume any responsibility for the conduct and deportment of the students outside the halls of the Institute. The object of the rule is only to give each student, newly arrived, the means of readily obtaining friendly advice and, possibly, assistance upon any or all matters of interest to him. It is, of course, to be anticipated by every one who knows anything about boys and young men, that some students will be shy and backward in availing themselves of the proffered service. Perhaps the very men to whom the system, if availed of, would do the most good, will be in this class. There are all kinds of young men; and among the students of any institution there will be some who will not readily respond to personal advances. But it is believed that by far the greater part of the students of the school, on arriving at the Institute, will make use of the opportunity thus afforded them to form a personal acquaintance with the instructor; while, in many cases, the slight acquaintance involved in the formal carrying-out of this rule will lead to friendship, perhaps to personal intimacy.

Instruction in Military Science.

By the requirements of both the Act of Congress, July 2, 1862, and the Act of the General Court of Massachusetts, April 27, 1863, military instruction is required to be given to the students of the Institute of Technology. That instruc-

tion is, for reasons which seem good to the Faculty, given to the students of the first year.

I spoke of the past history of this department, in my Report of 1892. I will now speak of the instruction as it has been rearranged by the Faculty, in conference with Captain Bigelow. All students of the first year are required to take this course unless excused on the ground of being aliens. Inasmuch, however, as many of the young men may, from one cause or another, be disabled for actual drill in the ranks and with arms, a standing committee of the Faculty hears all applications for excuse on physical grounds; and the students thus excused are required to take the course known as B. The remainder of the class take the course known as A, which embraces both practical and theoretical instruction, comprising one lecture and one drill of two hours per week. The lectures cover the subjects of strategy, tactics, and fortification.

For the purposes of the drill, which, by the courtesy and hospitality of the Commonwealth and of the officers of the First Regiment of Massachusetts Infantry, takes place in the South Armory, the corps of cadets is organized as a regiment of two battalions of two companies each. The number of students composing the battalion is two hundred and seventy. A new uniform has been adopted, consisting of a cap, blouse, and trousers of dark blue, of the same pattern as that of the undress uniform of the United States army.

Course B, arranged for those students, fifteen in number, the present year, who have been excused from actual drill, consists of two lectures a week. The lectures cover about the same ground as those given in Course A, but are supplemented by additional illustrations and theoretical problems. Extensive notes, with diagrams and illustrations, are prepared by Captain Bigelow, and printed by the Institute from time to time, to be used in connection with these lectures. These notes will aggregate a small volume of perhaps two hundred pages. In arranging the order of instruction, Captain Bige-

low has, for what seem to me excellent reasons, departed distinctly from the practice usual in military schools, where tactics are taught before strategy. Captain Bigelow's reasons for inverting this order are first, that, to the average mind, strategy is much more interesting than tactics, and he thinks it best to try at the outset to awaken an interest in the course and thus secure the attention of the class; secondly, that the students are better prepared on an average, when they enter the institution, for a course in strategy than for a course in tactics, the former being far less technical.

The following account of the course of instruction in the Armory may not only have interest in itself, but may indicate how far the system of organization and discipline pursued may be of professional use in after life in dealing with bodies of men. As soon as practicable after the cadets are enrolled, the four best qualified are selected to fill the positions of captains. For this purpose two examinations are held, — one in writing, covering the drill regulations as far as the school of the battalion, inclusive; and one in drilling and commanding, which is held in the Armory. All cadets are allowed to take part in the first of these examinations, and all who reach a certain standard there are allowed to take part in the second. The captains being appointed, they recommend, from among the cadets who have passed the before-mentioned examinations satisfactorily, the officers and non-commissioned officers for their respective companies. Every company lieutenant and non-commissioned officer is appointed upon the recommendation of the company commander, who is held responsible for the standard of instruction and discipline attained in his company.

Each company is divided into four squads, each comprising one sergeant and one corporal. The sergeant, as chief of squad, is responsible to the captain for the progress made in his squad; each lieutenant is given two squads to superintend. The drill commences with the school of the soldier without arms. Each cadet, as he qualifies therefor, is examined by the commandant with a view to his advancement

to the school of the soldier with arms. If he passes this examination, he drills in the advanced school of the soldier until he passes an examination for promotion to the school of the squad. In this school, he practises marching in line, turning, wheeling, and the firings. The squads are drilled in this collective school until they are found by examination to be proficient, when they are consolidated into companies. The companies are similarly examined before they are consolidated into battalions. The smallness of the battalions resulting from the regimental organization insures to each battalion sufficient room, — each battalion having the whole drill floor in turn; and a small battalion can execute more movements in a given time than a large one. The regimental organization, moreover, provides for the appointment and training of a larger number of field and staff officers than would be the case with only one battalion.

The military department aims at instructing the cadets not only as soldiers, but as citizens. As soldiers, they are taught a certain amount of military science, which may be regarded as a fair foundation for such study as they may care to pursue as militia or volunteer officers, and are familiarized in the Armory with the system by which raw recruits are qualified to take their places in the ranks. There is not time to instruct them in marksmanship; but every cadet is put through a systematic course of drill in the other regular exercises of a young soldier. The object is not to make a model organization, but to afford an object lesson in the system by which an organization is produced from raw material. In this country, if not in every country of the present day, it is the people and not the soldiers who decide the great question of peace or war, and determine the military policy of a nation. The course of instruction is directed with a view to preparing the graduates of this institution for an intelligent discharge of the duty of citizenship in time of war or of rumors of war; to forming among them centres of sound public opinion in military matters. It aims also at contributing to the effect of the literary and historical courses of the institution in broadening

the minds of the students by instructing them outside of their strictly technical departments. The science of war is deemed worthy of consideration as an element of liberal education. What the students learn at this institution of the theory and practice of war can hardly fail to increase their interest in the large province of general history which is taken up with the description of wars. Though war should cease forever, the study of war will ever be profitable as the key to the significance of a vast literature. A term of service as a cadet at the Institute may assist the student of history, as Gibbon's experience in the militia helped him to write his story of the Decline and Fall of the Roman Empire.

The Libraries.

The growth of the libraries during the past year has been marked by a considerable decrease in the number and cost of books purchased, and by a much larger increase in the number and value of gifts. The following table shows the growth for the last five years.

	1889-90	1890-91.	1891-92.	1892-93.	1893-94.
Accessions by gift . .	850	2,737	1,470	2,072	3,204
Accessions by purchase	1,446	2,002	2,354	2,448	1,936
Accessions by binding .	159	452	430	630	730
Total accessions . .	2,455	5,191	4,254	5,150	5,870
Cost, including binding	$2,249.83*	$4,221.00	$4,564.86	$5,146.41	$4,789.69

The net accessions have been 5,652, of which 4,045 are volumes and 1,607 are pamphlets. The distribution and cost of these accessions and the total number of volumes in each departmental library are shown in the following table: —

* Exclusive of binding.

Library.	Volumes added.	Pamphlets added.	Cost.	Pamphlets (bound and unbound) already catalogued.	Total number of volumes.
General	721	471	$354.14	2,568	3,814
Engineering.	877	236	1,374.95	2,360	5,424
Mining	106	55	120.70	238	1,382
Architectural	180	47	240.40	138	1,382
Chemical	382	158	661.16	1,310	5,805
Biological	189	71	324.79	277	1,612
Physical	516	83	735.39	586	4,361
Political Science . . .	752	170	663.04	2,387	6,764
English	188	4	221.49	35	1,838
Geological	132	311	93.63	598	1,520
Margaret Cheney Room	2	1	. . .	12	562
Totals.	4,045	1,607	$4,789.69	10,509	34,464

The number of periodicals received has been 419, and of annuals and serials, — not including official reports, — 96, a total of 515. The cost of the periodicals has been $1,515.21, and the expenses of the librarian's office $119.50, making the total amount spent on the libraries, exclusive of salaries, $6,424.40; 4,057 cards have been added to the main catalogue, which now contains 31,739 cards; 951 orders for binding have been given, covering 1,716 volumes, at a cost of $1,206.72. 1,253 separate orders for books were given; 212 were returned to the departments as duplicates, of which only 23 were re-ordered.

During the year a shelf-list of the Chemical Library has been prepared, under the direction of the librarian, in such a manner that it serves as a partial substitute for a regular subject-catalogue. The completion of this list made it possible to take an account of stock in the library for the first time. The great need of this was proved by the fact that over 200 discrepancies were found to exist between the cards and the shelves or pamphlet boxes, and over 150 volumes and pamphlets were missing. Many of these were simply out of place in the library; others were found by a careful search through the laboratories and offices of the department, having been taken out without registration. There were left unaccounted for,

finally, 20 volumes and 11 pamphlets, as the total loss in eight years from a library now amounting to nearly 6,000 volumes and 4,000 pamphlets. A similar examination of the Physical Library showed a loss of five volumes during the past year. From the Engineering Library, only two volumes were lost, although many more had been taken out by instructors without registration. As these three libraries contain one-half of all the books in the Institute, a total loss of about 20 volumes a year is indicated. It is desirable that shelf-lists of the other libraries should be prepared; but the work of the librarian's office is so great, at least during term time, that these cannot be undertaken.

As has been stated before, the gifts of the year have been larger and more valuable than usual. Besides the many gifts of single or a few volumes, the Institute has received and placed on the shelves the following: —

From the United States Government, largely to complete our sets, 300 volumes and pamphlets.

From Mrs. Henry Draper, of New York, 195 volumes, including many illustrated architectural works, and valuable sets of scientific periodicals.

From Dr. H. Carrington Bolton, of New York, 126 pamphlets, mainly on chemistry.

From Dr. Henry P. Quincy, from the library of the late Edmund Quincy, Jr., 71 volumes.

From the Honorable George Duncan, of Boston, 22 volumes on engineering.

From Mrs. William B. Rogers, $200 for the purchase of periodicals.

The purchase of books from the Pope Fund has been continued.

Printed Notes.

In a previous Report I referred to the practice which has grown up at the Institute of printing extensive notes, with tables, diagrams, etc. for the use of students in the several departments. Few features of our scheme of instruction are

more characteristic than this: indeed, it is fairly a question whether without it we could possibly carry forward our more technical courses, keeping not only abreast, but ahead, of professional practice. Text-books, as is well known, are often from five to fifteen years behind time. A reference to the details of the Treasurer's Report, accompanying, will show that during the fiscal year, 1893–94, an expenditure on this account reached the surprisingly large total of $3,276.20. These notes are sold to students at cost. The receipts from this source were $2935.31. The difference may be assumed to represent the balance of notes on hand, most of which will be disposed of during the present year.

Summer Schools.

The Summer School in Topography, Geodesy, and Geology was held during June last, at Keeseville, N. Y., the same location in which the school was held in 1893. Eighteen students were in voluntary attendance, being more than one-half the total number of students in the Junior year in Civil Engineering. The work was conducted by Professors Burton and Porter, assisted by Mr. Robbins, Instructor in Civil Engineering, and by Messrs. Nichols and Stose of the Geological Department. The plane-table survey of the surrounding region, which was begun in 1893, was extended over an area of 1,600 acres. The base line was again measured, the experiment being made this year of using a brass tape in conjunction with a steel tape. Besides the work during the day, measurements were, for the first time, made during the night, thus gaining the most uniform atmospheric conditions attainable. This year, for the first time, work was done with the new precise level, a line of levels being run along the bank of the Ausable River. The hydraulic work was much the same as last year, and consisted of measuring the discharge of the Ausable, and that of the flumes at Keeseville, with floats and current-meters of various kinds. The current-meters were also rated in the lake. The geological work consisted in

making geological profiles, in studying the geology of the surrounding country, and in visiting various points of geological interest. Many interesting specimens of rocks and fossils were obtained. The school was in every way successful and satisfactory.

The Summer School of Mining last June was held in Nova Scotia and Cape Breton. Eight days were devoted to the study of mining and milling at Waverly, near Halifax, where the mines are managed by Mr. J. E. Hardman, M. I. T., '77. Here we see, adapted to Nova Scotia conditions, the modern method of mining, whereby the work of prospecting of ore-bodies is kept well in advance of the work of extracting the ore, thereby transforming the industry from a fluctuating, now prosperous, now declining business, into a steady industry, in which a number of years of profitable work can be seen ahead, and the financial and engineering plans worked out to the best advantage. The work done by Mr. Hardman has shown that the pockety mines of Nova Scotia lend themselves readily to this treatment. His handling of the gold-milling problem has been quite as systematic. In such a well-ordered establishment as this the students had a fine opportunity for professional work, and they availed themselves of it with the greatest eagerness.

In Cape Breton, three weeks were spent by the students as guests of the Dominion Coal Company. The company has adopted the system of mining coal, generally, by the methods and appliances that were in use at the time of purchase of the different properties, but replacing the older methods with new and modern ones as rapidly as their efficiency could be proved and their adoption safely effected. Under these conditions, the company selected the Gowery Colliery at Cow Bay as that best adapted for the Summer School. In it the students spent a period of ten days, and had a fine opportunity to look into the methods of mining levels and rooms, of leaving pillars to support the roof, and into all the operations included in excavating, hoisting, and shipping coal. In another part of the Dominion Coal Company's property, — namely, on the Vic-

toria Areas, — the company had a stratigraphical problem on their hands. Authorities disagreed in regard to the continuity of a certain coal-seam. The students had the great privilege of working upon this problem, and were so fortunate as to gain facts which pointed toward its definite solution. It was here they obtained their practice in geological investigation.

The party was divided for the Cape Breton work, one squad working at the Victoria areas with Professor Richards, the other at Cow Bay with Professor Hofman and Mr. Lyon. At the end of ten days the squads changed places, each picking up the work where the other had left it. During the stay in Cape Breton, the Dominion Coal Company placed every facility at the disposal of the Summer School in the most liberal and kindly way, even to the furnishing of a guide to the geology of the region. The thanks of the members are especially due to Mr. John E. Hardman, of Nova Scotia, and to Messrs. H. M. Whitney, David Mackeen, J. S. Lennan, J. W. Revere, T. J. Brown, and A. M. Evans, Officers of the Dominion Coal Company. Before returning home, the whole party spent a very instructive day at the Sydney Mining Company's mine, and enjoyed the hospitality of the manager, Mr. Brown. On the Fourth of July they visited the Coxheath Copper Mine, and were hospitably entertained by Colonel B. Granger and President I. P. Gragg.

The Summer School of Architecture was begun in 1893 at Chicago, the World's Fair offering an exceptional opportunity for comparative study of both foreign and domestic art and construction. In 1894 the school was held in Salem, Portsmouth, and vicinity, for the study of colonial architecture. The class was met everywhere with the greatest courtesy, and the result is a great amount of measured work with sketches and photographs. The study of this architecture is of peculiar value as being the only historical precedent we can refer to in this country. We are also in the centre of the choicest of this work, and in the future we hope to make an exhaustive study of it. The work of both years has been under the supervision of Assistant Professor Homer.

The past year has also witnessed the tentative introduction of a limited amount of summer instruction in the laboratories and lecture-rooms of the Institute, by members of the instructing staff, though not as a part of any required course. These summer classes had the character of private instruction, and were conducted without expense to the Institute. While receiving Faculty sanction, they were conducted without supervision, or assumption of responsibility, on the part of the Faculty. The courses were primarily intended for the students of the Institute, but were open to other persons who could show suitable preparation. Nearly all of them were embraced within the first six weeks of the summer vacation.

The first proposed and the largest of the summer classes was that in Analytical Chemistry, conducted by Professor Talbot, with an attendance of twenty-four. This number included students who availed themselves of this opportunity to make up arrears; students who desired to obtain practice in chemical manipulation, in addition to that possible in the hours allotted to chemical work in their respective courses; students taking Institute courses in which Analytical Chemistry is not regularly included; and two persons not students at the Institute. A course in General Chemistry, designed with special reference to the needs of teachers, was given by Professor Bardwell, beginning in July, and was attended by three persons, not students at the Institute. Dr. Evans also conducted a course which included Organic Chemical Analysis and Organic Preparations. This was attended by five from among the students of the chemical course who had completed the work of the third year.

In the Department of Languages, Professors van Daell and Dippold presented a course of instruction in French and German, which was attended by eight students. Mr. Wendell gave a course of lectures and recitations on General Physics, with three students. The Mathematical Department presented two courses, — that by Mr. George, on Integral Calculus and Analytic Geometry, attended by six students, and that by Mr. C. M. Faunce, on Descriptive Geometry, attended by eight students.

The small attendance at many of these courses was doubtless due to the lateness of the conception and execution of the scheme, the announcement having, for reasons applying to the past year, been made but a very short time before the school closed. The earnest spirit manifested by those who did avail themselves of the advantages offered furnishes unquestionable evidence that there is a real demand for such opportunities to utilize a portion of the long summer vacation in making up arrears, or in gaining additional experience in professional work. It is probable that the Faculty will authorize the continuance of the system thus begun, and that upon a larger scale.

Gymnastics and Athletics.

In considering the matter of gymnastics and physical exercise at the Institute, it should be borne in mind that a very large proportion of our students do not reside in the vicinity of the school, but have their homes in the suburban districts and towns, or even at a considerable distance from Boston, as shown in my last Annual Report. These students must, in general, be presumed to get their exercise at home, or to take it in their coming and going. In the first year, also, the military drill answers many of the purposes of a gymnasium, not only in the actual exercise involved, but also in "setting up" the men and teaching them how to carry themselves easily and well.

It is gratifying to report a continued increase in the use of the gymnasium. The instructor in charge, Mr. Herman Boos, has shown intelligence and zeal in promoting physical exercise, and in forming classes for systematic bodily development. These classes are given regular practice, five afternoons in the week, with the dumb-bells, Indian clubs, chest weights, etc., as well as in the so-called "apparatus" work. The large floor of the gymnasium, 150 by 50 feet, is first subject to the demands of the regular classes; but, in addition to these, great numbers of students, many of them already well instructed, pursue feats and games at their own pleasure, while

the members of the several "teams" prepare themselves for the contests before them. It is much to be regretted that the Institute has not an athletic field and larger gymnasium facilities. At the same time, the position of athletics here is not by any means unsatisfactory. The students in general understand perfectly well that this is a place for men to work, and not for boys to play; and they organize their athletic teams and carry on their contests in a very sensible and practical spirit. It is, of course, impossible to organize championship teams without a very large sacrifice of scholarship; but our young men, without, for example, entering any foot-ball league, play with all comers for sport and exercise. This is the spirit in which athletics should be pursued in an institution like our own, where the demands of scholarship are severe. On the other hand, in individual athleticism, where the requirements of practice are far less exacting, the Institute men do exceedingly well. At the athletic "meet" in Worcester, in the spring, our students encountered competitors from ten colleges of New England, and carried off the honors by the very handsome score of thirty-eight out of one hundred and twenty, making, it will be seen, almost exactly one-third of all the points. Such a result shows that in respect to individual physical development our students suffer by comparison with no institution; and that failure to receive championship honors in team-work is due, not to lack of strength or of swiftness, but to the fact that study is here held to be the prime object of college life.

Association of Agricultural Colleges.

During the year the Institute has become a member of the American Association of Agricultural Colleges and Experiment Stations, which now includes nearly all the institutions receiving aid under the Morrill Acts of 1862 and 1890. The Secretary of the Faculty, Professor Tyler, attended the Annual Convention at Washington, in October last, as a representative of the Institute. In many States, those colleges represent the

highest educational standards there existing; and the further co-operation of the Institute is desirable, not only on account of our common interest in matters of legislation, but as a means of strengthening the general cause of education in the mechanic arts contemplated by the original Act of 1862.

The New Boiler-House.

There have been no structural changes in the buildings occupied by the Institute during the past year. An addition has, however, been made to our plant by the construction of a boiler-house on the Trinity Place lot, from which the engineering and the architectural buildings will hereafter receive steam directly, for heating and for power. Five years ago, when the Engineering Building was constructed, it was decided to send over the steam from the basement of Rogers Building, through a six-inch pipe, having the Emery system of joints and packing. This system has been in use now for five years, with a tolerable degree of success; but the increasing leakage from the settling of the ground and the constant imminence of a possible disruption, which would leave these two important buildings for some time without steam either for heating or for power, taken in connection with the increased demand for steam due to the construction of the Architectural Building in 1892, and the steadily extending work in the Laboratory of Steam Engineering, — all these causes combined to make it undesirable any longer to supply the Trinity Place buildings from the central battery. A boiler-house, thirty-four by forty feet, containing two one-hundred horse-power boilers, from the Roberts works at Cambridgeport, has accordingly been erected during the past summer, and is now in use. It is believed that the economy of coal thus effected will offset no inconsiderable part of the cost of constructing and maintaining this new source of steam supply. At the same time, I am disposed to think that the action taken in 1889, in respect to this matter, was wise, under the circumstances existing at that time.

We were not in possession of either the skating-rink lot or the Jordan land. It would have been impossible for us then to determine upon the best location for a steam plant. Any decision we might have reached in regard to a boiler-house for supplying the engineering building alone would have been very likely to prove unfortunate with reference to the entire tract we now own. I believe that it was worth all it has cost to postpone the decision of that issue.

The Courses of Instruction.

Mathematics. — The advance in the entrance-requirements in Mathematics, referred to last year, has now taken effect on the work of the present first-year class. Of the optional requirements in Advanced Algebra or Solid Geometry, about three-fourths of the applicants offered the latter, and the results of the examinations in both subjects were as favorable as could have been expected. Of the June applicants the present year, only fifteen entered with conditions in Solid Geometry; only five with conditions in Algebra. The mathematical work of the first year now begins with Algebra for those who have passed in Solid Geometry, and with Solid Geometry for those who have passed in Advanced Algebra; but becomes uniform for all upon the introduction of Trigonometry, at the end of eight weeks. The question of a further rearrangement of mathematical courses in the second and third years is still under consideration by the Faculty.

A few years ago the Mathematical Department obtained a number of models; and it was then the expectation that this collection would be increased by similar amounts from year to year. If this expectation had been realized, the department would now be in possession of a complete set of these extremely useful aids to mathematical instruction. No additional models have been acquired as yet; but it is hoped that provision may soon be made for this object. The department also feels very strongly the need of a few hundred dollars for the purpose of supplying the library with

standard works published in the past, the annual appropriation being hardly more than sufficient to provide for new publications.

History. — In my Report of last year, I explained the measures which the Executive Committee had taken to meet the exigencies arising from the unexpected resignation of Professor Levermore. The members of the Corporation will remember that the vacancy thus created was to a considerable extent met by the appointment of special lecturers for the year; namely, Dr. John Fiske, of Cambridge, and Professor Jameson, of Brown University, in American History; and A. Lawrence Lowell, Esq., of Boston, on the Recent Political History of Europe. In addition to these powerful reinforcements to the Department of History, an additional instructor was appointed. Of the work thus provided for, as well as his own, Professor Currier assumed a general oversight, and conducted the department during the year with marked ability. A special effort was made to improve the history given to the whole class, in the second term of the first year; and it is believed that the decided success achieved will be made permanent. More satisfactory results at this stage cannot fail to have a favorable influence on the subsequent historical and economic studies of the class. For the present academic year, it has not been thought necessary to secure lecturers from abroad, the force having been sufficiently strengthened by the appointment of Mr. Sumner.

Modern Languages. — The department library is increasing as fast as its slender appropriation allows. The policy has been to buy standard books of reference, and this should be continued for years to come. I have already referred to the importance of an increase in the number of teachers in this department. We ought to have one more instructor in French, and one more in German, so as to give each pupil a larger amount of personal drill. One point of extreme importance in regard to the modern languages is our relations to the preparatory schools. If we could ask, and I feel that the time is drawing near when we can ask, the offering of both

elementary French and elementary German, or, as a substitute an advanced examination in one of the two languages, our Institute course might take what must be its ultimate shape, namely, a more special training in the use of scientific French and scientific German, and, not least important, direct the students toward a broader comprehension of the literatures both of France and Germany, and of the civilizations of these countries. Then it would also become possible to develop options, either in the more advanced study of French or German, or in Spanish or Italian; and this could be done without encroaching at all on the attention necessarily given to technical studies. Indeed, in many cases we might expect to relinquish a part of the claim which the Modern Language Department must now make on the time of nearly all students. The schools are in many cases ready and even desirous to meet us; the circle of careful and consistent preparation is enlarging every year. Many institutions, even in distant parts of the country, are trying to introduce the New England standards. This must soon bring with it, as a matter of course, the ready acceptance of enlarged requirements.

English. — The policy of the department is to emphasize two lines of work. The first is the training of the student to write correct and practical English; the second, the broadening of his thought and culture through appreciative familiarity with literature. The correction, by this department, of technical memoirs prepared in other departments, is found to be most advantageous; and the continued effort is to make all work in composition as practical as possible. In regard to literary training, it is felt that, although so much time is necessary for the technical training of students, attention should still be given to general culture. The need of broadening the mind is all the greater because of the tendency to concentration which is the inevitable result of technical courses. A change has been made in the course of literature which is given to all second-year students. The entire class is now brought together for weekly lectures by the head of the department, and is divided into sections for further instruction and for

written work. This method promises good results, and is apparently regarded with favor by the class as well as by the instructors.

Having spoken thus far of matters common to all departments of the school, or to several of them at once, let me now proceed to speak, in more detail, of things which particularly concern individual courses.

Courses I. and XI., Civil and Sanitary Engineering. — I have already mentioned Mr. Lyon's appointment as instructor. Inasmuch as the number of assistants is the same as last year, the total teaching force of the department has been increased by one instructor. The number of students in the two courses is greater than ever before, the total in the three upper classes being one hundred and one. No important changes have been made in the course of study, which is found well adapted to the needs of the profession. Increased attention is being given to instruction in Geodesy, though it is not expected that the number of students desiring to pursue this subject in detail will be large. The geodetic work in the room on Myrtle Street, which was referred to in the last Report, was continued throughout the past year, to the great advantage of the students in the geodetic option. This year a similar room will be engaged during the second term. It is again necessary to emphasize the pressing necessity of our having a separate building, on firm ground, suitable for the special work in this option. A feature of the work last year was the series of pendulum observations carried on at the State House by two observers from the Coast Survey, sent here by Professor Mendenhall, Superintendent of the Survey, at the suggestion of Professor Burton, for the special purpose of determining the value of the force of gravity by pendulum observations. The students in Geodesy were permitted to take part in the work. A separate pier for the astronomical transit was erected at the expense of the Institute; and through the kindness of the architect of the State House Extension, Mr. Charles Brigham, a room was secured in which the pendulum observations were made. In the development

of the geodetic work, the transit used in running the line of the Hoosac Tunnel, which was obtained from the State some years ago, is now being altered so that it may serve as an astronomical transit and zenith telescope, for time and latitude observations. With this and the German altazimuth instrument purchased a short time ago, together with our usual instruments, we are sufficiently equipped for giving such a course in field astronomy as is necessary in a school which does not undertake to teach astronomy in detail. If the work in geodesy is to be still further developed, the special building referred to should be provided, and equipped with some additional instruments, such as pendulums, chronometers, and chronographs. Unless additional space is given, the geodetic work cannot be developed much, if at all, beyond its present condition, although the class-room instruction will, of course, be made to keep pace with the advances in the science.

The apparatus in the Hydraulic Laboratory has been increased since my last report by two very important pieces of apparatus; namely, a Pelton wheel and a large weir tank. The Pelton wheel is four feet in diameter, giving about thirty horse-power under a head of one hundred feet. This head has several times been exceeded in the work of the laboratory. The wheel is set up complete, with gate, piezometer connections, and brake, so that it can be and is regularly run in class tests; and the wheel itself is enclosed in a wooden casing with glass sides, so that its operation can be seen. It is, in every respect, a very interesting piece of apparatus, and a valuable addition to the equipment of the laboratory. The weir tank is about five by ten feet, and three feet high, is arranged with screens, and conforms in all respects to the conditions necessary in a standard weir. Moreover, the length of the weir is adjustable, so that complete sets of experiments can be carried on for determining the coefficients of discharge for weirs of different lengths, thus giving an opportunity for working in a field where experiments have been much needed; namely, with very short weirs. The weir can, moreover, be transformed into a weir

without end contraction; and the whole tank is so designed that it can be attached to the iron supply-tank, and used in connection with various other pieces of apparatus.

A Darcy-Ritter tube, of the standard French type, has been procured for gauging the flow in streams. This instrument, though used very commonly abroad, is seldom seen in this country. It was employed by our students in the work of the Summer School. The use of the nozzle, for measuring quantities of water, has assumed considerable prominence in the laboratory. It will be remembered that such a use of the nozzle, and the fact that, if properly made, it would serve as an extremely accurate water-meter, were first pointed out by a member of this Corporation, Mr. John R. Freeman. The experiments made in our laboratory have proved extremely satisfactory, and several new nozzles have been procured during the past year. In each case the nozzle is calibrated by direct measurement of the quantity discharged, thus determining its coefficient. The Blake pump procured last year continues to satisfy all requirements. There is need, however, of another rotary pump. A description of the Hydraulic Laboratory of the Institute was written by Professor Porter, and published in the "Technology Quarterly," the journal of the New England Water Works Association, and in the "Engineering News." There still remain many fields of investigation requiring new apparatus, which we hope in the near future to be enabled to explore. The equipment of such a laboratory should be constantly increased, in order that the experimental work may be varied from year to year, and in order that the Institute may keep in advance in the experimental investigation of new problems in hydraulics.

Special mention was made, in the last Report, of the instruction in Highway Engineering, the development of which is largely due to the liberality of Col. Albert A. Pope. During the past year, this development has continued. Room 46 of the Engineering Building is now used as a museum of highway engineering. In it have been placed a number of full-size models of roads and pave-

ments of various kinds, together with samples of stone blocks, brick, wood, and other materials used in the construction of streets and highways. The Barber Asphalt Company has presented to the department a complete exhibit relative to asphalt pavements, comprising samples of the materials in various stages, with models of pavements and samples cut from existing pavements after different periods of use. Two road-builder's levels have been procured for the instruction in this department; and a new piece of apparatus has been constructed for testing the wearing-power of road-materials of various kinds.

During the past year, in addition to the regular instruction in Highway and Railroad Engineering, as described in my last Report, special lecturers were engaged as follows, — Henry H. Carter, Superintendent of Streets of Boston, upon the Work and Organization of the Street Department; Henry Manley, of the City Engineers' Department of Boston, on Streets and Pavements; Edward W. Howe, Engineer of the Boston Park Department, on Parks; Albert F. Noyes, of the Metropolitan Sewerage Commission, and formerly City Engineer of Newton, on Streets for Suburban Cities; and Ernest W. Bowditch on Landscape Gardening. Mr. Bowditch also lectured on the Plumbing and Drainage of Houses; Mr. Noyes on the Sewerage of the City of Newton; while the lectures of Mr. Freeman on Hydraulics of Fire Protection, and of Mr. Blodgett on Railroad Signals, were given as usual. Acknowledgment is due to President Tuttle of the Boston and Maine Road, General Manager D. W. Sanborn of the same road, and General Manager W. H. Barnes of the Boston and Albany Road, for courtesies extended to our classes, by means of which their work has been greatly facilitated.

In my last Report, I gave some statistics with reference to summer work done by students in Civil Engineering; similar statistics have just been collected for the past year. These show that of twenty-nine students in the fourth year in Civil and Sanitary Engineering, nineteen, or 65.5%, were employed in engineering work during the past summer. The average

time of employment was about 2.5 months, and the average pay received, about $60 per month. Of the present third-year class, including only men who were in the Institute during the previous year, 15 out of 41, or 36.6%, were employed during the past vacation. The average length of time of employment was about three months, and the average monthly pay received about $45 per month. These last results are less favorable than those of last year; but considering the business depression and the large number of persons, in all branches of industry, out of employment, they are not unsatisfactory. Many students, of course, do not seek such employment.

Course II., Mechanical Engineering. — The following apparatus has been added to the Laboratory of Applied Mechanics; namely: —

1. A pair of plate-holders, to be used with the Emery testing-machine, each weighing about 2,600 pounds, and capable of gripping plates up to eighteen inches in width and three inches in thickness.

2. Some new apparatus for measuring the angle of twist of shafts tested in the torsion-machine, of such delicacy that an angle of four seconds can be measured.

3. A new cement-testing machine, designed in such a way as to effect a gradual application of the load, and to have a large range.

To the other portions of the engineering laboratories have been added: —

1. An experimental steam-engine governor.

2. A four H. P. Otto gas-engine, a gift to the Institute, which will serve to run some of the apparatus which requires but little power, when steam is not available, and also to give the students a little practice in testing gas-engines, until such time as a larger one can be obtained. The four-foot Pelton water-wheel and the adjustable weir have been spoken of in connection with the instruction in hydraulics. Besides the above, the facilities of the engineering laboratories have been much increased by the addition of the two new boilers, in the

new boiler-house adjacent to the Engineering Building already referred to, inasmuch as we thus obtain a larger number of boilers upon which to make tests; and, moreover, care has been taken to insert in the settings, at suitable points, a series of porcelain tubes, from which to obtain draught-pressures and temperatures, and also samples of flue-gases for test; besides which, the new steel stack will furnish the means of experimenting on chimney-draught.

The regular work of the engineering laboratories is so conducted as gradually to accumulate a vast amount of data of value to the engineer, a large portion of this work forming part of some systematically conducted investigation. The desirability of publishing this material was called to the attention of the Corporation by Mr. Mills, in his report as chairman of the Visiting Committee on the departments of Mechanical Engineering and Applied Mechanics, in February last. In accordance with that recommendation, it has been decided hereafter to publish the results of tests regularly in the "Technology Quarterly," at such intervals of time as may seem best; care being, of course, taken to include only results which have been obtained in work done under such supervision as to insure the highest degree of reliability and accuracy. This publication is not to include special investigations made in the course of the thesis-work, since these latter, when suitable for publication, are issued as separate papers, whether in the "Technology Quarterly," or in the Proceedings of some engineering society, or elsewhere. It is believed that the publication of results from the regular laboratory work, as stated, will be of value to the engineering community, and will constitute a service to the public which it is very suitable the Institute should render. The first instalment appeared in the "Technology Quarterly" of July; and the second will appear in the December number. Among the investigations regularly carried on in the laboratory, it may be worth while to mention the following in connection with which a good deal of work has been done during the last school year; namely: —

1. Tests of the triple-expansion engine, under a variety of conditions of steam jacketing, with a view to determine the effect of different combinations.

2. A long series of tests on the Emery testing-machine, to determine the crushing strength of different kinds of wood in a direction at right angles to the grain.

The following is a list of printed notes and of papers published by members of the instructing staff: —

1. Notes on Steam-Boilers (printed for the use of the students), by C. H. Peabody and E. F. Miller, with a chapter on Boiler Design by P. Schwamb.

2. Some Experiences in Engineering Practice, by Hon. George Duncan, published in the "Technology Quarterly" of October, 1894, being the substance of several lectures delivered by him before the students of the Mechanical Engineering Department.

3. A paper on Engineering Laboratories, by G. Lanza, presented to the Society for the Promotion of Engineering Education in August, 1894.

4. A serial paper on Engineering Practice and Education, by G. Lanza, published in the "Journal of the Franklin Institute," beginning in May, 1894, being a series of lectures prepared by the author for delivery before the Lowell Institute, in 1893.

5. Stresses in the Rims and Rim-Joints of Pulleys and Fly Wheels, by G. Lanza, — a paper presented to the American Society of Mechanical Engineers, in December, 1894.

6. The Application of Brakes to the Truck Wheels of a Locomotive, — a paper presented by G. Lanza to the American Society of Mechanical Engineers in December, 1894, being an account of the thesis work of Messrs. F. H. Keyes and John W. Logan, of the class of 1892.

7. Some Tests of Spruce Columns, by G. Lanza and E. F. Miller, presented to the American Society of Mechanical Engineers in December, 1894, being the results of work done on the Emery testing-machine.

8. Tests on the Triple Engine at the Massachusetts Institute

of Technology (2d paper), by C. H. Peabody and E. F. Miller, presented to the American Society of Mechanical Engineers in December, 1894, being an account of the recent results obtained in the course of the investigation which has been already referred to.

9. A Dynamic Steam-Engine Indicator-Tester, by C. H. Peabody and E. F. Miller, — a paper presented to the Society of Naval Architects and Marine Engineers, November, 1894.

10. A New Torsion-Machine, — a paper by E. F. Miller, published in the "Technology Quarterly" of December, 1893.

11. The Efficiency of Jack-Screws, — a paper by E. F. Miller and W. A. Johnston, published in the "Technology Quarterly" of December, 1893.

The lectures given by gentlemen from outside to the students of the fourth-year class in Mechanical Engineering, attended largely by members of other engineering departments, have been of great interest. The list is as follows: —

1. Mr. Taylor gave an account of an experimental investigation, lasting nine years, and made by himself in the machine-shop of the Midvale Steel Company, upon the Transmission of Power by Belting, with a description of the results.

2. Hon. George Duncan, formerly of the firm of Maudsley & Sons, engine-builders, in England, gave several lectures on Some Experiences in Engineering Practice.

3. Mr. Eliot C. Clarke, Treasurer of the Boott Cotton Mills at Lowell, Mass., gave a lecture on the Business Management of Corporations.

4. Mr. George L. Roberts, of counsel for the American Bell Telephone Company, gave a lecture on the Relations of Patent Law to Engineering.

5. Mr. C. C. Bowers spoke on Marine Engineering.

6. Mr. E. V. French spoke to the students of the Locomotive Option on Railroad Signals.

Course III., Mining Engineering and Metallurgy. — In the Mining Department, the year has been a prosperous one. The number of students, regular and special, following the

course gives proof that it is fulfilling its purpose. This year the numbers are: —

Second year	13
Third year	11
Fourth year	13

The work of the department has been continued with unabated zeal during the past year. Three new muffle-furnaces have been added, to meet the needs of the larger classes. A new Deville furnace has been purchased, for testing the fire-resisting qualities of clays at very high temperatures. With this furnace a valuable investigation was made last spring by two students under the direction of Professor Hofman. Two new alidades have been purchased for the plane-table work of the Summer School of Mines. They contributed materially to the geological investigation made in Cape Breton last summer. The library is growing, by the arrival of periodicals and the purchase of new works on Mining and Metallurgy. An investigation has been made by Professor Richards upon the velocities of grains of minerals, of different specific gravity, falling in water. It forms an important contribution to ore-dressing science. The results are already being used in the laboratory for the benefit of students.

Professor Richards is thoroughly revising his notes upon ore-dressing, and will probably visit all the principal districts of the United States, during the coming summer, to obtain the latest practice. The preparation of lithographic notes is being carried on to a greater extent than usual this year. The notes on the metallurgy of iron are being thoroughly revised and rewritten, with a great advantage from the assistance of experts at the works. Mr. J. W. Cabot, M. I. T., '79, is writing up the notes on steel. Mr. R. H. Sweetser, fresh from the works, is writing up the blast furnace; while Mr. W. A. Tucker has searched the literature of the last fourteen years to obtain the best practice. These notes will prove of great value to the students, not only while at the school, but after leaving it. The edition should last five years. Mr.

Lodge is preparing lithographic notes on the laboratory processes, as they are needed. The mining notes will be completely rewritten and brought up to date during the spring term. The fine exhibit of iron and steel products given to the Institute by the members of the Jernkontoret has been received. Four works are represented, — Söderfors, Österby, Horndal, and Ankarsrum. The two latter collections are already installed at the charges of a few friends of the department; the two former are being placed in their cases.

The following periodicals are among the recent accessions to the Mining Library, — Freiberger Jahrbuch; Canadian Mining Review; Journal of the General Mining Association of Quebec; Journal of the Illinois Mining Institute; Ohio Mining Journal; Proceedings of the Colorado Scientific Society; The Clay Worker; Transactions of the Mining Society of Philadelphia; Zeitschrift für Electrotechnik und Electrochemie; Zeitschrift für praktische Geologie.

Course IV., Architecture. — The Department of Architecture opens the year with no important changes in its scheme of study, but with a sensible extension of several of its technical courses. Some of last year's students in the graduate course have returned for still another year of study. The department is aiming to show that a post-graduate course of two years, continuing the same scheme of studies, governed by the same traditions, is of greater value to the student than to split the course by spending part of the time here and part abroad at the foreign schools. School training in the strictly professional work should teach in the highest degree the principles of composition, balance, proportion, and scale. To accomplish this requires years of hard and uninterrupted study, under instruction of unquestioned ability. Then comes the time for a year or more of foreign travel, when the value of the previous training will be apparent in the greater appreciation of historical architecture. Professor Despradelle's first year was a very successful one; and his second year has begun with equal enthusiasm on the part of his pupils. They have themselves created a higher standard for work than is

called for, and which is impossible to restrain. There is a constant appeal for longer hours, and that the library be opened during the evenings. The valuable library of the department and its vast collections of photographs increase every year both by gifts and by purchase. Another, larger and more useful, series of lantern-slides is being made in the department, to illustrate the lectures on ancient architecture. The instructors are the same as last year. Mr. S. W. Mead, of the firm of Cabot, Everett, & Mead, is Instructor in Architecture, with Professor Despradelle. Mr. Mead's scholarly attainments, with his practical experience, make his services peculiarly valuable. The instruction given in Water-Color, by Mr. Ross Turner; in the History of Ornament, by Mr. C. Howard Walker; in Pen and Ink, by Mr. D. A. Gregg; in Modelling, by Mr. T. H. Bartlett, — is of the highest order. Mr. Adams continues to be very successful in his conduct of the life-class. Extending the course in Architectural History has greatly added to its efficiency and interest. The various historical monuments discussed and illustrated in the class-room are now divided among the students as subjects for written themes. The results are successful in every way. This scheme also offers an opportunity for a more thorough knowledge of the contents of the library.

While the whole Institute has suffered a great loss in the death of Mr. Arthur Rotch, the blow to the Architectural Department has been especially severe. He always had its welfare greatly at heart; and his generosity, often appealed to, always responded. He was a constant visitor to the department, and its generous friend both in life and at his death. It was he who contributed or secured the funds for the furnishing of the new architectural building two years ago; and it was to his cordial interest that we owe the presence of the Envois of the Rotch Travelling Scholarship which adorn its walls.

The professors in the Architectural Department, as well as of the whole school, have, within the last few weeks, had special reason to feel proud by reason of the honors won by

three of our graduate students. At the competition held in New York City, by the Beaux Arts Society of architects, this fall, the three men representing the Institute of Technology received, severally, the first, the third, and the sixth prize, from among thirty-seven competitors: the gold medal having been awarded to Mr. F. M. Mann, now a candidate for one of the higher degrees of the Institute; the second "first mention" to Mr. H. H. Thorndike, and the third "second mention" to Mr. W. B. Faville. The competition was open to the members of the Beaux Arts Society, to the students of the departments of architecture in Columbia College, the University of Pennsylvania, Harvard University, the Massachusetts Institute of Technology, Cornell University, and Syracuse School, and to the members of the New York Sketch Club, the Boston Architectural Club, and the Philadelphia T-Square Club. The success of our students in a competition so wide is not only gratifying, as showing the thoroughness of the training received at the Institute, but also as proving that this, the oldest school of architecture in the United States, is abreast of modern thought and professional progress.

Courses V. and X., Chemistry and Chemical Engineering. — Some of the more important matters pertaining to this department have been mentioned in speaking of the changes in the Faculty and the instructing staff of the Institute. The teaching force of the Chemical Department now embraces two professors, five assistant professors, nine instructors, and five assistants, — in all, exclusive of lecturers from the outside, twenty-one.

The number of students in the chemical laboratories is as follows: —

Laboratory of General Chemistry	393
" " Analytical Chemistry	126
" " Organic Chemistry	20
" " Industrial Chemistry	14
" " Sanitary Chemistry	40
" " Textile Coloring	16
" " Gas Analysis	108
Total	717
Deduct for students reported more than once	79
Actual number, in all laboratories	638

There are more students taking Chemistry than ever before, and the present accommodations are insufficient. The Laboratory of Analytical Chemistry is crowded. Originally designed for one hundred and eight students, there are one hundred and twenty-six working in it. The Laboratory of Organic Chemistry is inadequate in size, and additional rooms are needed for physico-chemical work and for recitations.

The course in Chemical Engineering remains still under the charge of Professor Drown, pending the appointment of a successor to Professor Norton. The lectures in the course in Industrial Chemistry are now given mainly by Dr. Frank H. Thorp, of whose appointment mention was made in my Report of 1893, and who began his work as Instructor in Industrial Chemistry in February of this year. As heretofore, many lectures are given by experts engaged in various manufacturing industries. The course in Applied Chemistry in the fourth year is under the care of Professor Gill. The laboratory instruction in Industrial Chemistry and Textile Coloring is maintained in a high state of efficiency by Mr. J. W. Smith. In this connection it may be mentioned that Dr. Lunge, of Zurich, in his report to the Swiss government upon technical education in the United States, speaks of the Laboratory for Textile Coloring and the Laboratory for Water Analysis in the Institute of Technology as models in arrangement and equipment.

It is interesting to note the increasing aid which the different departments of the Institute give to each other in the course of their growth and development. The courses in Chemical Engineering and Sanitary Engineering represent the demand for young engineers who shall have a fair knowledge of Chemistry and Biology in addition to their training as mechanical and civil engineers. The relations of the chemical and physical, and the chemical and biological departments are likewise becoming more intimate each year. Chemistry and Biology occupy common ground in many matters relating to hygiene, sanitation, fermentation, and like subjects. The intimate connection of these departments is well shown in

the great investigation of the Massachusetts State Board of Health into the purity of the natural waters of the State, and into the means best adapted for the disposal and purification of the sewage of inland towns. This investigation, which is still in progress, has been for the last eight years under the charge of the heads of our chemical and biological departments. This increased usefulness of the Institute is the natural result of its wide scope and the high specialization of its corps of teachers.

The references which have been made to the chemical instruction at the Institute lead me to speak somewhat at length of the nature and extent of our courses in Theoretical Chemistry. Perhaps in nothing is popular opinion regarding this school more persistently in error than in supposing that the instruction here is almost exclusively professional and technical. The fact is, vastly more time has always been devoted at the Institute to scientific than to technical study; while, even in the technical applications of science, reference is had far more to their effect in impressing scientific principles upon the minds of the pupils, and in teaching them how to apply scientific principles to actual problems, than to the practical value of the technical methods and arts thus taught. The primary object in all teaching here is to fit young men for active work, through training them in independent thought and investigation, by which means only can they be taught self-reliance. This, in the Chemical Department, can, it is believed, be best accomplished by great thoroughness of instruction in chemical processes, combined with research work in the library on the part of the student, in order that the critical faculty, so important in a rapidly growing science, should be developed. With such a system of teaching as this, it is impossible to cover as wide a range of work as is done in many technical schools; but the results of the system in developing and maturing the students as independent thinkers, fully justifies this limitation as to the variety of the subjects which are given them to investigate. The foregoing statements may be well illustrated from the chemical course. Our laborato-

ries are the largest and best equipped in the United States; we have a staff of more than twenty teachers in this department; specialization has been carried to an unprecedented extent. Yet we teach fewer methods of technical analysis than many schools far below us in number and in organization, while our instruction in Theoretical Chemistry has been enlarged beyond that offered in any other school of our class, so far as I am informed. The system followed is the result of gradual development, and is thought to have at length attained an unusual degree of thoroughness and completeness. A brief description of it may therefore be of value from a pedagogical standpoint. It will also serve to show that the requirements of a technical school are not in the least incompatible with the preparation of the student for a purely scientific career.

The instruction in fundamental laws of chemical phenomena (usually called " Theoretical Chemistry ") is here not confined to a single lecture-course, but is so arranged as to extend through the whole four-years course of study. In this way two important results are secured. The attention of the student is almost continuously occupied with some part of the subject, involving to a greater or less extent the review of earlier parts, so that a more permanent impression is produced; and, in the second place, the instruction in the general principles of chemistry is thus made to accompany the increase of knowledge of the specific facts, instead of preceding it, as is often the case. During the first year, in connection with the course of lectures on Elementary Inorganic Chemistry, as is usual in such courses, the fundamental laws of chemical combination and their explanation by the atomic theory are discussed at length and exemplified by numerous stochiometrical problems solved by the student. Other theoretical questions — the principle of molecular-weight determinations by Avogadro's hypothesis, the conception of valence, and the periodic law — are also considered. The systematic instruction in Theoretical Chemistry begins, however, in the first term of the second year. In a course of thirty lectures, the principles,

already briefly considered in the first year, are taken up and discussed at length, and many new subjects are introduced. The first few lectures of the course are devoted to a review of the early history of chemistry down to the establishment of the atomic theory, the importance of the fundamental laws of the conservation of matter and of definite and multiple proportions, and their relation to that theory, being emphasized. The later lectures treat of the laws of gases and the hypothesis of Avogadro, its value as a means of determining molecular weights, the methods of determining atomic weights based upon it and on the physical properties of isomorphism and specific heat, the periodic law, the doctrine of valence, and the classification and structure of inorganic compounds. The recent discoveries regarding the nature of solutions and the practical applications of this knowledge to the processes of analytical chemistry are also considered.

It will be noticed that two subjects, stochiometrical calculations and the structure theory of organic compounds, the treatment of which occupies a large part of many text-books and lecture-courses on theoretical chemistry, are, thus far, omitted. This is done because it is thought desirable to teach the general principles of the science in direct connection with the study of the special facts to which they are related, to as great an extent as is practicable. Practice in stochiometrical calculations is appropriately combined with the instruction in quantitative analysis, and the discussion of the structure theory with the work in descriptive organic chemistry. In the third year a second course of lectures treats in great detail of important methods of determining vapor density, and the whole subject of solutions, in which such important discoveries have recently been made, is fully considered. In connection with these lectures, a laboratory course on the methods of molecular-weight determination has been established. Every student is required to obtain accurate results by the three vapor-density methods of Victor Meyer, Hofmann, and Dumas, and by the two solution methods of boiling-point and freezing-point, using the form of appara-

tus devised by Beckmann. The calculations involved constitute no small part of the value of this work.

The laws and theories of Chemistry comprise two distinct subjects: first, the general relations between the properties of bodies and their chemical composition, and second, the laws of chemical change and equilibrium. The latter subject, which has been said to constitute the highest aim of chemical research, and in which we have already attained a very considerable degree of knowledge, is, strange to say, ignored in many courses on theoretical chemistry. This is all the more remarkable since it is pre-eminently that part of the science which is of practical, every-day applicability to specific chemical phenomena. At the Institute the lecture-courses of the second and third years are concerned with the first subject; the second is taken up in the second term of the fourth year. The most important feature of this fourth-year course is an extended discussion of the laws of chemical change and chemical equilibrium, and of their numerous applications. The subjects of thermo and electro chemistry, dealing with the relations between chemical change and heat or electricity, also receive a due share of attention.

A course of laboratory experiments has recently been arranged to accompany these lectures. It includes thermochemical measurements of heats of neutralization and solution, measurement of the electrical conductivity of solutions, of the velocity of reactions, and of the solubility of salts, the last illustrating the principles of chemical equilibrium. The experiments have the double purpose of teaching the practical methods of determining these important data, and of impressing more strongly on the mind of the student the laws considered in the lectures. They are carried out in the new, well-equipped laboratory devoted entirely to Physical Chemistry, of which a description will be given when we consider the development of the Physical Department during the year.

Courses VI. and VIII., Physics and Electrical Engineering. — The resignation of Mr. Collins and the return of Dr. Goodwin

have been mentioned in speaking of the changes among instructors. Otherwise the regular teaching force of the Physical Department remains the same. Professor Holman has, to our great regret, been partly disabled by sickness, and special arrangements have had to be made that the work of instruction might not suffer in consequence. Professor Holman's colleagues have gladly done whatever was required in this direction. The lectures on "Heat" have been given with marked ability by Mr. Clifford, in addition to his regular duties in the department. On account of the death of Mr. A. C. White, for a number of years lecturer on the "Distribution of Electricity for Commercial Purposes," the course was assumed by Assistant Professor Puffer, who will continue to give this instruction. The removal of Mr. J. P. B. Fiske, to take charge of an important manufacturing establishment in Ohio, has necessitated a change in the lectureship on "Electromotors." We are fortunate in securing as his successor Mr. Walter C. Fish (S. B., M. I. T., VI., 1887), the director of the works of the General Electric Company at Lynn.

The embarrassment arising from an excessive number of students in the Physical Laboratory, with insufficient room for their proper accommodation, has become a chronic condition in the department, interfering, especially in Course VI., with the satisfaction fairly earned by the hard work of the corps of instructors. At the same time, the work of the year was successfully accomplished, as a whole. The work of the department is of three classes: (1) Instruction in General Physics, by lectures, recitations, and laboratory exercises given to the students as a whole; (2) Instruction to students in Course VIII., Physics; (3) Instruction to students in Course VI., Electrical Engineering. During the past year there has been carried on a course of recitations in Physics, in connection with the regular second-year lectures. The class (325 in number) has been divided into ten sections, each section reciting twice a week, under the instruction of Mr. Wendell. The results have been satisfactory in the highest degree, not only through diminishing the number of failures in the course

of the year, but also through increasing, in a very marked manner, the general interest in the subject, and the understanding of it attained by the class as a whole.

In the Laboratory of General Physics several changes have been made which it is confidently hoped will carry the instruction to a still higher degree of efficiency. The exact work required of our students necessitates the expenditure of much time, and requires careful individual instruction in order to attain the highest results. Furthermore, it is desirable that more instruction than heretofore shall be given in the details of various special methods of physical measurement. Dr. H. M. Goodwin has been given the immediate charge of all of the work in this laboratory, and besides the regular laboratory practice, will meet the third-year class in the lecture-room, at frequent intervals, for the purpose of discussing methods and instruments of measurement and research. There has also been undertaken a careful revision of the list of required experiments, with the view of arranging more or less distinct series of those having a professional bearing for students of the several courses, so far as is consistent with the general training in accurate physical measurement which it is the primary aim of this laboratory to impart. There are, of course, certain kinds of measurement in which every student, whatever his course, should be carefully instructed; there are others, of a more advanced character, whose particular importance will depend upon the profession which the individual student has in view. It is hoped and expected that such a procedure will lead to more enthusiastic work, and enable the student to appreciate more fully the need of carefulness and accuracy on his part in the various professional laboratories.

In connection with the general work of the department, should be mentioned the course of twenty lectures in Physics, given at the Institute to the students of the Boston Normal School of Gymnastics. These have been in charge of Mr. Louis Derr, and have been successful in all respects. There should also be mentioned the extension of the facilities offered to the students in the Geodetic Option of Course I., who take certain

special professional work in the first term of the fourth year. During the past year some practical experiments in pendulum-measurements were planned and a successful beginning made, through the diligent labor of Mr. Charles Ladd Norton, Assistant in Physics. The limited time devoted to the subject is a bar to any extended work; but the practice cannot fail to be valuable.

The principal addition, however, to our facilities for advanced instruction in pure Physics is the new Physico-Chemical Laboratory. Down to the present time there has been, so far as I am informed, no systematic instruction of this character given in this country. For this purpose, a special laboratory for physico-chemical work has now been fitted up. This laboratory, 28 × 29½ feet, occupies the front part of Room 2, in the southwest corner of the basement. This room is particularly well adapted to physico-chemical work, on account of the dark rooms connected with it. The large dark room will continue to be used for photographic work. The small one, adjacent to it, has been painted white, and will be used for experiments on the electrical conductivity of liquids. Two complete sets of conductivity-apparatus are provided. The third dark room will be devoted to optical work, with the polariscope and Pulfrich refractometer. The regular course will also include thermo-chemical measurements, experiments in chemical dynamics, measurements of small potential differences of voltaic cells, and molecular-weight determinations by Beckmann's boiling and freezing point methods.

The laboratory has been fitted up with every convenience, not only for practical instruction, but also for more advanced research work, which it is hoped will be carried on to no small extent. The course itself is designed primarily to give students practice in the most improved methods now in use in physico-chemical investigation. The laboratory work is taken in connection with a course of lectures on Physical Chemistry, in which the application of the methods to the various problems now attracting the attention of scientists at home and abroad is pointed out.

The importance of this work to students making a special study of Physics and Chemistry can hardly be over-estimated. Within the last few years, science has made such prodigious strides in this direction that a practical as well as theoretical knowledge of this subject is absolutely necessary to an intelligent understanding of physical and chemical literature at the present time. In Germany, particularly, where the greatest advances have been made, the importance of the subject has been recognized by the founding of special chairs of Physical Chemistry at the Universities of Berlin, Leipsic, and Göttingen. The course, as now arranged, will be taken by the third-year physicists and fourth-year chemists. Every opportunity for original investigation is also offered to advanced students who may desire to work in this field.

Still further, in Course VI. there has during the year been a marked movement in the direction of the specialization of courses, referred to in the last President's Report; and also a material advance in the amount and quality of the instruction in electrical measurements and in the study and testing of dynamo-electric machinery. There is much need in the Laboratory of Electrical Engineering of a considerable increase in the plant of dynamo-electric machines. There has never been any installation of such apparatus corresponding, in magnitude and cost, to the experimental engine and the great testing-machine in the Engineering Laboratory. The instruments needed for exact electrical measurement, which are far more essential than anything else, have, indeed, been supplied, to an exceptional extent, from current appropriations; but these are necessarily insufficient for the occasional purchase of large machinery. In connection with the departmental work of Courses VI. and VIII., attention should be called to the great increase in the use of the Physical Library, which has resulted from having a library-assistant constantly in attendance, so that books could be consulted conveniently at all hours of the session. It is proposed to have the Librarian give some instruction to the students as to the manner in which they can use the library to the best advantage.

Course VII., Biology. — There is only one drawback to the steadily increasing usefulness of this department, and that is a most urgent need of room. For ten years the Biological Department has been in one and the same place. Ingenuity, born of necessity, has adjusted and readjusted the allotted space until it has become utterly exhausted. Owing solely to lack of room, Professor Sedgwick is already obliged to repeat the laboratory work in General Biology. Next year, unless space can be had, other exercises will have to be repeated. The waste of energy thus wrought is much to be regretted. The number of registered students, regular and special, receiving instruction, during the present term, in the one room belonging to the Biological Department, is 103. In addition, 24 senior students of the Boston Normal School of Gymnastics are under instruction, making a total of 127. Of these, the number doing laboratory work is 123.

The several classes of the present term are attended as follows: General Biology, 51 students; Comparative Anatomy, 12; Anthropology, 16; Physiology and Hygiene, 5; History of Science, 4; Physiology of the Senses, 4; Microscopic Anatomy, 1; Physiological Laboratory, 2; Theoretical Biology, 5; Comparative Physiology, 28; Bacteriology, 10; Micro-organisms of Fermentation, 20.

The last-mentioned course calls for special notice, as it is not only new to the Institute, but also, it is believed, to the educational institutions of the United States. For the past ten years increasing interest has been felt in the advances making in Denmark in our knowledge of the micro-organisms of various fermentations, such as those of vinegar, milk, brewing, and bread-making. In June last, Mr. S. C. Keith, Jr., Assistant in Biology, went to Copenhagen and entered the well-known laboratory of Alfred Jörgensen, which is devoted to the physiology of the fermentations and especially to the technology of pure yeast-culture. Mr. Keith returned at the beginning of the year, bringing with him a supply of cultures and apparatus. With the consent of the Executive Committee, a circular was issued announcing, as a part of the regular

course in Bacteriology and Micro-organisms, a course of instruction in the Micro-organisms of Fermentation, and offering to a limited number of persons, properly qualified and actually engaged in fermentation industries, an opportunity to familiarize themselves with the latest methods and results of the Danish investigators. The response has been most gratifying. Every place has been taken; and ten persons actually engaged in manufactures depending in whole or in part upon fermentation are now at work in the Biological Laboratory.

Another fact in connection with the Biological Department is worthy of notice. Among the number of special students for the last two years, has been an increasing number of teachers, many of them in actual service in normal, high, or other public schools, or in the private schools of Boston and vicinity. During the present term their number, in this department alone, has risen to 25. It thus appears that the Institute is making a contribution of no small importance toward the teaching of natural science. For several years we have 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 1894, this room was occupied, with great advantage, by Dr. Theodore Hough and Dr. R. P. Bigelow.

Course IX., General Studies. — The demand for accommodations for the special use of the General Course has been constantly increasing, until this summer it appeared necessary to fit up Room 44, adjoining the present library, as a study-room. The growing interest in this course is evidenced by the recent organization of a society composed of students and instructors especially related to the course, whose object is to promote its intellectual and social interests. The library facilities of this department are being more generally recognized and utilized by the students at large. In Sociology, Dr. Ripley is preparing a new series of maps based upon the most recent German authorities, for class-room illustration, and will issue a new serial syllabus and bibliography of

Anthropology, Ethnology, and Sociology, for the use of the classes in Social History. It is much to be desired that the financial condition of the Institute were such as to allow a larger appropriation for the purchase of historical books, and also maps, diagrams, and other illustrative material.

Course XII., Geology. — The total membership of the classes taught by the instructors in the department during the past year was 367. In these classes there were 217 different individuals. Mr. Barton now has entire charge of the instruction in Structural Geology given to the students in Courses I., IX., and XI.; and Mr. Grabau is successfully teaching the Palæontology of the third year. In July, a party of nine students, under the leadership of Prof. W. O. Crosby, made a geological excursion to Nova Scotia, devoting two weeks to the study of different interesting localities, and bringing to the Institute a good collection of specimens. The expedition proved highly satisfactory to the members of the party, and they feel that they have been much benefited by the experience obtained. Mr. Henry W. Nichols and Mr. George W. Stose assisted at the Summer School of Topography, Geodesy, and Geology. There have been valuable additions to the collections used in the courses in Economic Geology, in Building Stones, and in Ore Deposits. The palæontological and mineralogical collections have been enriched by useful specimens, and the work of identification and labelling has progressed. There has been a large increase in the notes and syllabuses of courses prepared for the use of students. The demand for graduates of the department to take satisfactory positions has exceeded the supply. Mr. Nichols, who was an assistant last year, and whom we desired to retain on the staff of the Institute, is now in charge of the department of Economic Geology at the Field Columbian Museum in Chicago. Mr. Stose, to whom we offered Mr. Nichols's place, is now engaged on the physiographic work of the United States Geological Survey.

Course XIII., Naval Architecture. — The 28th of May, 1895, will see the first class graduate from the regular four-years

course in Naval Architecture. Experience has shown that the continuous course of lectures, now given twice a week throughout the third and fourth years, accompanied by two or three exercises a week in drawing, give opportunity for presenting the facts and theories of the science of Naval Architecture in a very satisfactory way, and afford the students a considerable degree of facility in applying them. The thorough training in Mathematics, Drawing, and Physics, and especially in Applied Mechanics, which the students in this course share with all other students of engineering, makes it possible to present the work of this particular course in a form which is at once clear and compact. The present fourth-year class in this department has completed even more work than was assigned. The future development of the course must be mainly internal, arranging the work and coordinating it with work given out of the department, so that the students may accomplish the most possible for a given expenditure of time and strength. Such development is unobtrusive, and calls for little comment. The third-year work, which is at once the most elementary and the most vital, has already been reduced to a form that will require only minor changes, and is now given to the students entirely by cyclostyle notes. The work of the fourth year deals with subjects at once more abstruse and, from the lack of positive knowledge, more indefinite. Much of the information regarding them is to be found only in original memoirs or in articles in technical periodicals, while the whole matter is subject to change. The adequate development of this part of the course will require time and labor, and will continue as long as the science grows.

The department has bought two more mechanical integrators, making seven in all; enough for our present needs. It is only by free use of such adjuncts that the work of the drawing-room can be done within the time at our disposal. The library has received many additions in the past year, and now contains nearly all the standard and recent publications of the profession. The department is really in need of

additional space for its proper accommodation. Much of the valuable material already in possession cannot now be properly stored or conveniently used; and much other material could be obtained and used to advantage if we had the room. The drawings and computations are made in the mechanical-engineering drawing-room, upon small tables; and the students have neither the space nor the quiet essential for properly laying down ship-curves and for the use of mechanical integrators.

In Memoriam.

The Institute of Technology has sustained a severe loss in the decease, during the year now closing, of three valued members of the Corporation. Mr. Francis A. Waterhouse, Head Master of the English High School, joined us in 1887. In 1889, on the death of Hon. Charles L. Flint, he became Chairman of the Visiting Committee on the Department of Modern Languages, which position he held to the end, giving most careful attention to the needs of the department, keeping closely in communication with Professor van Daell and his associates, and making frequent and always useful suggestions to them, as well as to the President and Corporation. Mr. Arthur Rotch was a special student of Architecture in the Institute from 1871 to 1873. In 1885, he became a member of the Corporation, and was made Chairman of the Visiting Committee on the Department of Architecture. The high value of his services to the department has already been recognized in the course of this Report. Mr. Rotch maintained to the last his interest in the Institute, and by his will made a substantial addition to the means for carrying on its architectural work.

How shall I speak of our lion-hearted comrade who has just left us? Mr. Henry Saltonstall joined the Corporation in 1885, and became a member of the Executive Committee, May 25, 1887. By a resolution, adopted at your last meeting in October, you warmly expressed your appreciation of

the immense value of Mr. Saltonstall's services to the Institute of Technology. I concur in every word of that testimonial, and for myself desire to add that Mr. Saltonstall's presence on the Executive Committee has been a joy and a strength to me during all these years.

Finances.

The finances of the Institute are such as to demand the most serious consideration of all who are interested in the welfare of the school. The Executive Committee have been able to reduce the annual deficit, which in 1892–93 reached $32,816.75, to $13,603.32 in 1893–94; but such rigid economy could not long be practised without impairing the efficiency and prestige of the school, while the gap between our receipts and expenditures is still far larger than can be contemplated without apprehension. In October of this year, by instruction from the Executive Committee, the President sought and obtained a hearing from the Board of Trustees of the Franklin Fund, consisting of the twelve aldermen of the city, *ex officiis*, and of the pastors of three of the older churches, in which he presented reasons why the Franklin Fund, now between $350,060 and $360,000, should be devoted to the permanent endowment of the Department of Physics and Electricity in the Institute of Technology. That such a use of this very notable and unique fund would form a worthy monument to the great philosopher, whose name has for twenty-six years been carved in stone upon the Rogers Building; that an application of this fund to the promotion of research and instruction in physics and electricity would yield results of great practical, as well as scientific, value; that it would be far better to further endow an institution already existing, and doing successful work, than to attempt to build up a new and separate institution which must always be poor and pinched for means, and regarding whose success there will necessarily be the gravest doubt, — all this appears clear to us; and I am bound to recognize

the great courtesy with which the Board of Trustees listened to the arguments presented. In the probable failure of this effort to enlarge our means of usefulness, and in contemplation of so large and dangerous a deficiency in our finances, the Executive Committee will to-day present to the Corporation a recommendation that the Legislature of the Commonwealth be asked to make annual appropriation of a moderate amount for a brief term of years.

To the Honorable House of Representatives and Senate of Massachusetts, in General Court assembled.

THE UNDERSIGNED, being thereto specially authorized by vote of the Corporation of the Massachusetts Institute of Technology, at a meeting held Dec. 12, 1894, respectfully petition your honorable body that there be granted from the treasury of the Commonwealth for the support and endowment of said Institute the sum of $25,000 per annum, for the term of six years next ensuing.

Your petitioners respectfully represent that the Massachusetts Institute of Technology was incorporated by an Act of the Legislature of Massachusetts, approved April 10, 1861, "for the purpose of instituting and maintaining a Society of Arts, a Museum of Arts, and a School of Industrial Science, and of aiding generally, by suitable means, the advancement, development, and practical application of science, in connection with arts, agriculture, manufactures, and commerce";

That, by the same Act, the Legislature conferred upon the said Institute of Technology the right of perpetual occupancy of two-thirds of the square bounded by Berkeley, Boylston, Clarendon, and Newbury streets, the market price of the land in which an interest was thereby given (restricted to erecting buildings on not more than one-third of the ground), being, according to official appraisement at that time, about $103,000;

That, by an Act approved April 27, 1863, the Massachusetts Institute of Technology was designated as the College of Mechanic Arts for the State of Massachusetts, under the Act of Congress approved July 2, 1862, and in that character and capacity was conceded one-

third of the annual proceeds of the lands granted by the United States to the Commonwealth under the said Act of Congress, the sum accruing to the Institute under this provision being about $5,000 a year;

That the said Institute of Technology, having been duly organized, was opened to students in January, 1865, and has since been conducted as a school of industrial science, with marked and increasing success; that, from the beginning, under its illustrious first president, the Institute of Technology not only afforded sound instruction and training to great numbers of the youth of the Commonwealth, but led in the development of the theory and practice of scientific and technical education, the world over; that in its laboratories of chemistry and physics were first applied methods of teaching which are now used, not only in one hundred scientific and technical schools of the United States, but in every classical college or university of respectable standing, and which are now even being carried down to high schools and academies, to the inexpressible advantage of the cause of education;

That the Legislature of Massachusetts, by acts approved June 16, 1887, and May 23, 1888, granted to the said Institute of Technology the sum of $200,000, payable in four annual instalments of $50,000 each, in view of the pressing financial needs of said Institute, as set forth in a memorial from the Corporation, — the special reason for the grant to the Institute of Technology at that time being found in the extraordinary increase in the number of its students, which, as set forth in the memorial referred to, had risen from 188 in 1878, to 637 in 1886. To-day the number of students in attendance has risen to 1183. One hundred and twenty towns and cities of the State send pupils to the Institute. Every county except Dukes and Nantucket is represented on its lists. There are seventy more students from Massachusetts, alone (707), than constituted the whole body of our scholars at the date of that memorial.

Your petitioners respectfully represent that by an Act of Congress, approved August 30, 1890, a further appropriation was made from the Treasury of the United States for the support of "Colleges of Agriculture and the Mechanic Arts," established by the Act of July 2, 1862, being an annual sum, for the colleges of each State, rising from $15,000, by an annual increase of $1,000, to a maximum of $25,000; that of this new grant, one-third was, by Act of the Legislature ap-

proved June 11, 1891, assigned to the Massachusetts Institute of Technology, as the College of Mechanic Arts for Massachusetts, making the total amount now annually received from the United States, through the State Treasury, under the Acts of 1862 and 1890, about $11,000;

That, during the eight years which have elapsed since the former petition of the Corporation to the Legislature, the expenses of the Institute have, in spite of rigid economy, risen to the annual sum of $295,332.33. Since the last appeal made by the Corporation to the Legislature, it has been necessary to erect two large buildings, at an aggregate cost of $164,473.97, and to purchase land of the value of $356,320.23, for these buildings, and as a provision for the future growth of the institution. Exclusive of all purchases of land, and of the cost of erecting buildings, the aggregate amount which has been expended by the Corporation of the Institute of Technology, in maintaining the school, and in promoting the application of science to the useful arts, since the opening of the Institute in 1865, has been more than three and a half millions of dollars. Including the cost of buildings and of purchased land, the total amount expended by the Institute of Technology has been more than four million six hundred thousand dollars. To this total the contribution of both State and nation combined, has been less than nine per cent.

Your petitioners further represent that, in consequence of the large increase in the number of pupils, and in the current expenses of the Institute, there has been encountered during the past two years an annual deficiency in receipts, as compared with income, of $23,210.03. This financial condition is not only fraught with the gravest danger to the future of the school, but it is at this moment crippling the institution in some measure and weakening the hands of its teachers and administrators.

In explanation of this large increase of expenditures, your petitioners respectfully represent that scientific education is necessarily expensive, requiring the use of costly apparatus and machinery (a single piece, the Emery testing-machine, in use at the Institute of Technology, costing $13,000); that, with every increase of students, it becomes necessary to add expensive instruments; and at all times to maintain an exceptionally high proportion of teachers to pupils. The rapid development of the sciences, especially Chemistry and Electricity, during the past ten years, has made it necessary that

any school which assumes to lead in the development of scientific and technical education, should spend and spare not in its efforts to secure the best and to do the most possible toward that object. The fact that the Institute of Technology is a young institution, surrounded and overshadowed by colleges and universities which have for generations enjoyed a high degree of popular confidence and affection, has made it impossible, in view of the large sums required for current needs, to accumulate, within so short a time, permanent endowments adequate to the scale of its existing operations. Its administrators and friends are, therefore, compelled to appeal to the bounty of the Commonwealth to provide temporarily some part of the means to enable it to continue its work without abatement.

Your petitioners believe that it is not for the interest of the Commonwealth that this school, the first institute of general technology founded in this country, and by far the largest, should be permitted to fail or to suffer from lack of means. When it is remembered that the poor republic of Switzerland has within the past few years expended a sum approaching four millions of francs — $800,000 — in constructing and equipping laboratories of Chemistry and Physics in the Polytechnicum at Zurich, it may fairly be asked whether this rich and powerful Commonwealth, whose wealth and power, not less than its high citizenship, have from the first been peculiarly the fruit of education, should withhold any part of whatever is needed to keep its chief school of industrial science and industrial art in the very forefront of educational progress.

Massachusetts is at the present time passing through a great industrial crisis by reason of the rapidly-increasing competition of the South and West in respect to manufactures traditionally regarded almost as belonging to her, or at least to New England. Without extraordinary efforts for the general education of our people; without further and rapid development of the industrial arts; without a constantly increasing application of the sciences to manufacture, — the sceptre of industrial power is in danger of passing from us. Already manufacturing corporations are asking the Legislature to give them leave to do business outside the Commonwealth; and more are known to be contemplating such a step. Massachusetts, if, in spite of her limited natural advantages, she would keep her supremacy, must do so by the exercise of the same means which first brought her that supremacy; namely, by commanding the highest trained intelligence for the

organization and conduct of her industrial, commercial, and financial enterprises.

In conclusion, it may be added that more than forty-eight per cent of the living graduates of the Institute, and a still larger proportion of former students not graduates, now reside in the Commonwealth, engaged in the advancement of its industries.

TREASURER'S REPORT.

STATEMENT OF THE TREASURER.

THE treasurer submits the annual statement of the financial affairs of the Institute for the year ending Sept. 29, 1894.

The financial results of the past year are decidedly more satisfactory than those shown in the statement submitted a year ago. The expenses still exceed the income by a large amount; but that amount, instead of being as last year nearly $33,000, is this year reduced to between $13,000 and $14,000. This is due in part to rigid economy in everything which was not essential to the efficiency of the Institute work; partly, also, to the fact that some of the expenditures of the preceding year were extraordinary ones and did not have to be met this year, and partly to the increase in income due to a larger number of students and to the large bequests received the previous year. There has, also, this year been received a considerable sum as rent for the Clarendon Street property purchased the preceding year. This last item has, however, been largely offset by the expenditure necessary in taking down and altering the northerly end of the building. These alterations we were, by the terms of the original purchase, obliged to make. The large expenditure made in 1893, on account of the Columbian Exhibition, of course did not recur the last year.

In the item of repairs, the saving of about $5,000 was accomplished. This, however, could not have been done, had not the expenditure in previous years been liberal.

In General Expenses there has also been a saving of nearly $3,000.

The income from students' fees has increased over $17,000. In the matter of department supplies there has been an increased expenditure of about $2,000, due to the increased number of students, and the same cause has led to an increase of about $12,000 in the salary account, due to the employment of a larger staff.

The past year has brought to the Institute generous bequests and gifts. By the will of Mrs. Catherine P. Perkins, $88,713 were received by the Institute, and something more is still to be paid it as one of the residuary legatees. Under the will of William J. Walker, $10.537.27 have been received. $868.11 have been added to the Susan E. Dorr fund. From the subscriptions of 1892, have come $24.500 in addition to the previous payments. Besides these, a gift of $200 has been received from Mrs. William B. Rogers, for periodicals; another of $575, from friends, for the mining department and the architectural department, whereby these departments have been enabled to make important additions to their respective collections. A. Lawrence Lowell, Esq., has contributed $500 for the general purposes of the Institute, and the Alumni have added $621 to the William B. Rogers Scholarship Fund.

The net results, after deducting the excess of expenditure over income, and certain other items, is a gain of $105,797.07 to the property of the Institute.

SECURITIES SOLD OR PAID AT MATURITY.
GENERAL FUND.

$2,000 Atchison Gen. Mtg. 4s.	1,351.49	
2,000 Bur. & Missouri River, 6s.	2,000.00	
25,000 Eastern R. R. of Minnesota, 5s.	25,125.00	
13,000 New York & New England 6s.	13,910.00	
1,000 International & Great Northern 6s.	1,164.63	
20,000 United States Consols 4s. 1907	22,950.00	
50,000 Atchison, Topeka, & Santa Fe, 6s.	50,000.00	
65,000 City of Hartford, 4s.	65,650.00	
1,000 Boston United Gas Co. 5s.	807.50	
1,000 Iowa Central 5s.	870.00	
2 shares Nat. Exchange Bank	231.25	
6 " State St. Safe Dep & Trust Co.	615.00	
16 " Firemen's Fire Ins. Co.	1,943.75	
25 " Third National Bank	2,193.75	
		188,812.37

SALE OF SECURITIES. WM. B. ROGERS MEMORIAL FUND.

$15,000 Atchison Gen. Mtg. 4s.	12,163.43	
2,000 New York & New England 6s.	2,140.00	
7,000 Chicago, Burlington, & Quincy 7s.	8,286.25	
		22,589.68

RECEIVED SECURITIES. GENERAL FUND.

$20,000 United States Consols 4s. 1907	22,950.00	
1,000 Iowa Central R. R. 5s.	845.00	
1,000 Boston United Gas Co. 5s.	770.00	
2,000 Brookline Gas Lt. Co. 5s.	2,000.00	
2 shares Dwight Manf. Co.	1,600.00	
1 share Merrimack Manf. Co.	1,015.00	
1 " Laconia Co.	605.00	
6 shares Hamilton Woolen Co.	390.00	
6 " Manchester Mills	660.00	
2 " Pepperell Mfg. Co.	2,300.00	
24 " Everett Mills	2,160.00	
31 " Great Falls Mfg. Co.	3,472.00	
10 " Lowell Bleachery	975.00	
27 " Brookline Gas Lt. Co.	2,700.00	
40 " Cambridge Gas Lt. Co.	7,000.00	
7 " Lawrence Gas Co.	882.00	
7 " Lowell Gas Lt. Co.	1,610.00	
16 " Firemen's Fire Ins. Co.	1,968.00	
6 " State St. Safe Deposit & Trust Co.	600.00	
25 " Atlantic Nat. Bank	2,875.00	
25 " Nat. Bank of the Republic	3,625.00	
25 " Third National Bank	2,150.00	
10 " National Union Bank	1,240.00	
2 " National Exchange Bank	226.00	
25 " New England National Bank	3,875.00	
15 " Merchants' National Bank	2,220.00	

PURCHASE OF SECURITIES. GENERAL FUND.

$35,000 Fitchburg R. R. 5s.	35,700.00	
26,000 Am. Dock and Improvement Co. 5s.	28,860.00	
65,000 City of Hartford 4s.	65,650.00	
65,000 Boston & Maine R. R. 4½s.	66,381.25	
		267,304.25

PURCHASE OF SECURITIES, WM. B. ROGERS MEMORIAL FUND.

24,000 Rome, Watertown & Ogdensburg R. R. 5s. 27,103.75

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

Dr.

Cash balance Sept. 30, 1893		12,043.01
From Augustus Lowell for Lowell Courses	5,400.00	
" " " " C. Kastner's salary	2,500.00	
" " " " Lowell School of Design	1,432.00	9,332.00
RECEIPTS FOR CURRENT EXPENSES.		
Income of funds for salaries	4,380.00	
" " " " scholarships (students' fees)	4,000.00	
" " " " Joy "	200.00	
" " " " Swett "	400.00	
" " " " Library	250.00	
" " " " general purposes	10,289.12	
" " Rogers Memorial Fund	9,535.72	
Students' fees	212,119.00	
State Agricultural Fund	5,079.50	
State Endowment Fund	6,666.67	
Laboratory supplies and breakages	6,701.37	
Rents, per Table (page 98)	12,273.79	
Gifts	1,275.00	
Contributed by former M. I. T. Students for expenses at World's Columbian Exposition	472.00	
Interest	2,229.97	
Pope Fund for Highway Engineering, used	1,084.06	
Letter-Box Fund $113.50, used of 1893, $74.00	187.50	
Scholarship Fund, used	500.00	
Boston University	1,150.00	
Sale printed Lecture Notes	2,935.31	
Profit and Loss, expenses more than income	13,603.32	295,332.33
BEQUESTS FOR SPECIAL PURPOSES, ETC.		
Income James Savage Fund, not used	632.42	
" James H. Mirrlees Fund, " "	8.38	
" Elisha Thacher Loring Fund, " "	41.47	
" Richard Perkins Fund, " "	285.20	
" Charlotte B. Richardson Fund, " "	1,699.23	
" Charles Lewis Flint Fund, " "	37.70	
" Thomas Sherwin Fund, " "	25.00	
" Farnsworth Fund, " "	25.00	
" Pope Fund, " "	115.94	
" W. F. Huntington Fund, " "	35.42	
" Susan Upham Fund, " "	51.87	
" W. B. Rogers Fund (additional $621.00)	813.94	
Susan E. Dorr Fund (income not used)	911.51	4,683.08
GIFTS AND BEQUESTS FOR GENERAL PURPOSES.		
Subscriptions of 1892 (additional)	24,500.00	
Catherine P. Perkins Legacy	88,713.00	
William J. Walker Legacy	10,537.27	123,750.27
SECURITIES SOLD OR PAID. GENERAL FUND. See List, page 89		188,812.37
SECURITIES SOLD. W. B. ROGERS M. FUND. See List, page 89		22,589.68
SUNDRIES.		
Income General Funds credited to Advance Bond Premium Account	300.00	
Income Wm. B. Rogers Mem. Fund credited to Advance Bond Premium Account	400.00	
Students' Deposits	150.00	
Boston Art Student's Asso. on acct.	666.67	1,516.67
		$658.050.41

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.
FOR THE YEAR ENDING SEPTEMBER 29, 1894.

Cr.

Paid for Lowell Courses	5,400.00	
" " Charles Kastner's salary	2,500.00	
" ". Expense Lowell School of Design	1,432.00	
		9,332.00

EXPENSES.

Salaries, per Table (page 98)	200,042.04	
" paid from the Pope Fund	800.00	
Lecturers and Supplies paid from the Pope Fund	284.06	
Scholarships paid from Swett Fund	400.00	
Repairs, per Table (page 99)	7,834.16	
General Expenses, per Table (page 99)	13,485.41	
Fuel	10,916.74	
Water	2,042.90	
Gas	1,812 45	
Printing and Advertising	2,681.67	
" Lecture Notes	3,276.20	
" Annual Catalogue	2,269.43	
Rents paid Boston & Albany R. R. Co.	180.00	
" " Natural History Society	200.00	
Laboratory Supplies and Libraries, per Table (page 12)	32,445.88	
Society of Arts	872.40	
World's Columbian Exposition	450.58	
Interest, 5 per cent on funds not in stocks and bonds	5,711.74	
Interest paid A. Lowell, Trustee	1,000.00	
" " on Mortgage Notes	8,626.67	
		295,332.33

SECURITIES BOUGHT OR RECEIVED AS LEGACIES. GENERAL ACCOUNT.

See List, page 3	267,304.25

PURCHASE OF SECURITIES WM. B. ROGERS MEMORIAL FUND.

24,000 Rome, Watertown & Ogdensburg R. R. 5s.	27,103.75

SUNDRIES.

Letter Box Fund 1893 used	74.00	
Scholarship Fund used	500.00	
Emery Testing Machine	70.56	
Clarendon Street Land and Building	3,060.94	
Boiler House	25.20	
Students' Notes	1,927.50	
Loan to Boston Art Student's Association	15,000.00	
Profit and Loss, per contra. (See page 90)	13,603.32	
		34,261.52
Cash balance, Sept. 29, 1894		24,725.56
		$658,059.41

The following account exhibits the property held by the Institute, as per Treasurer's books, Sept. 29, 1894 : —

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	
2,760.00	Kansas City, Memphis & Birmingham R. R.			
	920 General Mortgage 4s. . . .	1934		
	1840 Income 5s.	1934		
			2,155.00	
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 .		8,571.41	
	Bonds			251,558.91

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.

$16,000.00	Bur. & Mo. River (Neb.) R. R. 6s. non-exempt	1918	16,000.00	
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	
	Advances to Bond Premium account		5,541.62	
	Bonds			188,641.62
	Amount carried up			$458,756.36

Amount brought up 458,756.36

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	12,880.00
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
27	Brookline Gas Light Co.	"	100	2,700.00
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

150,025.50

REAL ESTATE.

Rogers Building		315,726.88	
Walker Building		190,492.44	
Land on Garrison Street	50,840.00		
Workshops " "	52,416.49		
		103,256.49	
Land on Trinity Place	76,315.69		
Engineering B'ld'g, Trinity Place	106,616.87		
		182,932.56	
Gymnasium Building		7,967.85	
Architects' Building		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	
			1,168,237.86
Equipment, Engineering Building		16,555.24	
" Workshops		20,628.56	
			37,183.80
Boiler House			25.20

SUNDRIES.

Notes Receivable	1,500.00	
Boston Art Students' Association	14,333.33	
Emery Testing Machine	10,000.00	
Students' Notes	2,902.50	
Cash Balance, Sept. 29, 1894	24,725.56	
		53,461.39
		$1,867,690.11

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	
General Institute "	36,028.00	
		456,007.24

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	52,989.44	
James Savage Fund	13,280.68	
Mrs. Susan H. Swett Fund	10,182.95	
William Barton Rogers Fund	10,202.27	
Joy Fund	8,555.83	
Elisha Thacher Loring Fund	5,370.86	
Charles Lewis Flint Fund	5,291.63	
Thomas Sherwin Fund	5,025.00	
Farnsworth Fund	5,025.00	
James H. Mirrlees Fund	2,675.99	
William F. Huntington Fund	5,243.75	
Susan Upham Fund	1,089.37	
Susan E. Dorr Fund	911.51	
		125,844.28

OTHER TRUSTS.

Charlotte Billings Richardson, Industrial Chemistry Fund,	35,683.79
Charles Lewis Flint, Library Fund	5,000.00
Albert A. Pope, Street Building and Highway Engineering Fund, balance	1,162.07
Letter Box Fund, balance	122.37

MISCELLANEOUS.

Notes Payable	220,000.00	
Students' Deposits	650.00	
Subscription of 1887	123,500.00	
Subscription of 1892	121.250.00	
Martha Ann Edwards Legacy, 1893	98,452.89	
T. O. H. P. Burnham Legacy, 1893	20,000.00	
Catherine P. Perkins Legacy, 1893	88,713.00	
William J. Walker Legacy, 1894	10,537.27	
M. I. T. Stock Account	473,167.20	
		1,156,270.36
		$1,867,690.11

Comparative Statement of Funds, etc.

	Sept. 30, 1893.	Sept 29, 1894.
Trusts for general purposes	456,007.24	456,007.24
" " Salaries	87,600.00	87,600.00
" " Scholarships	123,476.37	125,844.28
" " Library	5,000.00	5,000.00
Charlotte B. Richardson Ind. Chem. Fund	33,984.56	35,683.79
Albert A. Pope Street Building and Highway Engineering Fund	1,046.13	1,162.07
Letter Box Fund	196.37	122.37
Notes Payable	220,000.00	220,000.00
Student's Deposits	500.00	650.00
Subscription of 1887	123,500.00	123,500.00
" " 1892	96,750.00	121,250.00
Martha Ann Edwards Legacy	98,452.89	98,452.89
T. O. H. P. Burnham Legacy	20,000.00	20,000.00
Catherine P. Perkins Legacy		88,713.00
William J. Walker Legacy		10,537.27
M. I. T. Stock Account	495,379.48	473,167.20
	$1,761,893.04	$1,867,690.11
Increase	105,797.07	
Consisting of: —		
Charlotte B. Richardson Fund Income	1,699.23	
Scholarship Funds, not used	1,378.80	
Subscription of 1892, increase	24,500.00	
A. A. Pope Fund, increase	115.94	
Wm. B. Rogers Fund, additional	621.00	
Catherine P. Perkins Legacy	88,713.00	
William J. Walker Legacy	10,537.27	
Gain on Stocks sold, net	102.25	
Susan E. Dorr Fund	868.11	
Students' Deposits, increase	150.00	
		128,685.60
Less Loss. Expenses more than income	13,603.32	
" on Sale of 20,000 Atchison 4s	3,462.38	
" " Emery Testing Machine, amount charged off	3,923.83	
" " Students' notes, charged off	1,325.00	
" " Scholarship Fund, used	500.00	
" " Letter Box Fund	74.00	
		22,888.53
		$105,797.07

INCOME FROM GENERAL INVESTMENTS, AND APPLICATION THEREOF.

Applied to Salaries	4,380.00	From Dividends, Bank Stocks	599.25
" " Scholarships	4,000.00	" State Tax returned, Old Boston National Bank	71.08
" " Library	250.00	" Bonds	9,583.33
" " General Purposes	10,289.12	" Dividends, Railroad Stocks	2,791.75
" " Increase of Funds	2,970.03	" " Coal and Gas Stocks	2,222.00
" " Advances to Bond Premiums	300.00	" " Manufacturing Stocks	1,210.00
		" Interest allowed on Funds not in Bonds and Stocks @ 5 %	5,711.74
	$22,189.15		$22,189.15

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

Paid Massachusetts Institute of Technology .	9,535.72	Received Income from Railroad Bonds . . .	9,935.72
Credited to Advances Bond Premiums . . .	400.00		
	$9,935.72		$9,935.72

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			712.50	
Boston Water Works, use of Laboratory			200.00	
Land and Building, Clarendon St., 10½ mo. to July 15, and ⅔ tax		5,143.00		
less Taxes	1,152.00			
" Commission	750.00			
		1,902.00		
			3,241.00	
34 Commonwealth Avenue, 1 year		2,200.00		
less Annuity under Will	1,000.00			
less Tax and Repairs	401.83			
		1,401.83		
			798.17	
Use of Rooms and Gymnasium			1,522.12	
				12,273.79

Department Supplies.

Chemistry	9,272.61	
Physics	5,186.40	
Mining	1,816.58	
Mechanical Engineering	2,954.66	
Naval Architecture	127.63	
Applied Mechanics	1,530.93	
Civil Engineering	2,954.00	
Biology	2,239.34	
Geology	889.79	
Architecture	1,147.77	
Drawing	165.25	
Mathematics	98.78	
English	1,003.20	
Workshops	1,393.60	
Modern Languages	185.71	
Periodicals	1,479.63	
		32,445.88

Salaries.

Instruction	165,154.11	
Administration	18,172.24	
Labor	16,715.69	
		$200,042.04

Repairs.

Department Improvements: —		
Chemistry	899.85	
Workshops	696.98	
Physics	536.09	
Biology	315.09	
Mechanical Engineering	241.94	
Architecture	240.99	
Civil Engineering	234.70	
Drawing	207.95	
Mining	106.80	
English	100.86	
Applied Mechanics	75.01	
Geology	58.20	
Military	23.44	
Modern Languages	11.00	
Naval Architecture	6.68	
Mathematics	6.00	
		3,761.58
Sundries		749.20
Steam Fitting		611.00
Walker Building		964.16
Engineering Building		442.65
Rogers		381.56
Gymnasium		369.14
Architectural		36.44
Lowell School of Design		214.85
Boiler, Tools, etc.		256.94
Ventilation, Huntington Hall		46.64
		$7,834.16

General Expenses.

Fire Insurance	1,954.08
Stationery and Office Supplies	1,701.87
Postage	1,006.00
Furniture	885.13
Lowell School of Design	710.57
Entrance Examinations	662.97
Washing	564.67
Plumbing	539.60
Janitor's Supplies: Brushes, Pails, Soap, etc.	512.94
Sundries	604.75
Express Charges, Teaming, etc.	481.63
Cases, etc., Military Dept.	451.10
Electric Lighting: —	
Power 266.81	
Wiring, etc. 446.31	
	713.12
Diplomas, Commissions, and Expense of Drill	386.30
Gymnasium Supplies, etc.	319.66
Passage, Clarendon Street to Trinity Place, grading, etc.	255.17
Amount carried forward	$11,749.56

Amount brought forward		11,749.56	
Window Shades and Cord		234.03	
Paints, Varnish, etc.		221.82	
Books, Supplies, etc., for General Library . .		190.16	
Engine Room Supplies: —			
Oil	170.58		
Cotton Waste	33.90		
Sundries	211.34		
		415.82	
Ice		166.11	
Window Glass		155.10	
Lantern Slides for Lectures		106.00	
Examination Books		93.75	
Union Safe Deposit Vaults		50.00	
Telephone & Telegraph Co.		47.83	
Electric Clock and Dials		37.72	
Legal Fees		17.51	
			$13,485.41

BOSTON, Nov. 28, 1894.

An examination of the accounts of the Treasurer of the MASSACHUSETTS INSTITUTE OF TECHNOLOGY for the year ending Sept. 29, 1894, 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.