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Mass. Institute of Technology.

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President's Report

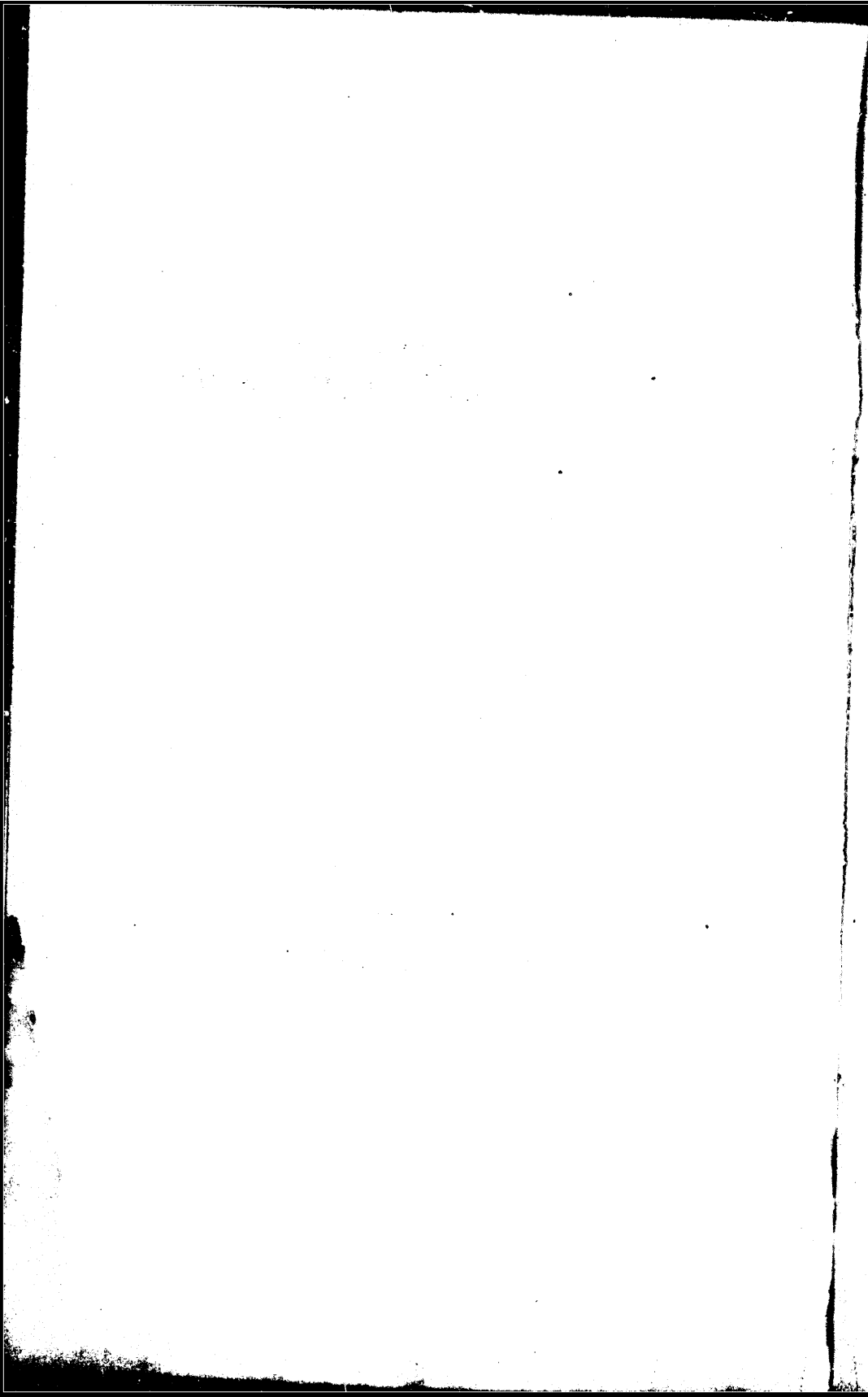
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1884.



TO THE CORPORATION OF THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY :

THE nineteenth year of its active operation finds the Institute of Technology enjoying an unprecedented degree of prosperity. The good work done in the past is now bearing its fruit in public confidence and enlarged means of usefulness. I desire to emphasize my belief, at the very beginning of this report, that the great, and indeed remarkable, accessions which the Institute has received during the past three years have been due to no recent good fortune, but to the comprehensive wisdom and scientific enthusiasm of its founder and first President, to the judicious and faithful care of the corporation during the early days of its existence, to the zeal, devotion, and intelligence of the corps of professors and instructors, and preëminently to the faith and courage with which the standard of high scholarship was maintained during the times of darkness and despondency and almost of disaster.

STATISTICS OF ATTENDANCE.

The number of students at the present time is far in excess of the number attending at any previous period in the history of the Institute. The total of persons registered in all the departments and schools under the control of the corporation is 557, against an aggregate, last year, of 516. The gain, however, during the year has been substantially greater than would appear from

this comparison, inasmuch as a reduction of 31 has been purposely effected in the Lowell School of Practical Design, with the object of raising the standard at once of admission and of instruction within the school. Omitting the students of the Lowell School from consideration, the total number of students this year is 497, against 425 last year. But the real position of the Institute will be best reached by the further exclusion of the students of the School of Mechanic Arts. Deducting these, the number of students in the School of Industrial Science, as by the catalogue now passing through the press, is 443, against 368 last year, making an increase of 75, or more than 20 per cent. The following table exhibits the total number of students in the School of Industrial Science, from the opening of the Institute to the present time. The figures are exceedingly instructive as regards the forces which have operated to affect the attendance upon the school:—

Year.	No. of Students.
1865-66	72
1866-67	137
1867-68	167
1868-69	172
1869-70	206
1870-71	224
1871-72	261
1872-73	348
1873-74	276
1874-75	248
1875-76	255
1876-77	215
1877-78	194
1878-79	188
1879-80	203
1880-81	253
1881-82	302
1882-83	368
1883-84	443

STATISTICS OF EXAMINATIONS.

The results of the applications for admission to all classes of the School of Industrial Science, thus far in the current school year, and of the examinations had thereupon, may be stated as follows :—

31 were admitted without examination, either to the first year class, upon presenting certificates of clear admission to some college of reputable standing, or to the third year class, upon the presentation of diplomas of graduation from some degree-conferring institution, classical or scientific. 83 were admitted, upon examination, free of conditions; 52 were admitted, upon examination, with one condition imposed; 33 were admitted with two conditions; 6 were admitted with three conditions. 48 applicants were rejected upon examination. 27 were admitted as special students upon examination in the studies specially requisite to the partial courses which they proposed to follow.

The total number of applicants appears, therefore, to have been 280. Of those admitted upon examination 17 have not thus far entered the school. In some instances, in the case of applicants heavily conditioned, this has been due to the advice of the faculty, that a longer period be taken for preparation; in some, to a change of plans, to sickness or other causes. The total number of applicants rejected or voluntarily withdrawing was, thus, 65. Of those who were admitted upon examination as regular students, some have elected to become special students, mainly in the department of architecture.

STATISTICS OF RESIDENCE.

Not only is the aggregate attendance upon the Institute increasing, but scholars are coming to us from a constantly extending field, geographically. The students of

the School of Industrial Science are registered as from twenty-six States of the Union ; in addition to which, students report themselves from Montana Territory, from the District of Columbia, and from four foreign countries. The tendency to a wide geographical extension of the constituency of the Institute is seen in a comparison of the respective proportions in which the successive classes of the regular departments are made up of students from within or from without Massachusetts. Thus, of the 29 members of the fourth year class, about to graduate, 25 are from Massachusetts, and but 2 from outside New England. Of the 37 members of the third year class, 30 are from Massachusetts, and 5 are from outside New England. Of the 61 members of the second year class, 42 are from Massachusetts, and 14 are from outside New England. Of the 145 members of the first year class, 82 are from Massachusetts, leaving 34 to come from other New England States, and 29 from outside New England. Eighteen States, besides the District of Columbia, the Territory of Montana, and two foreign countries, are represented in the membership of this class.

Of the total number of 272 students of the regular courses, in all classes, 179 are from Massachusetts, 43 from other New England States, and 50 from outside New England. Of the total number of 443 students, including special students, 288 are from Massachusetts, 57 from other New England States, and 98 from outside New England. Eight Southern States appear on our rolls, with an aggregate of 22 students.

The following table shows the number of students, of each specified class, from each State or Territory or foreign country:—

	Students of the Regular Courses.					Special Students	Aggregate School of Industrial Science.
	4th Year	3d Year	2d Year	1st Year	Total Students of the Regular Courses.		
Massachusetts	25	30	42	82	179	109	288
Maine	1	1	1	13	16	3	19
New Hampshire	1		1	10	12	5	17
Connecticut			1	7	8	3	11
Vermont			2	3	5	1	6
Rhode Island		1		1	2	2	4
Total New England	27	32	47	116	222	123	345
New York		1	2	4	7	8	15
Pennsylvania		1	1	3	5	3	8
New Jersey						2	2
District of Columbia				2	2	1	3
Ohio			1	1	2	7	9
Illinois	1	1	4	3	9	5	14
Indiana						2	2
Wisconsin						1	1
Iowa			1	3	4		4
Minnesota			1	2	3	2	5
Kansas			1	1	2		2
Nevada				1	1		1
California						1	1
Montana				1	1		1
Delaware						1	1
Maryland	1			2	3	6	9
Virginia				2	2	1	3
North Carolina		1	1		2	1	3
South Carolina						1	1
Kentucky		1	1		2		2
Missouri				1	1	1	2
Georgia				1	1		1
Dominion of Canada				2	2	3	5
Scotland							1
South America							1
India							1
Total	29	37	61	145	272	171	443

PROPORTION OF OLD AND OF NEW STUDENTS.

The table following exhibits, for each year of the School's history, the distribution of the total number of students among two classes: first, those students remaining whose names are found upon the catalogue of the year preceding that for which the statement is given; and, secondly, those students whose names appear as new names upon the catalogue of the year to which the statement relates:—

Year.	(1) Total No. of Students.	(2) No. of Students in the Cata- logue 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 No. were regular first year Students.	(5) No. of New Students not of the regular first year class.
1866-67	137	34	103	58	45
1867-68	167	79	88	54	34
1868-69	172	82	90	50	40
1869-70	206	90	116	63	53
1870-71	224	109	115	71	44
1871-72	261	122	139	82	57
1872-73	348	173	175	112	63
1873-74	276	171	105	59	46
1874-75	248	159	89	35	54
1875-76	255	139	116	65	51
1876-77	215	130	85	31	54
1877-78	194	95	98	47	51
1878-79	188	99	89	34	55
1879-80	203	102	101	34	67
1880-81	253	121	132	62	70
1881-82	302	136	166	86	80
1882-83	368	173	195	114	81
1883-84	443	231	212 *	140 †	72

* This number differs from the number previously stated as having been admitted thus far in the school year, 1883-84, by three, being the number of former students of the Institute returning after an absence more or less protracted.

† In addition, five students are repeating the first year.

It will appear from the foregoing table that, since 1879, there has been a steady and rapid increase in the number of students remaining over from year to year; the number for 1879 being 102; for 1880, 121; for 1881, 136; for 1882, 173; for 1883, 231. That the rate of increase of the number of new students has in some of these years even exceeded that of the number of students remaining over, is not due to any greater tendency to drop out of the school, but to the large absolute increase in attendance.

PROPORTION OF REGULAR AND OF SPECIAL STUDENTS.

Still another table which has been prepared exhibits both the absolute number of regular and of special students, as by the catalogue of each successive year, and also the proportion existing between these two classes:—

Year.	No. of Regular Students.	No. of Special Students.	Total No. of Students.	Percentage.	
				Regular.	Special.
				Per cent.	Per cent.
1865-66	64	8	72	89	11
1866-67	110	27	137	80	20
1867-68	124	43	167	74	26
1868-69	105	67	172	61	39
1869-70	125	81	206	71	29
1870-71	143	81	224	64	36
1871-72	180	81	261	69	31
1872-73	235	113	348	68	32
1873-74	182	94	276	66	34
1874-75	170	78	248	69	31
1875-76	182	73	255	71	29
1876-77	134	81	215	62	38
1877-78	117	77	194	60	40
1878-79	103	85	188	55	45
1879-80	110	93	203	54	46
1880-81	140	113	253	55	45
1881-82	164	138	302	54	46
1882-83	219	149	368	60	40
1883-84	272	171	443	61	39

It is gratifying to note a tendency within the past two years to an increase in the proportion of students attending regular courses. This expression, however, should not be taken as implying that it is in any way desirable that the class of special students should disappear from our catalogue, or should be reduced to insignificant proportions. Among the special students have always been some of our best and most promising scholars; and many of the most marked successes of this School of Industrial Science have been achieved in the training and preparation for active life given to those whose age at the time of entrance, or whose family circumstances or pecuniary condition, or whose plans for life, would not have permitted their taking the full regular course in any of the departments of the school. It has always been the policy of the faculty to encourage and promote the admission of special students of this class, especially in the case of those who, having entered upon active life with inadequate preparation, have had the courage and the self-denial to break abruptly off from gainful occupations and come hither for two years, or, it may be, for a single year, with a view to accomplish themselves in those particular respects in which they were most deficient. Moreover, among the special students of the Institute are always found some who are doing their best to qualify themselves as regular students by making up existing deficiencies of preparation.

THE CORPS OF INSTRUCTORS.

The instructing staff of the Institute has necessarily varied with the fortunes of the school and with the number of students in attendance, though not with anything approaching strict correspondence. The following table exhibits severally for each school year the number of professors, of assistant professors, of instructors, and of assistants since the opening of the school:—

Year.	Professors.	Assistant Professors.	Instructors.	Assistants.	Total.
1865-66	10				10
1866-67	12		2		14
1867-68	12	1	2		17
1868-69	13		6	2	20
1869-70	16	1	6	1	25
1870-71	18	2	7	5	32
1871-72	21	2	11	1	35
1872-73	23	2	9	1	35
1873-74	20	3	10	4	37
1874-75	20	3	7	3	33
1875-76	23		6	8	37
1876-77	21		4	10	35
1877-78	20		3	14	37
1878-79	18		7	12	37
1879-80	16		7	8	31
1880-81	15	2	6	7	30
1881-82	17	3	6	11	37
1882-83	16	3	10	11	40
1883-84	15	8	15	10	48

The appointment, during the year, of Dr. Sedgwick, as Assistant Professor of Biology, of Dr. Norton, as Assistant Professor of Organic Chemistry, of Mr. Wells, as Assistant Professor of Mathematics, of Mr. Swain, as Assistant Professor of Civil Engineering, and of Mr. Crosby, as Assistant Professor of Mineralogy and Lithology, has greatly strengthened the instructing staff.

COURSES OF INSTRUCTION.

Regarding the various courses and departments of the School, it may be said that the fortunes of the Institute, the changing conditions of the national industry, the varying tastes and predilections of individuals, and, to a certain extent, doubtless, the tendency of students to move together, have combined to produce not a little fluctuation in the numbers of students within the several courses and departments. The following table exhibits the number of persons who have graduated within each of the several courses at each successive year since the first diplomas were conferred in 1868:—

Year.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	Total.
	Civil Engineering.	Mechanical Engineering.	Mining Engineering.	Architecture.	Chemistry.	Metallurgy.	Natural History.	Physics.	General Courses.*	
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	1	3	1	7					25
1874	10	4	1	1	1				2	18
1875	10	7	6	1	5			1	2	28
1876	12	8	7		2	1		3	3	41
1877	12	6	8	4	2		2			32
1878	8	2	2	3	3				1	19
1879	6	8	3	1	3		1	1		23
1880	3		3		1		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	4	1	3					18
	104	61	66	18	46	1	5	6	15	322

The following table exhibits the distribution of the 127 regular students in the three upper classes of the Institute among the several courses, the choice of courses being made, it will be remembered, only at the close of the first year of study:—

	I.	II.	III.	IV.	V.	VII.	VIII. B.	IX.	Total.
	Civil Engineering.	Mechanical Engineering.	Mining Engineering.	Architecture.	Chemistry.	Natural History.	Electrical Engineering.	General Courses.	
4th year class	5	6	8		10				29
3d year class	6	8	9	2	6	1	5	1	37
2d year class	10	19	10	3	6		13		61
	21	33	27	5	21	1	18	1	127

* This includes not only the General Courses now existing, but the former Science and Literature Course, and the former Elective Course.

The regular students of the first year now number, as by the forthcoming catalogue, 145.

THE WORK OF SPECIAL STUDENTS.

The 171 special students in the School of Industrial Science cannot be classified systematically, but the following table exhibits the number of special students pursuing each particular branch of study, according to the attendance papers filed by them, and approved by the Faculty:—

NUMBER OF SPECIAL STUDENTS ATTENDING EXERCISES IN THE FOLLOWING DEPARTMENTS OF STUDY OR PRACTICE.

Architecture	28	German	75
Astronomy	8	Mathematics	76
Assaying	7	Mechanics	13
Biology	9	Mechanical Engineering	26
Botany	1	Metallurgy	10
Chemistry	76	Metallurgy Laboratory	1
Civil Engineering	16	Military Drill	20
Drawing	37	Mining	3
Descriptive Geometry	6	Mining Laboratory	5
English	60	Physics	58
French	11	Shop Work	40
Geology	8	Zoölogy	2
Total number of entries, by special students		596	
Total number of special students		171	
Average number of entries		3.5	

NEW DEPARTMENTS OR COURSES: ELECTRICAL ENGINEERING; PREPARATION FOR THE STUDY OF MEDICINE.

Among recent developments, in the matter of the courses of instruction in the Institute, especially deserve to be mentioned the following: The establishment last year of a course (VIII. B) in Electrical Engineering, under the special charge of the Professor of Physics, intended to

meet the rapidly increasing demand for persons qualified to conduct the great variety of business enterprises which the remarkable discoveries in electrical science have called into being within the last few years, and, secondly, the institution during the present year of a course (VII B) in preparation for the professional study of medicine. Regarding the latter, it should be said that its germ has long existed in the course relating to natural history, which, under the charge of Professor Ordway, has offered no small facilities for the special preparation of young men who had it in contemplation to enter any one of the medical schools of the country upon leaving the Institute. The lack, however, of an adequate biological laboratory, and the great variety and exacting nature of the duties charged upon Professor Ordway, or assumed by him in his unstinted zeal and devotion to the interests of the school, have heretofore prevented any considerable actual development in this direction. The appointment of Dr. Sedgwick as Assistant Professor of Biology, and the assignment of a commodious and convenient laboratory to the work of instruction under this head have, since the beginning of the present school year, brought strongly out the possibilities of such a course in the Institute, and already a number of students have enrolled themselves in connection therewith. I feel assured that this is destined to be among the most useful of the departments of instruction in the future; and it is gratifying to observe a great degree of cordiality among the most eminent physicians and professors of medicine in Boston and Massachusetts towards the proposed scheme. The essence of the course preparatory to the professional study of medicine, as drawn up by the Faculty, consists of instruction and laboratory practice in chemistry, in physics, in general biology, and in physiology. The cultivation of the perceptive powers, the systematic practice of the art of observation, the use of instruments of precision, the early familiarity with the structure, habits, and workings of liv-

ing objects, which are involved in this course, must be conceded to afford the kind of training best suited to enable the scholar to pursue the subsequent study of medicine, with the greatest advantage, and cannot fail to prove of peculiar value to the physician in his professional practice.

PROGRESS IN THE LONGER ESTABLISHED COURSES.

Throughout the longer established courses of the Institute, the same high standard of study and laboratory practice which has been maintained from the first, even against poverty and inadequacy of means, still characterizes the work of the school. Indeed, with the increasing knowledge of the needs of instruction on the part of teachers, due to their experience with successive classes, with the enlarged facilities and improved apparatus afforded by the liberal policy of the Corporation, and with the higher organization and more perfect systemization which are sure to be achieved in the intelligent prosecution of any service, that standard may confidently be claimed to have risen steadily from year to year. Perhaps no better illustration could be offered of this than in the very remarkable development of the chemical department. The work which formerly was carried over four years of study and laboratory practice, is now completed in three. This has not been effected by any abridgment of the field of work, any scrimping of experiment or practice, or any lowering of the requirement of performance. Nor, on the other hand, has it been effected by any greater tax upon the time of the students, or any greater strain upon their nervous force. It has been effected, as suggested, solely by the more perfect organization and systemization of the service. The entire fourth year of the chemical course is now left open to a class of work which, ten years ago, even the ambition of the devoted professors in this department did not allow them to contemplate as practicable. And what has

been achieved in this department has been in greater or less measure achieved in other departments of the school.

THE NEW LABORATORIES.

The feature which especially characterizes the Massachusetts Institute of Technology, in contrast with other scientific and technological schools, is the predominance of laboratory, shop, and field practice, experiment, and research. These are used at every point, where it is found practicable, to supplement, to illustrate, and to emphasize the instruction of the recitation or lecture room. Especially have the departments of mechanical engineering and of applied mechanics had their opportunities for experiment largely increased during the year. Twelve months ago the department of applied mechanics was confined to a single small room, in which, however, has been carried on some of the most original and useful work ever done in this line of research; the laboratory of steam engineering found its space only in the dark hall-way of the basement of the Rogers Building, without a partition or even a screen to protect its one small engine and limited apparatus; while the machine shops, established in 1876 by the enlightened wisdom of President Runkle, had the use of only a part of the low brick annex, where, often in the same room, materials, processes, and products were necessarily crowded together, without the facilities either for nice work or for orderly arrangement. To-day, the department of applied mechanics has expanded until it occupies more than three times its former space. The department of mechanical engineering has the use of laboratories adequate not only to its present needs, but to a very large future increase; while, in addition to the small but excellent engine presented some years ago by the generosity of Mr. George B. Dixwell, the department has now the use of two powerful engines of improved modern types, always available for purposes of instruction

and experiment. The mechanic art shops have been, within the past few weeks, removed to the new buildings on Garrison Street, where, in light and commodious rooms, covering twenty thousand square feet of floor surface, have been placed forty carpenter's benches; thirty-seven wood lathes, on benches which can, also, be used for carpenter work; thirty-two blacksmith's forges, with anvils and vises; twenty-two engine and fifteen speed lathes, for working metal, with a full equipment of planers, shapers, milling machines, and other apparatus, from the best machine shops of the country.

Exclusive of the members of the School of Mechanic Arts, ninety-five students now receive instruction in the ordinary mechanical arts. In the belief that nothing can surpass this species of instruction in value, not only for the uses to be made of the knowledge and aptitude acquired, but also for the training of the perceptive powers, for the development of executive faculty, and of practical, economic sense, all possible extension will be given to this branch.

The Rogers Physical Laboratory has shared in the opportunity for expansion afforded by the completion of the New Building, of which it will occupy the first story nearly entire, with a lecture room for two hundred students on the second floor. The rooms assigned to the physical department are now being fitted up in the most thorough and comprehensive manner, with reference both to elementary instruction and to advanced work and original research in heat, light, sound, and electricity. The number of laboratory students in physics is as follows: second year, 19; third year, 40; fourth year, 18. The number attending the lectures given in the second year is 110.

The introduction of a course of instruction and research in ventilation, for the benefit of the students in physics, in architecture, and in civil engineering, has been an interesting feature of the last year.

For chemical practice, the facilities of the institution,

by the completion of the Kidder laboratories, founded by the late Jerome G. Kidder, of Boston, have been greatly extended.

It may be long before any American institution will be able to offer opportunities for the highest kind of research, such as are afforded in the laboratories of the ancient universities of Germany; but I have no hesitation in saying that during the first four years of chemical study and practice, the student cannot find in any school of the old world facilities superior to those which the friends of the Institute of Technology have provided.

The new laboratories contain desks for 450 students in chemistry: 288 in the laboratory of general chemistry, 108 in the analytical laboratory, 30 in the laboratory of organic chemistry, making 426; while the remaining 24 are found in 5 small private laboratories. There are at the present time 272 students in chemistry, of whom 189 are in the first year, 29 in the second year, 25 in the third year, and 29 in the fourth year. Of the fourth-year students, 12 work in the laboratory of organic chemistry, and 13 in the laboratory of industrial chemistry. The Kidder Chemical Lecture Hall in the third story has a seating capacity of two hundred.

THE MINING AND METALLURGICAL DEPARTMENTS.

The Mining and Metallurgical laboratories of the Institute have long been recognized as possessing a merit almost unique for the purposes of instruction. They have been built up, so to speak, from the ground, under the most painful restrictions as to space and as to available means, by the devotion, the self-sacrifice, and the intelligence of a graduate of the Institute. A high European authority has recently pronounced the metallurgical laboratory of the Institute the first in the world for purposes of instruction. Probably the most pressing present need of the Institute, after the magnificent endowment this year provided for the

chemical and mechanical engineering departments, is that of a new mining and metallurgical laboratory, in which the inventive talent and the professional ambition of Professor Richards may have scope to develop themselves fully in the building up of machinery and apparatus for this most important service. A school which has already done so much, with so little, in promoting the education and training of young men to direct and control the development of our mineral resources, should not be denied the means for realizing its largest possible usefulness in this direction.

THE DEPARTMENT OF INDUSTRIAL CHEMISTRY.

The Corporation have already given expression to a desire that the department of Industrial Chemistry should receive a rapid development, to enable it to meet the increasing demand from the various manufacturing industries of New England and of the country. That this department has in the past done excellent work is attested by the positions attained by the graduates of the School in connection with many of the largest industrial establishments of the United States; but its usefulness has been restricted heretofore not only by the lack of laboratory facilities, but also by the numerous and exacting duties which the absolute needs of the school have imposed upon the head of that department. From many of these the re-arrangement and re-assignment of duties, both of instruction and of supervision, have already, within the past two months, relieved Professor Ordway. The erection of a laboratory of industrial chemistry, for which the land purchased during the last year by the Corporation would amply suffice, will be a pressing necessity within the near future.

MATHEMATICAL INSTRUCTION.

Mathematical studies must always remain in a high sense the most vital part of any school of pure or applied science.

The success of the departments of chemistry, of physics, of metallurgy, and even of biology, is dependent, in a large degree, upon the discipline acquired in the mathematical recitation-rooms as well as upon the knowledge of mathematical principles there obtained. In this branch of instruction the Institute is, as it has always been, exceptionally strong. The requirements of such professional courses as are alone fit to be pursued in a school of the highest grade cannot fail to be found somewhat onerous and painful by students who are not gifted with natural mathematical aptitudes, nor is it easy for a scientific faculty greatly to qualify those requirements without lowering the standard of attainment and accomplishment.

INSTRUCTION IN THE MODERN LANGUAGES.

Instruction in the Modern Languages becomes, of necessity, a very important part of all the regular courses, and of any extended special course, in a scientific or technological school. It is gratifying to report a marked degree of success in this department of instruction, within the Institute. The ability to read easy French is now required as a condition of entrance to all the regular courses, and the study of that language is pursued throughout the first year by all regular students, except such as may be individually excused, as having previously acquired the requisite degree of knowledge and proficiency. After the first year this study becomes elective, except that in the fourth year of the course in architecture, the further study of French is required. The study of German is begun at the opening of the second year by all regular students, and is pursued as a required exercise, except in the case of students individually excused, until the close of the third year, after which it becomes elective. Spanish and Italian are elective studies throughout the second, third, and fourth years.

The total number of students of all classes in French is 145 ; in German, 167 ; in Italian, 2.

At the beginning of the last academic year, elementary French was introduced as a required study into the second year of the School of Mechanic Arts.

THE DEPARTMENT OF MECHANICAL ENGINEERING.

Upon the retirement of Professor Channing Whitaker, after eight years of laborious and devoted service, from the chair of Mechanical Engineering, Professor Lanza, at the request of the Corporation, assumed the charge of that department in addition to his own, viz., Applied Mechanics. Professor Lanza's conduct of this most important department—now become the largest in the Institute—has been marked by singular force, comprehensiveness, and soundness of judgment. The four instructors in mechanical engineering, three of whom are graduates of the Institute, constitute an exceptionally strong staff, and the increased facilities put at the disposal of the department give assurance of a development commensurate with the rapidly increasing demands made upon it by the industries of the country.

THE GENERAL COURSES.

I have spoken of recent developments in the courses of instruction in the Institute, especially the establishment of the course of electrical engineering, and the extension of the instruction in natural history, as a means of preparation for the subsequent professional study of medicine. There is still another direction in which the Faculty strongly desire to secure an early extension of the usefulness of the school, namely, through giving unity and vitality to the courses now known on the catalogue as General Courses, A, B, and C, which have for their special object the preparation of young men for active business life, through studies

which are of a predominantly scientific character, yet not directed toward any one of the distinctly scientific professions. Almost from the opening of the school, courses have been arranged with reference to this object; but the exacting demands made by the engineering and other technical departments upon the very limited resources of the Institute, have, in the past, prevented instructors from giving to these courses the degree of time and effort necessary to secure their proper development. Moreover, as the primary object of the Institute has been known to be technical education, it has not been found easy to attract the required degree of attention to the projected branches of study, on the part of pupils or their parents.

Somewhat more than a year ago, the Faculty, with the approval of the Corporation, established the three general courses above referred to, recommending them in the case of young men whose purpose it is to become merchants, manufacturers, or bankers, and who desire a preparation for active life, liberalizing in its tendencies, but without any influence to alienate the student from the ideas, tastes, and habits which are appropriate to practical business pursuits. Each of the courses thus instituted contains a solid body of scientific study and of scientific field or laboratory work. In the first, physics, with the requisite mathematics, predominates among the scientific studies; in the second, chemistry, with the closely related sciences of botany and physiology; in the third, geology, with botany and zoölogy. While each of these courses contains thus a great deal of scientific study and practice, more attention is devoted to the study of language, literature, history, political economy, business law, and industrial science than would be compatible with the requirements of the purely professional courses. The time which in the latter is necessarily given to the special technical study and work essential to the architect, the engineer, the naturalist, or the chemist, is, in the courses under consideration, assigned to more general studies,

which are of a nature to enlarge the views and enrich the life of the man of business.

The period which has elapsed has not been sufficient to test the suitability of the courses thus projected to meet the demands of the community; but with the improved facilities of instruction at the command of the Institute, I cannot doubt that the opportunities thus offered for an education which shall combine both practical and liberal tendencies will be made use of in a rapidly increasing degree.

THE EDUCATIONAL INFLUENCE OF SCIENTIFIC AND TECHNOLOGICAL STUDIES.

While it must be conceded that force of expression and facility in the communication of thought are best to be acquired through the philosophical, dialectical, and rhetorical studies and exercises which in the main compose the curriculum of the older institutions of our country, I believe it to be equally true that the faculties of clear perception, of careful discrimination, and of just generalization are developed by the study of natural history, of chemistry, of physics, as they can be through no other educational means.

There is, moreover, a consideration of not a little moment, in this connection, which may fairly influence the minds of parents and of preparatory teachers, in deciding between the traditional and the new education. This consideration I will, without the slightest wish to undertake any disparagement of classical studies, now venture to indicate.

It is a fact, too palpable to be questioned, that the large and undoubted advantages of the traditional system of education are secured by those students whose aptitudes and tastes give them an interest in the pursuit of language and literature, at a great and unspeakable sacrifice on the part of that other and not inconsiderable

class of young men whose faculties and dispositions do not prepare them for, or incite them to, studies of this character. It is a familiar feature of classical colleges that large numbers of students, who are by nature neither vicious nor idle, not finding the wants of their minds satisfied by the studies to which they are directed, relinquish, at a very early date in their collegiate career, all scholarly ambition, and come, with more or less reluctance, to accept the part of doing nothing well, contented to be known as poor scholars, frequently rebuked and harassed by their instructors and their parents on account of their deficiencies, and aiming no higher than to pass the periodical examinations which are to determine the question of their continuance as members of the college. Surely this is a poor preparation for life, at least for practical business life, where success is to be gained far less by talent or acquirement than by promptitude, by punctuality, by industry, by self-respect and by strict attention to duty. It is making no unseemly boast and offering no unfair comparison, to say that students of that class are exceedingly rare in this school. The idle student is hardly known here. The painful task of harassing and menacing scholars, who are such only in name, who have, as scholars, neither ambition nor self-respect, is one from which the Faculty are almost entirely relieved. What with the variety of courses here presented to the student for his own free election, what with the interest which the youthful mind always finds in one or another kind of laboratory practice or field work, it is seldom that a student fails to give, without compulsion, even without admonition, all the time and effort to his own chosen course which his instructors deem right and proper. Differences, and great differences, indeed, exist as to the degree of success attained by our scholars. Yet it is surprising to observe how far the opportunity to make choice of the kind of work which shall be done goes to make up for the deficiencies which appear when a large body of students are

subjected to one and the same test of scholarly ability or performance. Young men who exhibit no inclination or aptitude whatever for linguistic or philosophic studies, are often found to take the deepest interest in natural history, in chemistry, or in mechanics; to have remarkable aptitude for manipulation, and to possess excellent powers of perception, discrimination, and judgment.

Not infrequently one who, if compelled to pass through long courses of classical, rhetorical, and dialectical exercises, would have had a thoroughly unhappy career, finding nothing in his daily tasks to interest his mind or call out his powers, feeling himself continually at a disadvantage in comparison with others, and soon, probably, sinking into that most unfortunate condition for a young man, of accepting a low standard of performance, is found among our brightest, most apprehensive, most enthusiastic, and most successful scholars.

A generation ago it was the accepted theory of educators, generally, that instruction, to be most effective, should cross the grain of the youthful mind; that if disinclination were shown towards any particular study, the teacher should catch at this as his welcome clue; and that the scholar should thereafter be practised and drilled, for his mind's good, against his indifference, his dislike, and even his repugnance, until he should learn to do well and freely that for which he had originally the strongest inaptitude. In a word, indisposition towards any kind of mental exercise was to be dealt with like a sinful inclination; war was to be made upon it until it should be conquered.

Not only a better observation of life, but the study of physiological psychology has led the educators of to-day to a widely different view of the office of instruction. It is now generally admitted that it is the first duty of the teacher to ascertain the true bent of the youthful mind, and that, so far as practicable, instruction should be made to conform thereto; that the successful teacher is not the

one who compels the scholar to do, at the last, reasonably well that which he was at the first least disposed to do, but the one who brings the scholar to do, in the fullest degree and in the most perfect manner, that for which he has the greatest aptitude, leading him, with ever-increasing freedom and pleasure of work, in the ways which nature has pointed out ; that in any other system of training there is enormous and irreparable loss of nervous force and moral énthusiasm, with a result certain to be lower and less desirable than under the system which seeks to develop to their highest efficiency the native powers of the mind.

These remarks have been suggested by reference to the so-called General Courses which have been described. I feel a strong assurance that an increasing appreciation of the superior advantages of a predominantly scientific and practical education, with a modicum of literary and philosophical training, in the case of all young men who have not a decided taste and aptitude for the traditional studies of the American College, will secure a steady, rapid growth of the Institute upon this side.

MILITARY DRILL.

One other branch of instruction requires to be mentioned here ; namely, Military Drill. As a beneficiary under the grant of the General Government, the Institute is bound to give instruction in military tactics. It would be entirely practicable, and perhaps not unfair, to reduce this branch of our work within very narrow dimensions, as is done in many institutions which stand in the same position in this respect. But the action of the Corporation and the Faculty in the past has made this a substantial and relatively important department of the school. The entire first-year class, with the exception of such as are specifically excused for physical disability or other cause, undergo a thorough training in military tactics, including

the evolutions of the battalion. This department is now under admirable control, at the hands of Gen. Hobart Moore, the recently appointed instructor. Through means of the drill thus afforded, our young men, coming to the school from every variety of conditions, acquire the instinct of subordination, the power of cohesion, promptitude and precision of movement, and habits of mind as well as of physical bearing which cannot fail to be useful in a high degree.

WOMEN IN THE INSTITUTE.

As early as 1867, among the Lowell Free Lectures given by instructors of the Institute, were two courses in chemistry, by Professors Eliot and Storer, open equally to both sexes. In 1868, laboratory exercises were substituted for lectures, upon the same condition. This continued, with the exception of one year, until 1877. In the latter year, the erection of the low brick annex on the grounds of the Institute furnished the space requisite for a separate laboratory for women, and the sum of \$2500 was furnished by the Woman's Education Association to provide instruments and apparatus for instruction in advanced chemistry, mineralogy, botany, and industrial chemistry. In November of that year the laboratory was opened to students. In the seven years that have intervened, the whole number of students in this laboratory has been 102, more than half of whom were teachers at the time of their entrance into the laboratory, or were fitting themselves for that profession.

When the erection of the new building of the Institute was last year determined upon, the Corporation accepted the gift of \$8,000 from certain associations and individuals interested in the object, as a means of providing, in the contemplated chemical laboratories, adequate space and

facilities for the instruction of women. The completion of these laboratories of necessity supersedes the separate laboratory which had been so long maintained, largely through the zeal and self-devotion of Mrs. Ellen H. Richards, herself a regular graduate of the Institute, who has for seven years given instruction, several hours of each school day, without any compensation for her services. The Corporation have already granted the full degree of the Institute to five women, who have completed one or another of the regular courses of study and research. The number of women at the present time with the School, as regular or special students, mainly in the departments of chemistry and biology, is eleven. Two of these are members of the senior class, in good standing, and will offer themselves next summer as candidates for a degree. The "Margaret Cheney Reading Room," named in memory of one of the former scholars of the Institute, which is now being fitted up on the third floor of the new building, will afford the students of this sex adequate facilities for retirement and rest in the intervals of recitation and laboratory work.

THE SCHOOL OF MECHANIC ARTS.

I have thus far spoken only of the School of Industrial Science, which forms, and will doubtless always form, the predominant part of the Institute of Technology; which, indeed, in the view of most persons, is the Institute. Two subsidiary schools have, however, been established, which deserve the confidence and support of the Corporation. The School of Mechanic Arts, founded in 1876, has fully justified the efforts and sacrifices involved in its establishment. It has given a useful education and training to considerable numbers of young men; it has paid its own expenses; and it has gone far to meet the cost of maintaining mechanical laboratories and workshops for the benefit of the students in

engineering and architecture in the School of Industrial Science. The attention of educators in all parts of the country is being increasingly drawn to the need of this species of education and training for multitudes of young men whose financial conditions or plans for life do not allow them to contemplate a professional career; and, much as our School of Mechanic Arts has already contributed to the credit and reputation of the Institute, it is, I believe, destined to do so in a far higher manner in the immediate future, when it shall be recognized as the prototype of great numbers of schools of this class, forming an important integral part of the educational system of the country. It is a question which will probably arise during the present year, whether the course of instruction in this school may not advantageously be lengthened to three years.

THE LOWELL SCHOOL OF INDUSTRIAL DESIGN.

The Lowell School of Industrial Design, established in 1872 by the Trustee of the Lowell Institute, has, from its foundation, filled, and now fills, a position of great usefulness. The opportunities it offers for acquiring taste and skill in composition and design, with reference to the industrial arts, have been a great boon to large numbers of young persons. Graduates of this school have had, on the whole, a remarkable degree of success in their chosen avocations, and the number of applicants for its privileges is continually increasing. This has allowed an advance at once in the standard of requirement for admission, and in the standard of performance within the drawing rooms of the school.

COMMITTEES OF VISITORS.

The appointment of Committees of Visitors, under the recently adopted Rules of the Corporation, promises to be of great service. Already, the good influences of the new

force thus set in operation have been felt throughout the school. Instructors and students alike have been gratified and encouraged by the presence of members of the Corporation at recitations, lectures, and laboratory practice, while several suggestions of manifest practical value have been offered as the first result of this visitation.

THE SOCIETY OF ARTS.

The Society of Arts has, through the past year, continued its course of usefulness in the diffusion of scientific knowledge and in the discussion of new discoveries and inventions applicable to the arts of life. The Executive Committee, under the chairmanship of Mr. Jacob Dresser, have taken unwearied pains to enlarge the scope of the Society, the result of which appears in an increased attendance upon the meetings, and in the greater number and variety of papers presented. The proceedings have been published annually through the past four years, and a compilation of the records of the first seventeen years of the Society's existence is now in progress with a view to publication.

THE BUILDINGS, NEW AND OLD.

The course of this report has involved frequent reference to the new structures which have been undertaken and completed during the year. The extension of the facilities of the Institute in this respect has, indeed, been remarkable, increasing the available floor-space occupied by the several departments and schools by at least 150 per cent. Even those members of the Corporation who have most attentively watched the work of the last ten years can hardly realize the relief that has been afforded thereby alike to the students and to the officers of instruction, the added pleasure and zest that have been given to the exercises in every department, or the opportunities allowed

for the enlargement and improvement of each and every part of the work done within the school. The Corporation, Faculty, and students alike are under a deep obligation to Mr. Philbrick, the Chairman of the Building Committee, and to Professor Wing, for the zeal, intelligence, and energy with which the great building under whose shadow we meet to-day has been pushed to completion, within a time which even the most sanguine deemed inadequate for so large and difficult a task.

The buildings, the property of the Corporation, used for the purposes of instruction, are five, of which, however, one will necessarily be torn down with the opening of the next season. These are (1) the Rogers Building, erected between 1864 and 1866, at a cost of about \$300,000, which, with the exception of the low brick annex and the gymnasium, has, from the date of its completion to the present year, embraced all the services and departments of the school. This building is 92 x 145 ft. Its several stories contain about 53,000 sq. ft. of floor-space, exclusive of halls and entries, but inclusive of the rooms in the basement occupied for laboratory purposes.

In the re-assignment of space consequent upon the completion of the other buildings, the departments of Civil and Mechanical Engineering, of Applied Mechanics, of Geography and Geology, of Mineralogy and Lithology, of Physiology, Botany, and Biology, will remain in the Rogers Building. The suite of rooms in the second story will be occupied for the purpose of instruction in Mathematics. Until a new and more commodious Mining and Metallurgical laboratory can be provided on the land upon Garrison Street recently acquired by the Corporation, it will probably be unavoidable that this most interesting department of the Institute shall remain in the basement of the Rogers Building, where, already, some relief has been afforded it by the assignment of two large rooms recently vacated by the Chemical department. The Society of Arts will continue to hold its semi-monthly

meetings in this building, unless the increase in attendance should require a removal to the larger hall opening out upon Newbury Street, from the first floor of the new building.

(2) The Gymnasium and Drill Hall, erected in 1874 at a cost of about \$8,600, at the corner of Boylston and Clarendon Streets, but removed in 1882 to Exeter Street, where it stands on land leased from the Boston & Albany Railroad Company. This building is 50 x 160 ft., one story high.

(3) The low brick annex, built in 1876, at a cost of about \$7,000, primarily for the uses of the workshops, but occupied in part, also, by the Women's Laboratory, from the first, and by the department of Industrial Chemistry. This building is 40 x 170 ft., one story high. The workshops were at the opening of this school year removed to the new mechanical laboratories on Garrison Street, while the students of the Women's Laboratory were afforded in the new Kidder laboratories accommodations far superior to those previously enjoyed. The annex is at present occupied by the department of Industrial Chemistry. Inasmuch as the ground on which it stands is, since the completion of the new building, on the former site of the gymnasium, in excess of what the Institute is entitled by the concession of the State to occupy, it will be necessary to raze this building early in the coming year.

(4) The New Building of the Institute, on the corner of Boylston and Clarendon Streets, erected during the past season at a cost of about \$165,000. This building is 90 x 156 ft., four stories and basement. In it the departments of Chemistry, of Physics, and of Architecture have been amply provided for. The Industrial Museum will occupy a hall 110 x 30 ft. on the second story. A suite of rooms in the third story have been allotted to recitations and lectures in Language, History, and Literature.

(5) The series of workshops, drawing and recitation-rooms, comprising about 25,000 square feet of available floor space, erected the past summer along the line of

the Providence Railroad at the foot of Garrison Street, for the accommodation of the workshops, of the School of Mechanic Arts, and of the Lowell School of Design.

THE ROGERS MEMORIAL FUND.

I cannot close this report without giving fresh expression to the gratification which every friend of the Institute feels in the establishment of the William Barton Rogers Memorial Fund of \$250,000, through the exertions of two members of the Corporation, alike as a memorial to our illustrious first president, and as a guaranty and perpetual defence of the institution to which he devoted so many years of his honored life.

All of which is respectfully submitted,

FRANCIS A. WALKER,
President.

