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REPORT

OF THE

PRESIDENT AND TREASURER

PRESENTED AT THE DECEMBER MEETING OF THE CORPORATION

JANUARY, 1906

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Report of the President.

To the Members of the Corporation:

The Report which I have the honor to present at this time is the sixth annual Report which I have addressed to you, and marks the end of five years of service with the Institute.

The year which has passed has been one of quiet work in the various Departments, but has been marked also by several incidents of more than ordinary interest in the life of the Institute.

The celebration last December of the one-hundredth anniversary of the birthday of President Rogers was an occasion long to be remembered in the history of the Institute. The tribute paid to the founder on that day was a very genuine and a very high one, and was an unusual mark not only of the respect but of the affection in which Mr. Rogers' name is held.

During the whole of the past year those connected with the Institute have been subjected to a somewhat unusual experience in the discussion of what has been called the Harvard-Technology alliance. This plan for a single great technical school instead of two in the community of greater Boston involved certain changes which required careful consideration and which were viewed with very different eyes by different members of our constituency. A little later I give as a part of the history of last year's administration a short résumé of this whole matter.

The Executive Committee of the Institute, also, had upon their hands during the past year a somewhat trying matter in the conduct of the questions arising out of the collision between the police and the students at the time of the November elections. The position which the Institute authorities took in this

matter was that students have no rights other than those pertaining to all other citizens. As a matter of fact, great care was taken to make it clear that, in the opinion of the authorities of the Institute, students must hold themselves obedient to law. But it was equally evident that the police officers should be obedient to the same law and that in the affair between them and the students they had clearly overstepped its limits. The decision which was finally reached by the Police Board, in the degradation of the police officers who were responsible, was a complete vindication of the attitude which the Executive Committee took in the affair.

THE GYMNASIUM BUILDING.

No new buildings have been erected during the past year, with the exception of the new Gymnasium building on the Garrison Street land adjoining the Mechanical Laboratories. This new building was made necessary by the fact that the Boston and Albany Railroad Company felt compelled to use for their own purposes the land covered by the old gymnasium. The new building was built with the aim of securing the best possible building at the lowest cost. The building is considered to be remarkably well suited for its purposes, and it has been secured at a cost of some $2,000. less than the lowest contract price at which it could have been let.

CHANGES IN CORPORATION AND FACULTY.

During the last year there have been no changes in the Corporation and those in the Faculty have not been numerous. We have lost by resignation Professor C. M. Spofford, who resigned his position to go to the Brooklyn Polytechnic Institute as Professor of Civil Engineering. His work here will be taken largely by Professor McKibben and Mr. Thorndike.

Into the Faculty at the beginning of the present year have come a number of new members, including Associate Professor William E. Mott and Assistant Professors Samuel P.

Mulliken, George B. Haven, Walter S. Leland, William J. Drisko, Harrison W. Smith, C.-E. A. Winslow, Carroll W. Doten, and Douglas W. Johnson.

Professor Mott, a graduate of the Institute, comes to us after a very successful service at Cornell University.

STUDENT REGISTRATION.

The student registration of this year as compared with that of last year shows a diminution of approximately one hundred names; that for last year being fifteen hundred and sixty-one, that for the present year fourteen hundred and sixty-six,—a loss of ninety-five names. This loss is partly explained by the large number of rejections at examinations in the present year, namely one hundred and eighteen, compared with sixty-seven rejected last year.

Notwithstanding this difference in rejections, the present registration does indicate a diminution in attendance as compared with that of last year. It is interesting to note that this diminution comes entirely from near-by states, namely from the states of Massachusetts and New York, for New York next to Massachusetts has always been the chief source of students for the Institute of Technology. A comparison of the last two years is as follows:

	1904.	1905.
Massachusetts	889	807
New York	94	71
	983	878

In other words, the diminution this year has come entirely from what might be called local students. The actual number of men coming from outside of Massachusetts and New York is greater than ever before, and the percentage of Massachusetts students to the whole number is the lowest in the history of the Institute, amounting this year to only fifty-five per cent.

That this loss is wholly a local one may be still further indicated by a comparison of the attendance from the three coun-

ties of Massachusetts which furnish the largest number of students.

	1904.	1905.
Middlesex	274	257
Suffolk	255	227
Essex	126	104
	655	598

On the other hand, there has been a gain instead of a loss from nearly all other states, including those in the West, like California, Michigan, Illinois, Missouri, and Minnesota, in which the State Universities are making the most rapid gains.

These losses and gains are to be explained, to my mind, on the following ground: local students are those who feel the most acutely a raise in the tuition fee or in the expense of student life, and this diminution in attendance may be referred to their efforts to secure cheaper tuition. The reduction in attendance of students from New York is doubtless due in similar manner to the attractions of Cornell University, where very great facilities are being offered engineering students at a less cost than in Boston. On the other hand, an increase in tuition does not affect students from abroad in the same way, because such students, as a rule, must have fair resources in order to attend a distant institution at all. During the present year large gains in engineering students have been shown at Cornell and Pennsylvania, both institutions being convenient to men coming from the South and the West, and the latter institution has recently provided new engineering buildings and laboratories of the most attractive sort at a cost of $900,000., and these are exclusive of physical and chemical laboratories. The attendance of graduate and foreign students at the Institute in the present year shows a very satisfactory increase. The number of graduate students has increased from one hundred and eighty-one, last year, to two hundred this year; twenty-eight of these are candidates for advanced degrees.

Students from foreign countries number sixty-six, compared

with fifty-four of last year. These come from twenty-five countries, of which the following send the largest numbers:

China	8
Mexico	7
Ontario	6
England	5
New Brunswick	4
Cuba	4

and three each from Armenia, Australia, Japan, and the Transvaal. From the continent of South America are six students in all.

This casual examination of the attendance for the present year shows a satisfactory representation at the Institute from all sections and is an encouraging exhibition of the appreciation throughout this and other countries of the instruction offered by the Institute.

HARVARD–TECHNOLOGY ALLIANCE.

For a year and a half past the Trustees and friends of the Institute have given serious thought to the discussion of a possible alliance with Harvard University. The question involved many considerations of moment concerning both the present and the future of the Institute whose effects were not easy to foresee. The history of the discussion has been fully given in a special number of the *Technology Review* containing the speeches and arguments both in favor of and against the proposed plan. I add here such details as are necessary to complete this history.

This question was opened by a resolution laid before the Corporation in May, 1904, signed by six members of the Corporation, all of them alumni or former students of the Institute. The resolution provided "that the Executive Committee be requested to ascertain whether any arrangement can be made with Harvard University for a combination of effort in technical education such as will substantially preserve the organization, control, traditions, and the name of the Massachusetts Institute of Technology." The resolution was passed

at the meeting of May 4, 1904, and referred to the Executive Committee of the Corporation. This Executive Committee appointed a sub-committee of its own body consisting of the President and Mr. A. Lawrence Lowell to take up with a similar committee of the Harvard Corporation the consideration of a possible plan. The Committee from the Harvard Corporation consisted of Dr. Henry P. Walcott and Mr. C. F. Adams, 2nd. As the result of their efforts, a tentative plan of alliance was agreed upon which the two committees were ready to recommend to their respective Corporations, and which was as follows (printed now for the first time):

TENTATIVE PLAN OF CO-OPERATION BETWEEN HARVARD UNIVERSITY AND THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

Harvard University and the Massachusetts Institute of Technology, without making any change in their organization or general objects, agree to combine their resources to conduct a single school of industrial science, to be known as the Massachusetts Institute of Technology, in the following manner:—

(1) Three members of the Corporation of Harvard University shall be elected members of the Corporation of the Massachusetts Institute of Technology, and also of its Executive Committee, which shall thereafter consist of nine persons.

A member of the Corporation of the Massachusetts Institute of Technology shall be elected a Fellow of Harvard University at the first vacancy which shall occur after this agreement is made.

Vacancies occurring in these seats shall be filled in the same manner.

(2) The initiation of measures for the development and management of the School shall lie with the Executive Committee of the Massachusetts Institute of Technology constituted as provided in Section 1; but all appropriations from funds held by either Corporation and all proposed appointments of officers whose salaries are to be paid therefrom shall be submitted to the Corporation concerned, and approved by them before they are finally adopted. Students' fees in the School shall be fixed, collected, and expended or appropriated by the Corporation of the Institute through its Executive Committee. Except as above provided, the powers of the Corporation and of the Executive Committee of the Massachusetts Institute of Technology, and their relation to the School, shall be as now provided in the Charter and By-laws of the Institute. The President of the Institute shall also have in relation to the School the authority described

by those By-laws, and his salary shall be paid from the funds under the control of the Massachusetts Institute of Technology.

(3) The Massachusetts Institute of Technology shall place at the disposal of the School all funds and property it may now or hereafter possess for the promotion of instruction in industrial science; and, as soon as practicable, shall remove to a location in Boston on the right bank of the Charles River and as nearly as possible opposite to Harvard Square, and shall there erect, furnish and equip buildings having at least the capacity of its present buildings.

(4) Harvard University shall place at the disposal of the School all funds and property it may now or hereafter possess for the promotion of instruction in industrial science, including three-fifths of the income derived from the bequest of the late Gordon McKay.

(5) Within three years after the Institute begins the construction of its buildings—provided that the School is then prepared to give the students of the Lawrence Scientific School all their instruction in industrial science in the new location of the Institute—the Lawrence Scientific School shall be discontinued as a separate school of industrial science, and thereafter Harvard University shall not confer the degrees of S.B. or S.M. in industrial science, or any degrees in engineering subjects, except as provided in Section 6.

(6) The Faculty of the School shall consist of all professors, associate professors and assistant professors in the Massachusetts Institute of Technology and all professors, associate professors and assistant professors in Harvard University who give courses of instruction which lead to degrees in industrial science.

The degrees of S.B. and S.M. in industrial science and all degrees in engineering, the courses of study leading to these degrees and the discipline of the School shall be within the province of the Faculty. Degrees recommended by the Faculty shall be conferred by the two Corporations acting separately.

(7) Students in the Massachusetts Institute of Technology shall have the same privilege as students in Harvard University as regards access to and use of the play-grounds, museums and libraries of the University. Under regulations to be made by the two Corporations they shall be admitted to courses of instruction and to the laboratories of Harvard University, appropriate fees being paid in such cases to the University.

(8) Under regulations to be made by the two Corporations students in Harvard University shall be admitted to the courses of instruction and to the laboratories and libraries of the Institute of Technology, appropriate fees being paid in such cases to the Institute for the benefit of the School.

(9) Separate announcements and a separate catalogue shall be issued

by the Massachusetts Institute of Technology, but in all such publications it shall appear that the Institute is conducted in connection with Harvard University.

(10) This agreement is intended to be perpetual and shall be modified only by the consent of both parties thereto.

(11) The time when this agreement is to go into effect is to be inserted when it can be definitely agreed upon.

The departments of architecture are not included in this agreement and their mutual relations are to be the subject of future discussion and arrangement.

NOVEMBER 14, 1904.

After this proposed plan had been placed before the Corporations of Harvard University and of the Institute, a vote was passed that it should be first submitted to legal advice to determine whether the plan as proposed was in due legal form and whether its provisions contravened in any way the present duties and obligations of either institution. After a careful legal scrutiny, the essential features of the plan were embodied in the following Form of Agreement, which was then submitted to the Corporation of the Institute for its approval.

AGREEMENT BETWEEN HARVARD UNIVERSITY AND THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY FOR CO-OPERATION AND ALLIANCE IN THE CONDUCT AND PROMOTION OF EDUCATION IN INDUSTRIAL SCIENCE.

Harvard University and the Massachusetts Institute of Technology, being convinced, after a careful consideration of the conditions which affect the work of education in industrial science, that such work can be greatly advanced and enlarged by a co-operation of the two institutions, in order to secure mutual assistance, render possible a larger enterprise, promote economy, avoid duplication and competition, and give to the purpose of donors who have bestowed money in trust for that object a fuller accomplishment, do make this agreement, which shall endure so long as it shall be found to serve, to the satisfaction of both institutions, the objects above declared. But, whereas the carrying out of such agreement will require the employment of the income of the funds which the University holds, or will hereafter hold in trust, and the University feels that faithfulness in the performance of these trusts which it has accepted is its first duty, to which all other considerations must yield, this agreement shall not go

into effect until and unless the University shall have applied to the Supreme Judicial Court for instructions and the court shall have made a decree that this agreement may be carried out without violation of its duties as a trustee and in accordance with law and equity.

I

The organization of the University, the organization of the Institute, and the title of each to its property and funds shall remain unaffected by this agreement, as shall also the rights and duties of each in investing and managing its funds.

II

The institution for the combined work of promoting and furnishing education in industrial science, which it is the object of this agreement to establish, shall retain the name of the Massachusetts Institute of Technology; it shall be under the direction of an Executive Committee, and the instruction therein shall be given by a Faculty, which two bodies shall be constituted as herein below provided.

III

The said Executive Committee shall consist of nine persons to be designated by the Massachusetts Institute of Technology, of whom two shall be the President of the corporation of the Institute and the Treasurer of the Institute, and three shall be members of the corporation of the University.

Subject to the restrictions herein below expressed, the said Executive Committee shall have the general administration and superintendence of all matters concerning said combined work, including the appointment of officers of instruction and government, and of servants, the power to remove any of them, the fixing of their salaries, and the prescribing of their duties, the care of buildings, property and equipment, the appropriation of money put at its disposal under this agreement, the fixing, collecting and expending of students' fees, and the supervision and direction of the work of the Faculty, these being substantially the powers now conferred on the Executive Committee of the Institute by its by-laws; it being, however, expressly provided that all appropriations from money furnished either by the University or by the Institute, and all proposed appointments or removals of officers whose salaries are to be paid therefrom, shall be submitted to the corporation concerned and approved by it before being finally adopted, it being understood that student's fees shall be deemed to be furnished by the Institute, and that no change shall be made in those fees without its approval.

The said Executive Committee shall keep records of its proceedings,

and shall make reports to the corporation of the University and the corporation of the Institute annually, and at such other times as either corporation may request.

IV

The President of the Institute for the time being shall be the President of the said Executive Committee, and shall preside at its meetings, when present. His salary, as fixed by the corporation of the Institute, shall be paid from the funds furnished by the Institute. He shall be the Chairman of the Faculty, shall have the superintendence of the several departments, and shall act as general executive and administrative officer subject to the direction and control of said Executive Committee. He shall annually make a report to the corporation of the University and to the corporation of the Institute. Whenever a person shall vacate the office of President of the Institute, he shall thereupon cease to be a member of the said Executive Committee.

V

The Treasurer of the Massachusetts Institute of Technology shall be *ex officio* the Treasurer of the said Executive Committee. He shall, as Treasurer of the said Executive Committee, have charge of the funds put at the disposal of said committee, shall make such payments as the committee may authorize, shall keep accurate accounts of all money received and expended, and shall make report of his doings annually, or oftener if required, to the said committee, and to the corporation of the University and to the corporation of the Institute.

VI

The Faculty shall consist of all the present professors, associate professors, and assistant professors of the Institute, and all professors, associate professors, and assistant professors of the University who now give courses of instruction leading to degrees in industrial science, and such officers hereafter appointed as said Executive Committee may designate. The present professors, associate professors, and assistant professors of the University as aforesaid shall not be removed nor have their present salaries reduced without the consent of the corporation of the University.

Subject to the supervision and direction of the said Executive Committee, the Faculty shall have charge of instruction and discipline.

VII

Subject to the reservations hereinafter set forth, the University shall place at the disposal of said Executive Committee, as above provided, the

net income of all funds which are now credited on its books to the credit of the Lawrence Scientific School, also the use of all machinery, instruments, and equipment which the University holds, and the income of all property which it may hereafter acquire for the promotion of instruction in industrial science, and also three-fifths, but no more, of the net income which may accrue from the bequest and devise of the late Gordon McKay.

VIII

Subject to the reservations herein set forth, the Institute shall place at the disposal of the said Executive Committee the net income of all funds and the use of all property and equipment which the Institute may hold for the promotion of instruction in industrial science, reserving only such amounts and property as it may require to maintain its organization and to carry on such functions as may remain to it independently of the promotion of industrial science.

IX

In so far as money contributed by either corporation under this agreement may be used by the said Executive Committee for the purchase of equipment or supplies, the title thereto shall be in the corporation whose money is appropriated therefor.

X

The site of the institution shall be in Boston on the right bank of the Charles River, as nearly as practicable opposite to Harvard Square, and the Massachusetts Institute of Technology shall there erect, furnish, and equip buildings having the capacity of at least its present buildings. But the Institute shall not be required to proceed with such purchase and construction until it shall have sold a sufficient part of the land which it now owns. Provided, however, that this agreement shall be avoided, if at the end of four years from the time when this agreement goes into effect the Institute shall not have purchased said land and proceeded to a substantial extent with such construction.

XI

Within three years after the Massachusetts Institute of Technology begins the construction of such new buildings, if the Institute is then prepared to give in its new location to the students of the Lawrence Scientific School all needed instruction in industrial science, the Lawrence Scientific School shall be discontinued as a separate school of industrial science so long as this agreement remains in force.

XII

The degrees of Bachelor, Master and Doctor in Science, so far as given in industrial science, and all degrees in engineering, together with the requirements of courses of study leading to these degrees, shall be within the province of the Faculty, and these degrees shall be conferred by the corporations of the University and the Institute, acting separately.

XIII

Male students in the Institute shall have the same privileges as students in Harvard University in the use of the playgrounds, museums, and libraries of the University.

Under regulations to be made by the two corporations, and on payment of proper fees, students of the Institute shall be admitted to courses of instruction and the use of laboratories of the University, outside of those pertaining to industrial science, and students of the University to the courses and use of laboratories of the Institute.

XIV

The corporation and overseers of the University and the corporation of the Massachusetts Institute of Technology shall each have full right at all times to inspect the institution, and suggest to the said Executive Committee changes in the methods of management.

XV

The Department of Architecture in the University and in the Institute respectively are not included in this agreement, but remain unaffected hereby.

XVI

It is expressly provided that, as regards the funds and property of the University and of the Institute respectively, this agreement shall be subject to any special terms and requirements upon which such funds and property may be held; and any property or funds which may be held at any time by either corporation under such terms and restrictions as would prevent the use of them in the precise manner contemplated by this agreement shall, nevertheless, be used by the two corporations respectively for the support, benefit, or encouragement of the scheme agreed upon, in such manner as may be permissible and in accordance with the trusts upon which they may be held.

XVII

The arrangements established by this agreement may be terminated at any time either by the President and Fellows of Harvard University or by the corporation of the Massachusetts Institute of Technology, upon reasonable notice to the other corporation.

In the event of the termination of this agreement, the Massachusetts Institute of Technology must pay, at such prices and upon such terms as the parties may agree upon, and, if they cannot agree thereon, as may be fixed by arbitration (usual arbitration clause), for any buildings or fixtures upon said site, paid for with funds furnished by the University.

XVIII

This agreement shall take effect when finally adopted and approved by the corporation and the overseers of the University and the corporation of the Institute, and when and if a decree of the Supreme Judicial Court, as provided for in the preamble hereof, shall have been obtained.

This plan, before being acted upon, was referred to the Faculty of the Institute for a report and immediately afterwards was submitted to the alumni of the Institute for an expression of opinion. The Faculty by a very large majority, fifty-six to seven, reported against the plan. Both the majority and the minority reports are printed in full in the special number of the *Technology Review* devoted to this matter.

Besides being sent out to many who were not graduates, the plan was submitted to thirty-two hundred graduates. Of this number eighteen hundred and fifty-eight voted, of whom thirteen hundred and seventy-four voted against, and four hundred and sixty-two voted in favor of the proposition. Twenty-two votes proved impossible of classification.

After these reports had all been received, the consideration of the plan was taken up by the Corporation and at a special meeting held on June 9th, 1905, by a vote of twenty-three to fifteen, a resolution was adopted instructing the Committee to present the plan to the Corporation of Harvard University with the approval of the Institute Corporation, provided a favorable decision be had in the matter of the Boylston Street land.

A decision was handed down by the Supreme Court on the sixth day of September, which denied to the Institute any right of this property in fee simple, and specifically enjoined it from either selling or building over the two-thirds area not now occupied. This decision made the carrying out of the agreement entirely impossible for many years to come unless there should be provided promptly a sum of money approximately equal in amount to the value of the land on Boylston Street. As the probability of raising this sum seemed indefinite, and as it was undesirable to leave the matter in a state of uncertainty, the Corporation of the Institute at its meeting on October 11, 1905, instructed the Executive Committee to indicate to the Corporation of Harvard University the fact that this body finds itself unable to go on with the plan. The correspondence which closed this matter is given below:

PRESIDENT CHARLES W. ELIOT,
HARVARD UNIVERSITY, CAMBRIDGE, MASS.

My dear President Eliot:—

I am directed by the Corporation of the Institute of Technology to communicate to you the fact that, in view of the recent decision of the Supreme Court of the State in the case of John Wilson *et al.* vs. The Massachusetts Institute of Technology, the Corporation of the Institute finds it impossible to proceed with the plan of co-operation which was considered at its meeting of June 9.

In communicating this fact the Corporation desires at the same time to express its appreciation of the fairness and courtesy of the Corporation of Harvard University in our common effort to solve a difficult question.

I am,

Very sincerely yours,

HENRY S. PRITCHETT,
President.

OCTOBER 11, 1905.

At a meeting of the President and Fellows of Harvard College in Boston, October 30th, 1905, the following vote was passed:—

Voted, That the committee of conference appointed by this Board May 16, 1904, at the instance of the Corporation of the Massachusetts Institute of Technology be hereby discharged; and that the President be requested

to express to the members of the two committees of conference the high appreciation by the President and Fellows of the foresight, good judgment, and public spirit of which the committees' project for a close affiliation between the Institute and the University gives evidence, and the regret of the President and Fellows that the project has been brought to naught by the recent decision of the Supreme Court, which makes it impossible for the Institute to place itself beside the University.

Voted, To acknowledge hereby the receipt of notice from the Corporation of the Massachusetts Institute of Technology that the negotiation with this Board started by the Institute May 4, 1904, is at an end.

A true copy of record.

Attest:

JEROME D. GREENE,
Secretary to the President.

THE INSTITUTE'S DEVELOPMENT IN THE IMMEDIATE FUTURE.

I have called attention in my two last annual Reports to the desirability of outlining as definitely as possible the future policy of the Institute in respect to a location and to its intellectual and educational aims. The proposed plan of alliance with Harvard University was such an effort; it was definite and was framed to meet a policy which contemplated one great school of technology rather than two. That plan having been dismissed, it remains to turn heartily and earnestly to the development of the Institute in its present site, for it seems to me clear that the decision of the Supreme Court, which made the alliance impossible, has also settled the question of site for at least a number of years to come. We must, as it seems to me, continue to use the land on Boylston Street, and therefore for certainly twenty or twenty-five years the Institute must continue where it has been in the past.

The policy of the Institute, therefore, for the next quarter century seems to me to be stated somewhat definitely in the following way:—

(1) To acquire additional land in the immediate vicinity of the present Engineering Buildings, sufficient to provide for the normal development of the next quarter century.

(2) To provide money for endowment and for building so as to make this site the seat of an effective and well-equipped group of engineering buildings.

(3) To develop on our Brookline site, adjoining the Athletic Field, dormitories for such students as may desire to avail themselves of a community life; these dormitories being constructed on the plan of furnishing simple and inexpensive rooms for men of small means, as well as more ambitious rooms for those who care to pay for them, for the purpose of bringing men together on a democratic plan.

(4) To develop with sound judgment and true perspective in education the intellectual work of the Institute. And while this is put last, it is, of course, first in importance and significance in any institution. The quickening of the means of instruction, the constant examination of the courses to the end that they may serve best the student's needs, a frequent overhauling of requirements so as to preserve a fair perspective of student work,—these are the most important matters of policy which an institution has to settle, and these, of course, lie in the hands of the Faculty.

It is some such programme as this to which it seems to me the Institute of Technology should now commit itself heartily and enthusiastically.

EDUCATIONAL IDEALS.

One of the interesting things which has been brought out by the discussion concerning the possible alliance with Harvard is the evidence which this discussion has given of two entirely different ideals as to what the Institute's work ought to be. According to one view, the Institute should remain an undergraduate institution offering to students fixed and rather rigid courses of undergraduate study leading to the professional work of the engineer, the chemist, the architect. This conception has for its ideal the disciplinary rather than the educational side, and aims to teach men to keep a certain step and do a certain work with energy and precision. The second conception has for its ideal an institution which shall preserve,

indeed, the undergraduate work as its great heart and center, but which shall make this the foundation for a great school of professional, graduate and research work.

These two conceptions, while not opposed, are in a certain sense contradictory and it will be necessary in the end for those who have in charge the educational work of the Institute to lend themselves either to one or the other view. For, if the second conception is to hold, there must be introduced into the Institute's courses a somewhat greater elasticity. It must be made easier for men to come to the Institute, and get what they wish, whether adhering absolutely to any prescribed course or not. It must be made easier, also, for men to take up such professional and graduate work whether they come into it from the undergraduate courses of the Institute or through the training of some other institution.

This choice of an educational ideal or general educational policy is before us now in a very practical way, since one-seventh of our students have already had college instruction. Most of these are college graduates. These men are asking and will ask in increasing measure a larger elasticity in their choice of work and greater convenience in fitting themselves to the requirements of our régime. If the Institute is permanently to attract such men, it must make such elasticity, in the higher years of the courses, possible.

It is the second of these views, that one which contemplates not only a graduate school but the work of research as well, which seems to me the true one and the one which promises the greatest results in leadership and power.

EDUCATIONAL DEVELOPMENT IN THE INSTITUTE.

In the reports of the heads of Departments will be found a number of recommendations as to the specific things in which the instruction at the Institute may be bettered or freshened. Thus, in the Department of Electrical Engineering, the head of the Department writes: "The matter of the Course Scheme has been considered by the Department with great care and at

considerable length. The conclusions reached are that a radical simplification is most desirable, in fact, is absolutely necessary, since the students are working under pressure in too many subjects. The time for the digestion and assimilation of what is presented to them and for clear and careful thinking must be very considerably increased. This can be brought about by the elimination of certain work."

In the Course in Chemistry and Chemical Engineering, the head of the Department calls attention to radical and important changes. In the fundamental subjects of Mathematics and of Physics, the heads of Departments refer to changes which they recommend in the courses, or which they hope to recommend.

With regard to the development of educational efficiency, it may be said that an institution of learning necessarily leaves much more to the individual teacher than is left in other organizations. While this gives play in a certain way to individual initiative, it also means that the changes which are made and which involve the consent of many individuals, come very slowly and only after the need for the change has been made very manifest. It has seemed to me for some years that our courses of study might be improved if we could take them up afresh and construct as nearly as possible what might be called ideal courses at the present time, and this not only with respect to the professional engineering Departments but with respect to the more fundamental subjects like Mechanics, Chemistry, and Physics.

It is somewhat singular that Mathematics, the oldest of the sciences, lends itself even in our day less easily as a tool in the applied sciences than Physics or Chemistry. I believe that this is due to the methods pursued in our schools and universities in teaching it,—a method in which the subject is separated into divisions under the heads of Higher Algebra, Analytic Geometry, Differential and Integral Calculus and the like. When one considers that in the Institute of Technology, as in most technical schools, two years only are given to these subjects, and but a small number of hours in each year, it is

surprising that the student should fail to get a good grasp of such a tool for instance as the Calculus. A wiser plan would seem to be to treat the whole time for the two years as given to a single course in Mathematics; to demand of the student Trigonometry at entrance. Beginning, then, with the first year, the student could be introduced at once to the equation as a means of representing geometric form and could learn to derive the equations of conics as well as of higher plane curves and of other curves which have valuable properties. Having done this, he can be introduced at once to the simple machinery of differentiation and integration from which he can take up at once the analysis of all such curves, deriving the equations of tangents, normals, asymptotes by means of the Calculus and determining also lengths of arcs and values of areas. In the same way he might take up most of the work which is given in Higher Algebra under more cumbersome and clumsy methods, with the result that at the end of the second year he ought to find himself using the Calculus as a tool deftly and easily.

In general, without going into specific recommendations, it seems to me clear that those who are to lead in the technical schools of America need to lend their efforts toward making as great an economy as can be effected in introducing students to the practical applications of Mathematics, Mechanics, Physics, and Chemistry, to the end that these fundamental subjects may serve not only the purpose of general training but the much larger purpose of connecting the student's thinking with the effective application of that thinking,—which is, after all, the direction in which technical education ought to show its greatest efficiency.

ADMINISTRATION AS RELATED TO EDUCATIONAL EFFICIENCY.

The question of what is the best form of administration for an educational institution has received increasing attention in the last two years. In most American institutions the administration has assumed a form much more resembling that of a

business organization than is the custom in foreign universities and technical schools.

Whether this tendency is a good one or not is certainly an open question, for, however desirable it may be to secure a due sense of responsibility on the part of teachers and students, it is also true that the best intellectual results are likely to come with a larger measure of freedom. On the other hand, it is also evident that an administration in which the individuality of the teacher and of the student is conserved offers serious difficulties in the way of what may be called initiative. When a course of study or a change in the plan of organization or other important question within the institution is to be determined by the votes of a large number of men acting on their individual judgment, it is evident that the inertia of the organization must be much greater than if the power is lodged in the hands of one man or in a small body of men. Nearly all administration is a compromise between these two ideals,—the ideal of the executive officer or small committee with large power insuring well-defined responsibility throughout all parts of the organization and also power of initiative, and the other ideal of individual freedom of action based on the consent of all members within the organization and necessarily, therefore, acting slowly and without great initiative.

It seems clear to me that the idea of the individual freedom of the professor is a fundamental condition in any institution of learning. It also seems to me equally clear that this freedom must extend in some measure at least to the student, and that also some means must be had to increase the power of initiative of our educational organizations. Our Institutions of learning are conducted on the intellectual side wholly by the Faculties. These have now become quite large in the larger institutions, and, when we introduce the ideal of the preservation of individual freedom and combine it with the plan of organization which assigns only a single professor to a single subject, we preserve a system which has the faults of both plans of organization. It remains, perhaps, for the American professors

themselves to suggest some means of administration which, while preserving the individual freedom of the professor, may at the same time give to educational organizations somewhat of the initiative which we find in business organizations.

A partial step toward this result would be reached in the Institute if the separate Departments of professional study were considered as schools and the determination of their Courses of Study left more fully to these separate faculties. In fact the name Institute would most fitly indicate a congeries of schools and it ought to be possible to administer the School of Architecture, of Civil Engineering and the like without losing the trust which now exists between Departments having these names, while leaving to each larger initiative.

ATHLETICS.

With the building of a new gymnasium on our land on Garrison Street and with the equipment of our Athletic Field in Brookline, the Institute is now well furnished with facilities for athletic exercise and athletic sport. The new gymnasium is well lighted and heated and is plentifully provided with shower baths, while on the Athletic Grounds in Brookline are provided not only the ordinary facilities for football, and baseball, and track but also tennis courts as well. In fact for the ordinary undergraduate athletic life, the Institute is well equipped, the sole objection to the arrangement as it now stands being the fifteen minutes of time necessary to go from the Institute's site to the athletic grounds.

The athletic life in the Institute of Technology represents, in my judgment, a sane and normal development. There is a very hearty athletic spirit and this shows itself principally in the cross-country runs, in the track team, and in the other events in which the individual can most easily enter.

Five years ago an arrangement was made with the student-body under which intercollege football was given up, with the substitution of the annual Field Day football game between the Freshman and the Sophomore classes. This annual field

event has grown into a most satisfactory and interesting occasion. It concentrates into one effort much of the athletic activity of the two younger classes.

There are men in the Institute to-day who would be the better for a longer time spent in open-air exercise or some athletic sport, but there are very few who have pursued athletics to the injury of their college work.

When one considers in how great measure the athletic development in our colleges and universities has displaced scholarship, the present situation in the Institute of Technology is one in which there is a certain amount of satisfaction. In the Institute to-day athletics remains still a sport and it has become neither an occupation nor a business. In this connection I wish to express again the obligation of the Corporation, of the Faculty, and of the student-body to the Advisory Council on Athletics for the admirable work which that body has done and to add the suggestion that an athletic system carried on as ours is necessarily brings in small receipts, not enough for the modest needs of the régime now established. If the Advisory Council could have the assistance of some $1,000 a year it would enable them to conduct their work without the difficulties now connected with it.

THE FINANCIAL SHOWING FOR THE YEAR.

The Treasurer's Report, which is appended, gives in detail the financial showing for the past year. The exhibit is a very satisfactory one and is particularly gratifying in comparison with last year, for, although there is still a deficit of something over $10,000, this deficit is small compared with the $55,000 of the year before. This change has been effected by an increase of some $23,000 in the income, due to the higher tuition fee, accompanied by a decrease of some $19,000 in the total expenses. This saving has been effected by an effort to economize in many directions, with the general understanding that economy should be effected in material expenses, rather than in the salaries of professors and instructors.

The greatest saving has been effected in the matter of departmental supplies, and with due effort for economy by those connected with the Institute for the coming year it may be hoped that our deficit may be small for the present year.

This showing is due in the main to the admirable work of the Treasurer and of the Bursar.

REPORTS OF DEPARTMENTS.

The needs of the various Departments are set forth in the reports of the heads of Departments, which are printed in connection with this Report. These reports state more clearly than can be given here the views of the department heads. I commend these to the careful consideration of this body.

HENRY S. PRITCHETT.

DECEMBER 13, 1905.

Reports of Departments.

DEPARTMENTS OF CIVIL ENGINEERING AND SANITARY ENGINEERING.

The instructing staff in the Department of Civil Engineering has been materially strengthened during the past year by the addition of Professor W. E. Mott, who comes from Cornell University, as Associate Professor of Hydraulic Engineering, and of Mr. George E. Russell, who also comes from Cornell University, and enters the Institute as Instructor in Civil Engineering.

Professor Mott graduated from the Institute in the Class of 1889, with an enviable record. Since that time he has been engaged in practical engineering work and for a number of years has been connected with the Civil Engineering staff of Cornell University. Professor Mott comes to us after mature experience as a teacher and an engineer and brings new ideas gained at another institution. His accession will be a source of gratification to all who are interested in the Institute. He will devote his time principally to instruction in Hydraulics.

Mr. Russell graduated from the Department of Civil Engineering of the Institute in 1900, and was for a year an Assistant in the same Department. Resigning his position to engage in practical work, he was connected for a number of years with the American Car and Foundry Company, in the work of designing and building steel cars. His experience in this position gave him a good insight into the engineering and business operations of large corporations. A year ago he resigned his position to engage again in teaching as Instructor in Civil

Engineering at Cornell University. His experience and training make him a valuable addition to the staff of the Department.

Mr. S. H. Thorndike, who a year ago was appointed Instructor in Civil Engineering, is to devote his attention hereafter to the work of Stereotomy and Structural Design, his connection with the City Engineer's department having given him valuable experience in both these lines.

The staff of the Department has suffered a loss in the resignation of Professor C. M. Spofford, who, after a service of nine years, has resigned to become Professor of Civil Engineering at the Brooklyn Polytechnic Institute. Professor Spofford will be much missed, and the good wishes of all his associates go with him in his new position. His work will be taken largely by Professor McKibben and Mr. Thorndike.

Mr. J. W. Howard, who has been an Assistant in the Department, has been promoted to be Instructor in Civil Engineering. All the other Assistants who served last year have resigned to engage in practical work. To fill their places, seven of the graduates of the Class of 1905 have been appointed Assistants in Civil Engineering, namely, Messrs. J. Ayer, J. E. Barlow, C. T. Humphrey, J. H. McManus, W. E. Simpson, F. C. Starr, and K. Whitman, Jr.

The course of study in the Department has not been modified, except so far as was necessary to adapt it to the increased entrance requirements, which this year render a change necessary in the third-year work.

The number of students in the second year is about the same as last year. The number in the two upper classes is somewhat greater. It is not desired that the number should increase very greatly; but, with our strengthened staff, we ought to be able to make our instruction more efficient than ever before, and also to provide opportunities for advanced work, should any candidates for such work present themselves.

The equipment of the Department has been added to by the purchase of several new transits and other surveying instru-

ments. Provision has also been made by which a larger number of students can be accommodated in the second-year drawing-room. The Department needs, however, a considerable increase in space in order to provide in the most efficient manner even for our present students. The drawing-rooms are too crowded already, and the only way to provide for an increase in numbers would be to allow two students to occupy the same desk. This is practicable in the second year; but in the third year, when the students are at their desks so much of the time, it would be a serious handicap if each man were not furnished with a desk of his own. We should have also a larger number of lecture-rooms which could be devoted to the work of the Department and in which work could be left on the blackboard from exercise to exercise. We need very much a large lecture-room capable of accommodating not only the entire second-year class, but an even larger number of students.

The Engineering Library is near the limit of its capacity, and offers practically no facilities now for the quiet occupancy of tables by students. It is growing fast in number of volumes and is becoming very valuable; the floor-area devoted to it should be doubled or tripled.

The Summer School in Surveying was held during the last summer at East Machias, Maine. Eight students attended. As this school is now open to students in the second and third years, it will probably be given only every other year.

Altogether the work of the Department is proceeding satisfactorily. The staff is larger than ever before and sufficient for the number of students. The work this year should be better than for some time past. The principal need of the Department is for more space.

The class which graduated last June numbered about sixty-five students. It is gratifying to be able to state that, notwithstanding the size of the class, the applications for our men have been more numerous than ever before, and that we could have found places for two or three times as many men as were available. Altogether, since about the first of last May, there

have been 128 positions offered suitable for young men just graduating. These situations may be classified as follows:—

Railroad work	47
Structural work	16
Hydraulic, Sanitary, and Municipal work	33
Miscellaneous	32

GEORGE F. SWAIN.

DEPARTMENTS OF MECHANICAL ENGINEERING AND APPLIED MECHANICS.

A number of improvements have been made in the Course in Mechanical Engineering in consequence of the additional time gained through the increase in the entrance requirements. These improvements have now become effective in the work of the third-year and of the fourth-year classes.

Besides considerable gain in the time devoted to literary studies, that given to Differential Equations has been trebled, a course has been added in Precision of Measurements, the time devoted to instruction in Electrical Engineering has been doubled, and a considerable increase has been made in that devoted to each of the four Options, viz., Marine Engineering, Locomotive Engineering, Mill Engineering, and Heating and Ventilating Engineering. With these additions, and with the constant development of all the work in the Department, the Course has been materially improved, both from the literary and from the professional standpoints.

In connection with the thesis work, a very considerable amount of investigation has, as usual, been carried on, of which some has developed results of importance in engineering.

Through the kindness of the Westinghouse Air Brake Company, the Department has received, as a gift, a complete and modern brake equipment for an electric car, including the motor.

The number of students to whom instruction is given in Mechanical Engineering subjects is eight hundred and twenty-

two, and the number receiving instruction in Applied Mechanics is four hundred and ninety-five.

The statements made in the Report of last year regarding the urgent need of considerable additional apparatus in order to give the needed laboratory instruction, and to carry on the amount of research work which is customary in this Department will not be repeated here. These needs are, however, fully as great as ever before, and even greater, and the lack of such additional apparatus must result in a decrease of the amount of this kind of instruction for a certain number of students. No special appropriation has been made for new apparatus since the year 1900, and the appropriation made this year for the regular expenses of these Departments is the same as it was in 1892–'93, when the total number of students was much smaller.

A number of members of the instructing staff of these Departments have been called upon for additional work in connection with the administrative work of the Institute, in connection with the work of the Lowell School for Industrial Foremen, and in other connections.

GAETANO LANZA.

DEPARTMENT OF MINING ENGINEERING AND METALLURGY.

The facilities in the Ore-dressing Laboratory have been improved by the addition of a new small-sized Wilfley concentrating table; this will relieve the congestion in demand for the present table. A high power Wetherill magnet is being installed to treat sands of all degrees of magnetic susceptibility, effecting separations that are impossible with the wet machines alone. The steam engine has been set aside for the electric motor, a change which results in a saving in coal and the additional advantage that this motor can be run night and day. A new automatic discharge has been put upon the jig to draw off the concentrates while the jig is at work; this brings one

more method of concentration to the attention of the students. A small low-pressure boiler for heating the steam drying tables in summer has been installed. The use of small electric motors for running little machines is being adopted with great advantage in saving wear and expense. Professor Richards's new pulsator is installed in the laboratory for the use of the students. No changes have been made in the Smelting Laboratory or in that of Metallography. A new balance has been supplied for the Assaying Laboratory.

In the library, while no large addition has been made, the current publications have been carefully scrutinized by Professor Hofman and copies have been added to the list when their value seemed to warrant it. A new book case has been provided, but the library is much too small.

A moderate amount of outside professional work by the teachers benefits both school and pupil by keeping the teacher in touch with the latest developments in his subjects. The problem of concentrating the black sand of the Pacific coast undertaken by the United States Geological Survey at the Lewis and Clark Exposition offered an unusual opportunity for investigation. Professor Richards spent three months at Portland, Oregon, in the employ of the Survey on this work. Part of the work was carried on at the Institute by Messrs. Locke, Brown, Reed, Glidden, Barnaby, and Hayden of the Mining Department, and by Professor Warren of the Department of Geology.

The students in the fourth, third, and second years number forty, thirty, and forty respectively, a fact which shows that the numbers are nearly keeping up to the highest figure. There are more college graduates than ever before.

The John Cummings Laboratory of Mining Engineering and Metallurgy is so full of apparatus that an instalment of a new machine can be made only by removing an old one. In this case the machine having the least value for instruction will be rejected.

The Summer School, in charge of Professor Hofman, aided

by Mr. Locke, studied the smelting and refining of lead, copper, and the precious metals at the works of the American Smelting and Refining Company at Perth Amboy, New Jersey; the refining of copper at the De la Mar Copper Company's works at Chrome, New Jersey; the mining and concentrating of zinc at the mine and works of the New Jersey Zinc Company at Franklin Furnace; zinc and spiegeleisen smelting and a sulphuric acid plant at Hazard, Pennsylvania; the electrolytic refining of gold and silver at the United States Mint in Philadelphia; coking coal, smelting iron, and Bessemer steel at the works of the Maryland Steel Company at Sparrows Point, Maryland; smelting iron, Bessemer steel, and open hearth steel at the Carnegie Steel Company's Braddock and Homestead works, near Pittsburg; the making of black plate and tin plate by the American Sheet and Tin Plate Company; the making of steel pipes by the National Tube Company; the drying of air for the blast furnace by the Gayley Refrigerating Process at the Isabella furnaces; the mining, screening, and shipping of coal at the Hazel Mine of the Pittsburg and Buffalo Coal Company at Canonsburg; the puddling process and the manufacture of high grade crucible steel at the Crescent Works; puddling at the Sable Iron Works; the malleabilizing of castings by the Pittsburg Malleable Iron Company; and the water works of the Pittsburg Filtration Plant.

The Department desires to record here its thanks for the generous and cordial welcome given to the students of the Summer School by the managers of the above mentioned companies and firms.

ROBERT H. RICHARDS.

DEPARTMENT OF ARCHITECTURE.

This year has opened with numbers that have tested the full capacity of our floors. The material changes made last summer in the arrangement and lighting of our drawing-rooms have proved very successful. A floor area which formerly

was poorly lighted has now become most available, and the screens that have been added now permit us to show to the best advantage our very valuable collection of drawings. Yet, with all these good conditions, we are still cramped.

The good results of bringing the advanced classes into closer touch with each other in the drawing-rooms are already being seen, and our larger exhibition room permits of calling the students together at short intervals to discuss their current problems in design, and to receive criticism on their work. All this tends toward the formation of an *esprit de corps*, as well as toward a closer co-operation between student and instructor than we have been able hitherto to bring about. It seems advisable to develop in the highest degree those lines of work which we have already undertaken rather than to start anything new.

The Rotch Prize of two hundred dollars for the regular student making the best record during the four years was given to Miss Ida A. Ryan, and the prize of two hundred to the special student doing the best work during two years was divided equally between Mr. W. H. Crowell and Mr. M. H. Whitehouse.

The Boston Society of Architects also gave two prizes of the value of fifty dollars each in books, one to Miss Ida A. Ryan, and one to Mr. W. P. Delano, Jr. These two prizes were given for skill in design, the decision being made by the Society. The occasion was celebrated by a dinner of the Department, given by the Boston Society of Architects to the fourth-year class. Dr. Pritchett was the guest of honor, and announced the awards.

"The Class of 1904 Competition Prize" was awarded last year for the first time. This prize gives ten dollars each to the regular and the special students whose designs are placed first in a competition held between the Christmas and the mid-year recesses. The first was given to Mr. A. Blodgett, and the second to Mr. P. F. Mann.

Of particular interest to the Department will be the award at the end of the school year of a travelling scholarship amounting

to twelve hundred dollars, the very generous gift of a friend. "It is to be awarded solely on the basis of distinguished merit," but candidates must have passed two consecutive years in the Department, and at least one of the years must have been in the Graduate Course.

A fact worthy of note is that Mr. W. D. Crowell, a student with us two years ago, recently won and is now holding the Rotch Travelling Scholarship of two thousand dollars for two years' study abroad.

It is a satisfaction to note the continuance of a good graduate class, and also the large number of college graduates who have entered this year, many of them candidates for our degree.

FRANCIS C. CHANDLER.

DEPARTMENTS OF CHEMISTRY AND CHEMICAL ENGINEERING.

During the past year radical and important changes have been made in the schedules of the Courses in Chemistry and Chemical Engineering. It became necessary some years ago to make an arrangement by which the students of the Course in Chemistry who were fitting themselves for technical positions should have an opportunity to obtain some instruction along engineering lines, in order that they might be able, as occasion offered, to pass from the chemical laboratory to positions of larger responsibility in the management of industrial plants, where some knowledge of the principles of Mechanics and of Steam Engineering is indispensable. At this time five series of optional studies, continuing through the last three years of the Course, were arranged, among them one involving certain fundamental work in Mathematics, Mechanics, and Steam Engineering, while at the same time the student completed all of the general and some of the special subjects of the Course in Chemistry. The Course in Chemical Engineering, on the other hand, offered a course in which the greater stress was

laid upon the work of the Department of Mechanical Engineering, the smaller portion of the time being devoted to chemical subjects. These two Courses have existed together since 1900. It has, however, become increasingly evident from a consideration of the character of the recent calls for our graduates that the training afforded by the Option of the Course in Chemistry referred to above did not afford sufficient experience in mechanical lines to enable the graduates to take up their work with the best attainable efficiency, and, on the other hand, many of the graduates from the Course in Chemical Engineering deplored their limited experience on the chemical side. It moreover seems evident that the chemical engineer of the future must be a man who has a fundamental knowledge of chemical principles, that is, a man who is primarily a chemist, but combines with this knowledge as much of the fundamental principles of engineering practice as it is possible for him to acquire in the years available for study. He must not only know thoroughly the meaning of the chemical equation, and its underlying principles as written on paper, or carried out in the test-tube, but must also have the ability to take an active share in transferring the reactions of the test-tube to a productive plant upon a technical scale.

The necessity for a rearrangement of the two higher years of all Courses, which has resulted from the changes in the requirements in Modern Languages, made this an opportune moment to attempt a reconstruction of the schedules of both the Courses under discussion. The initial efforts to bring each of them more into line with the conditions outlined above soon made it clear to the members of the Department that the resulting schedules differed so little as to make their separate maintenance inadvisable. This position was ultimately accepted by the Faculty, with the result that the Option of the Course in Chemistry containing the engineering subjects has been discontinued, and the Course in Chemical Engineering has taken on the character of a chemical course, with a fair share of fundamental instruction in Mechanism, Applied Mechanics, Steam Engi-

neering, and the drawing which accompanies these subjects. The specialized courses in Chemistry have been necessarily omitted, and the analytical practice is slightly less than in the Course in Chemistry. The hours devoted to Mechanism, Applied Mechanics and Steam Engineering are also somewhat less than in the Course as it has been offered for a number of years. The remaining hours and subjects afford, however, a fundamental training in each field, and it is believed that they approach as closely as possible in the time available to the requirements of the technical chemist, who, under the existing industrial conditions, must be a chemical engineer. It is, nevertheless, unquestionably true that this composite training demands for its best fulfilment an additional year of study, in which, with the fundamental work as a basis, the student's knowledge of both Chemistry and Engineering can be so developed as to enable him better to grasp the applicability of principles to problems, thus increasing the ready availability of his store of information.

Other significant features of the changes in the course schedule are the transfer of the instruction in Industrial Chemistry to the fourth year, the re-adjustment of the instruction in Organic Chemistry, so that it commences in the third year and is accompanied from the start by laboratory work, and the transfer of all instruction in Theoretical Chemistry to the fourth year, with an increase in laboratory instruction in this subject. Corresponding changes will soon be made in the Course in Chemistry.

The series of optional studies in the Course in Chemistry known as the Metallurgical Option has also been discontinued. This Option was taken by only a few students, and complicated the work of the fourth year of the Course.

The year has been one of general prosperity in the various branches of the Department. While no striking innovations in methods are to be noted, instruction in many of the subjects has been modified in minor details, with, in most instances, favorable results. A new course of instruction in Inorganic Chemistry has been introduced into the Course in Chemistry, and the time

devoted to Industrial Chemistry has been extended for all Courses, both constituting much-desired changes. New advanced elective courses on the "Recent Developments in Organic Chemistry" and the "Chemistry of the Technically Important Organic Compounds" have been offered by Professor Moore, and the promotion of Dr. S. P. Mulliken to be Assistant Professor of Organic Chemical Research is indicative of the intention of the Institute to offer increased opportunity for advanced work in this field.

During the past year new books have been published, as noted in the List of Publications, by Mr. Rolfe, Mrs. Richards, and Drs. Talbot and Blanchard, while Dr. Thorp has completed a new edition of his "Outlines of Industrial Chemistry."

Of the recent graduates from the Department Messrs. A. W. Rowe and R. S. Williams are now students in the Universities at Heidelberg and Göttingen respectively, and Drs. R. S. Balcom and S. C. Lind have recently returned from abroad and have accepted positions as Instructors at the University of Michigan.

The experience of the past year has clearly emphasized the increasing difficulty which technical institutions in particular are likely to meet with in retaining the services of efficient teachers. Three of the members of the instructing staff in Chemistry and one in the Research Laboratory have been called upon to choose between continued devotion to the work of a teacher, or an investigator associated with an institution of learning, and a field of labor in which the work should be essentially technical in its character, but should bring with it distinctly larger financial returns. It is creditable alike to these men and to the Department that they should have been sought out for positions of marked responsibility demanding ability of a high grade, and it is the good fortune of the Institute that Professors Walker and Fay have determined to continue their work with us. It should be pointed out that it is by no means the financial attraction alone which determined a choice

in favor of the industrial positions in the other instances referred to, but rather the attractiveness of the work in the research laboratories which have sprung up in connection with several of our important industries and to which these men have been called. These laboratories, like that under the direction of Professor Whitney at Schenectady, offer opportunities for productive work which are unsurpassed and well worthy of the consideration of men of ability. The awakening interest in the establishment of such laboratories and the significance of chemical control and oversight in many manufacturing operations seems likely to increase rather than to decrease the difficulties involved in commanding the services of able men as teachers in Chemistry, unless these positions can also be made financially attractive and the routine work of teaching and administration reduced to a minimum. The Department still has thoughtful teachers and able men, but more rather than fewer are needed.

The statements made in the Reports of recent years concerning the urgent need for additional facilities, especially for the better accommodation of our teachers and the encouragement of research work among them, and, in particular, for the re-uniting of the scattered branches of the departmental work, certainly apply with equal force at this time. It is our hope that relief may be found in some feature of the plans for the development of the Institute to be considered in the near future.

H. P. TALBOT.

RESEARCH LABORATORY OF PHYSICAL CHEMISTRY.

The Laboratory has suffered a severe loss in the resignation from its staff of Professor W. D. Coolidge, who has accepted an attractive position in the technical research laboratory of the General Electric Company at Schenectady, where he will be closely associated with Professor W. R. Whitney. To Professor Coolidge has been due the development of one of the

most important lines of work in progress in the Research Laboratory of the Institute,—the investigation of the conductivity of aqueous solutions at high temperatures,—a research that will be continued not only by several investigators at the Institute, but also by Professor Coolidge at Schenectady. Mr. Yogoro Kato, who has also been engaged on the conductivity investigation for two years, has accepted a position in the leading technological institute in Japan, the Technical High School of Tokio, where he will have charge of the work in Inorganic Chemistry and Electro-Chemistry. Dr. Wilhelm Böttger returns as Privat-Docent to the University of Leipzig, at which he will conduct one of the laboratory courses in Analytical Chemistry.

In place of these retiring members the following new appointments to the research staff have been made: William C. Bray, B.A., Toronto, '02, Ph.D., Leipzig, '05; Guy W. Eastman, S.B., M.I.T., '04; Gilbert N. Lewis, Ph.D., Harvard; Edward W. Washburn, S.B., M.I.T., '05. Mr. Roy D. Mailey has been promoted to the position of Research Associate.

Professor Wilhelm Ostwald, of the University of Leipsic, is delivering during the present term at the Institute a course of six lectures, on the Historical Development of Chemistry. The whole Instructing Staff of the Institute and all students in the Courses in Chemistry and Physics have been invited to attend. Besides these lectures, two new advanced courses are being given this year in connection with the laboratory through the co-operation of members of other Departments—one by Professor Warren on the Geometrical and Physical Properties of Crystals and one by Dr. Blanchard on Oxidation and Reduction. The laboratory course in Glass Blowing, under the charge of Mr. C. A. Kraus, is being continued.

At the close of the last school year a second gift of two hundred dollars was received from Mr. Samuel Cabot for use in promoting the investigations in the Research Laboratory. The Laboratory has also been assisted by a further grant of five hundred dollars from the William E. Hale Fund.

Seven candidates for the degree of Doctor of Philosophy are now pursuing work in the Laboratory.

The researches described in the Report of last year are all being continued, and one new line of investigation has been entered upon,—that of the hydration of salts in aqueous solutions. This constitutes one of the most important as well as one of the most difficult of the unsolved problems relating to solutions, and is being attacked by two independent methods, both of which give promise of success, by Mr. Edward W. Washburn and Mr. Richard C. Tolman. A series of eight articles describing the researches made in the Laboratory during the last two years is about to be submitted to the Carnegie Institution for publication.

A. A. NOYES.

DEPARTMENT OF ELECTRICAL ENGINEERING.

The significant changes which have been made in the instruction in this Department during the past year, other than those relating to distinct changes of course scheme, concern the introduction of recitations in place of lectures, a change which has given most satisfactory results, and the assignment of problem work for solution in the class-room rather than outside the Institute. This last has produced a distinct gain among the students in the power of rapid and accurate thinking, and seems to the Department a principle well worth broad extension in Institute work. The possibility of replacing lectures by recitations is due in some degree to the preparation of notes by members of the instructing staff of the Department for their classes, and this will, it is hoped, be considerably extended in the near future. It is gratifying to observe that the journal meetings are bringing about a much freer use, not only of current periodicals, but of the department library as well.

The matter of the course scheme has been considered by the Department with great care and at considerable length. The conclusions reached are that a radical simplification is

most desirable, in fact is absolutely necessary, since the students are working under pressure on too many subjects. The time for the digestion and assimilation of what is presented to them and for clear and careful thinking must be very considerably increased. This can be brought about by the elimination of certain work of lesser importance and the devotion of greater time to exercises, both written and oral, under the immediate supervision of the instructing staff.

The reports of students in connection with the excursions to the various power plants in Boston and vicinity have shown a very great gain in clearness of expression and logical arrangement, due in no small degree to the co-operation of the Department of English in this particular line of work. This contact of students with the actual engineering operations going on in their own chosen line of work is something which should certainly be increased, if by any possibility the necessary time can be found for such increase, and the presentation of formal reports in connection therewith should certainly be insisted upon as giving the students the power of analyzing the important features of any engineering process and of giving clear and logical expression to their thoughts.

A change of considerable importance which becomes effective for the first time with the present third-year class is the completion of a large part of the work in the Standardizing Laboratory during the third year, thus giving the fourth year so far as this laboratory is concerned mainly to the study of special problems arising in connection with thesis work. This, together with a considerable increase in the time devoted to Theoretical Electricity, puts the course on a much sounder and more logical basis than that on which it has previously rested.

The facilities of the Standardizing Laboratory have been extended in increasing degree to other Courses, and undoubtedly this laboratory will be depended on by all Departments of the Institute for such work as comes within its special province. There have been very considerable additions to the equipment of the Standardizing Laboratory during the past year, but

notwithstanding these additions there is still a marked deficiency in apparatus essential to the proper carrying on of thesis work.

The equipment of the Dynamo Electric Laboratory, in both apparatus and instruments, still needs very considerable supplementing. The lack of duplicate instruments and apparatus renders it impossible the present year to extend to the students of the Mechanical Engineering Department the training in this laboratory which was suggested by that Department and approved by the Faculty as a desirable change in the curriculum.

The demands on this Department for instruction to students of other Departments are rapidly increasing; and this increase is likely to continue for some years, until a sound training in some of the fundamentals of Electrical Engineering is given to the students in most of the Engineering Departments of the Institute.

These demands, together with the considerable increase in the number of fourth-year students in this Department, render the giving of proper instruction more difficult and make it extremely desirable that there should be in each laboratory, in addition to the Faculty members, at least one person of the grade of Instructor who shall exercise supervision and be immediately responsible to the Professor in charge. This can be realized, I hope, in the immediate future.

The need of more room, which was very plain a year ago, has now become most pressing through the increasing use of the various class-rooms in the Lowell Building for work other than Electrical Engineering and Modern Languages; in fact the departmental instruction in certain directions has been seriously hampered through the inability to secure class-rooms in which experimental illustration can be satisfactorily given. The rooms allotted to research in the original plan of the Augustus Lowell Laboratories have of necessity been taken largely for regular undergraduate work; and in the present year research work carried on by graduate students in the large labora-

tory is seriously hampered by the constant interruptions and disturbances arising from the regular laboratory work.

The demand for graduates of this Department has been particularly keen, the positions offered having largely exceeded in number the available men. Inquiries for men not infrequently specify that only those are desired who can think clearly and concisely and who have a natural adaptability in dealing with men, the knowledge of a great number of details being of secondary importance.

The output of the power plant has shown a steady increase, having risen recently to a value of very nearly six hundred kilowatts. The running of this plant at night, with the consequent shutting off of the Edison service, will undoubtedly result in a certain economy, although since the beginning of night running, on October 30th, the load has shown a steady and marked increase. The facilities of this plant have been extended to the Mechanical Engineering Department for certain laboratory work, and power plant tests have been successfully conducted with great advantage to the students of both Mechanical and Electrical Engineering.

During the past year there have been gifts of certain small pieces of apparatus and various framed photographs from the larger electrical manufacturing companies, and loans of apparatus and instruments for limited periods have also been made by them.

The instruction to students in the Lowell Institute School for Industrial Foremen has been given with most satisfactory results and this year there is being carried on a course of lectures and laboratory work for the Teachers' School of Science. Such instruction as this, giving as it does the services of the staff of the Institute, and the facilities of its laboratories to those engaged in teaching or in the actual conduct of engineering operations, is most important and desirable. So far as it can be carried on without interfering with the regular work of the Institute it should certainly be encouraged.

H. E. CLIFFORD.

DEPARTMENT OF BIOLOGY.

The year has been one of quiet, fruitful work in teaching, and also, as may be seen by an examination of the list of published papers, in research.

The text-book on Physiology and Hygiene upon which Professor Hough (formerly of the Institute and now of Simmons College) and Professor Sedgwick have for some time been engaged is passing through the press of Messrs. Ginn & Co., and will soon be issued. It is entitled "The Human Mechanism: Its Physiology and Hygiene and the Sanitation of Its Surroundings," and should prove a valuable adjunct to that more scientific education in the subjects which it covers which is to-day so greatly needed. In January and February last Professor Sedgwick delivered a course of ten public lectures in the Lowell Institute upon "The Sanitation of Cities", which he hopes before long to find time to publish.

Assistant Professor Prescott has continued his investigations and instruction in Industrial Biology and, as stated below, has opened a private laboratory for the benefit of manufacturers and others desiring investigations and reports upon the efficiency of the bio-chemical processes involved in their work which can not properly be made in an educational institution.

Assistant Professor Winslow's work on Applied Microscopy, a small illustrated volume which appeared in March, was immediately brought into service for our own students and has received favorable recognition elsewhere. In this volume, and in the numerous public addresses which he has given upon sanitary subjects, the author has shown his readiness and his ability to serve the state as well as the Institute.

A sudden, unexpected and unexplained decrease in the number of students in the Department, in the face of a larger demand than ever for its graduates, and in spite of other favorable conditions, occurred at the opening of the present session. This is perhaps due partly to the radical change of the Course in General Studies, from which good students have frequently

been recruited; partly to the diminishing number of women studying at the Institute; but mostly to causes as yet obscure. It has always been difficult to convince first-year students desiring to pursue the Course, or to persuade their parents, that Biology is a really practical subject, although students in other Courses who have reached their third and fourth years often report that, if they had understood, in their first year, what the Course in Biology is and what it leads to, they would have elected it without hesitation. Against this difficulty we shall doubtless long have to continue to struggle, in spite of the fact that we are, and for several years have been, unable to meet the demand for graduates in Biology, owing to the limited number electing the Course, and in spite of the fact that those who have taken it have readily found remunerative employment and promotion. In a technological school like the Institute some pains will doubtless have always to be taken to bring strongly before the students the opportunities offered by the more scientific as compared with the more technical Courses. It seems desirable that some way should be found to make it more generally known than it is, both by the student community and by the public at large, that the Courses at the Institute in Physics, Chemistry, Biology, and Geology are no less likely to lead to honorable and self-supporting careers for those who may elect them, than are those in Engineering.

The courses in biological subjects participated in by students from other Departments have been well attended. Industrial Microscopy, for example, draws a good number of students from the Chemical Department, and General Biology from this and from Sanitary Engineering; while the courses in Microscopical Organisms, Bacteriology, Industrial Biology, Biology of Water and Sewage, Municipal Sanitation, and Sanitary Science and Public Health, are largely attended. The short course on the Hygiene of Heating and Ventilation given to one of the Options of the fourth year of the Course in Mechanical Engineering is steadily growing in attendance, and is of somewhat exceptional interest and value.

By the introduction of the General Options in the third year opportunity has been found for a considerable expansion and improvement of the course in the History of the Inductive Sciences, given by Professor Sedgwick since 1889, chiefly to students of the Courses in Physics and Biology. In the present year the Faculty broadened the course by including in it the History of Mathematics. This part of the instruction has been put in charge of Professor Bartlett of the Department of Mathematics, the time allowed has been doubled, and the subject has been made one of the new General Options in the first term of the third year. Professor Sedgwick, during a leave of absence from March 25th last until the end of the school year, visited Sicily and southern Italy, partly to become more familiar with the field of labor of Empedocles, Pythagoras, Archimedes, Euclid, and other of the pioneers of science, and partly to get time for adequate preparation of material for the new lectures. Professor Bartlett likewise prepared during the summer, and the new course is now in successful operation with an attendance of fifty-three students. This is believed to be the first regular and complete instruction in the History of Science to be given in any American university or technical school.

Reports upon biological analyses, inspections, or investigations are often sought, and often important, for municipalities, manufacturers, corporations or individuals, and yet it is obviously impossible for officers of the Institute to make such examinations and reports in their official capacity or, if they are extensive, upon the Institute premises. To meet similar needs there have sprung up in the neighborhood of some educational institutions private laboratories, owned and directed by the officers of those institutions, but otherwise not connected with them. The numerous demands made upon the Biological Department for such aid as is described above, and the desirability of meeting these demands, have induced Assistant Professor Prescott to open during the summer a private laboratory of Industrial and Sanitary Biology and Chemistry in which such outside work can be done. Professor Prescott's laboratory

bears the name of The Boston Bio-chemical Laboratory, and is already in successful operation under his direction with the aid of two assistants technically trained at the Institute. It is believed that by the inauguration of this laboratory a real public need will be satisfactorily met, while opportunity will also be furnished in it for certain investigations in Industrial Biology and Bacteriology which could not be readily undertaken upon the premises of the Institute.

The Sanitary Research Laboratory and Sewage Experiment Station, affiliated as it is with this Department, has proved during the year of the highest service to students of Biology, and it is greatly to be desired that it shall become a permanent part of the Institute equipment, since it furnishes facilities now almost indispensable for students of Sanitary Biology, Municipal Sanitation, and Sanitary Science, not to mention those in Sanitary Engineering and Sanitary Chemistry.

W. T. SEDGWICK.

SANITARY RESEARCH LABORATORY AND SEWAGE EXPERIMENT STATION.

In the spring of the present year (1905) the sum originally contributed by the donor of the Sanitary Research Laboratory and Sewage Experiment Station,—namely, five thousand dollars a year for three years,—was generously augmented by an additional gift of five thousand dollars.

In July, two full years of actual investigation having elapsed, the first of our experiments was completed, and a large part of the summer was spent by the Biologist-in-Charge, Professor Winslow, and the Research Chemist and Bacteriologist, Mr. Phelps, in making a careful digest of the work thus far done and in preparing a Report. To this it was deemed desirable to prefix a comprehensive review of the present state of the sewage-disposal problem in England, Germany, and the United States. This report, consisting of two hundred typewritten

pages and thirty carefully prepared drawings and diagrams, is now ready for printing, and when published will constitute, it is believed, the most complete and timely report upon the theory and practice of sewage disposal that has yet appeared. It is impossible and unnecessary to epitomize here the conclusions which have been reached through our experiments, but it is believed that these already enable us to affirm the practicability of the purification of the sewage of a seaboard city, such as Boston, by means of so-called trickling, percolating, or sprinkling filters, upon an area and at an expense which need not be prohibitory. By further treatment of the effluents from these filters, with subsequent sterilization, we hope to develop a method for the cleansing of city sewage such as the donor in making the original gift desired us to find.

One of the notable events of the year is the construction and operation of a large outdoor trickling sewage filter, of ten thousand gallons daily capacity, equipped with a distributing device of original design.

The first volume of "Contributions from the Sanitary Research Laboratory and Sewage Experiment Station of the Massachusetts Institute of Technology," consisting of six papers and one map, and covering one hundred and twenty-nine pages, was published in June, and has been received with so much favor that it is already out of print. Several popular leaflets in the series begun last year upon "Dirt and Disease" have now appeared, although the publication of these was interrupted for a time by Professor Sedgwick's absence from the country. The demand for them at cost has been large and several hundred have been gratuitously distributed.

The laboratory and experiment station have continued to be of material service to the Department of Biology, and through this to the Departments of Chemistry and Sanitary Engineering of the Institute, inasmuch as students and instructors alike have here constantly an opportunity of obtaining for investigation and experiment and of experimenting upon, the sewage actually flowing away from a large seaboard city, besides

effluents in various stages of purification derived from various types of purifying processes.

The Laboratory and Experiment Station have been ably and faithfully conducted by Assistant Professor Winslow and Mr. Phelps. They have been appealed to in a number of instances during the year for practical aid in the solution of problems of importance to the public health other than those of ordinary sewage purification, notably by the United States Geological Survey, for investigations concerning the action of copper upon typhoid fever germs in water contained in copper canteens, and upon the purification of strawboard and other manufacturing wastes.

It is not easy to convey in a few words any adequate idea of the importance of a laboratory and experiment station of this kind in the educational work of a great technical school. Only those who are brought into daily contact with earnest young men preparing themselves for the arduous and intelligent work to-day required in all branches of public hygiene and sanitation can realize the immense educational value of such practical demonstrations and working facilities as are here furnished.

The heartfelt thanks of all who have had the opportunity of using the laboratory and experiment station are hereby tendered to the donor (who still prefers to remain anonymous) for its inauguration and continued support.

W. T. SEDGWICK, *Director.*

DEPARTMENT OF PHYSICS.

Several improvements in the general course of instruction have gone into effect during the past year, among which the following may be especially mentioned.

A new lecture-course upon the Electrical Discharge in Gases and Radio-Activity was given by Professor Cross during the second term of the past year. The lectures were very fully illustrated by experiments. Attendance was optional, and

they were given at a late hour in the afternoon, when the students were free from other exercises. It is intended to continue this course in succeeding years.

It has long been the desire of the Department that the instruction in the Laboratory of General Physics should begin at the middle of the second year instead of at the end of the first quarter of the third year, though until within a few years this has been feasible only for the Courses in Electrical Engineering and Physics. It is far more interesting to the student to enter upon elementary experimental work of the general character of that with which the course in Physical Measurements begins before his attention is largely concentrated upon more strictly professional work. Furthermore, an earlier start in this direction allows time in the later years for the more advanced instruction in Technical Physics which is called for in constantly increasing measure in most of the professional Courses. For over twenty years past the studies in the Courses in Physics and Electrical Engineering have been laid out so as to secure the end under consideration, and for a number of years past the same has been true of the Course in Chemistry. The Courses in Civil Engineering, Sanitary Engineering, Biology, and Geology have now been modified so as to permit of a like arrangement. The consequent overlapping of the second and third-year classes of the first-mentioned Course, which took place last spring, when the new arrangement went into effect, produced an unprecedented crowding in the laboratory, a difficulty which will not recur until a like change is introduced into some of the remaining large Courses. The inconvenience referred to was only temporary, however, while the gain from the change is very great.

A further advance is the extension of the instruction in the Precision of Measurements. This important subject now forms a part of the teaching given by the Department to students in all Courses taking work in the Laboratory except in Civil Engineering, Chemical Engineering, and Sanitary Engineering.

It is gratifying to have this fuller recognition of the value to

all professional men of a knowledge of the methods whereby they may determine the numerical accuracy of observations. While the principles referred to are naturally taught in connection with Physical Measurements, they are equally applicable to all branches of science. Moreover, an endeavor is made in the various illustrations and problems of the course to deal with engineering as well as with purely physical data.

The extension of this subject has necessarily increased the amount of class-room instruction demanded of the laboratory staff, but it is believed the results are well worth the effort.

In the Electrical Laboratory Professor Laws has introduced several modifications of the methods of instruction which have materially increased their efficiency. A number of new and refined methods of magnetic and electrical measurement have been carefully investigated with a view to adapting them for use in practical work.

The Laboratory of Heat Measurements, in charge of Professor Norton, has profited greatly by the special appropriations which have been made for its equipment and enlargement. The laboratory will shortly possess practically all standard apparatus at present employed for the maintenance and measurement of high temperatures, the study of the calorific power of fuels, the measurement of thermal conductivity, and the investigation of the effects of heat upon the materials of engineering.

Through the generosity of Mr. John W. Dunn this laboratory has been equipped with an 8″ x 4″ ammonia pump to be used in connection with our refrigerating apparatus. It is hoped that the available supply of liquid air will be such as to enable us to carry our instruction and research over much wider ranges of temperature.

In the Optical Laboratory Professor Wendell has been much hampered by the limited space which is allotted to this work. The equipment, however, is excellent, and consists of apparatus of the most recent type. The instruction in Optics during the past year was made especially valuable through the courtesy

of Dr. Frank B. Jewett, who gave a course of lectures upon Interference and Diffraction extending throughout the year. Also three experimental lectures were kindly given by Mr. A. H. Munsell upon color notation and the photometric study of colors.

In the Electrochemical Laboratory, which is in charge of Professor Goodwin, the experience of the past two years has shown that the equipment for scientific as well as for technical work is all that can be desired. Especially is this true as to facilities for investigation, as is well shown by a consideration of the varied lines of research which have recently been pursued therein. Among these may be mentioned investigations on the properties of fused magnesium oxide, the Edison storage cell, the electrolytic reduction of lead sulphide, the ionization of fused salts, the electrolysis of carnallite, the densities and melting points of cryolite and double fluorides, the migration ratios of copper salts, and Billitzer's method for absolute potential measurements. A number of these researches have already been published or are in press.

The lecture course on the Technical Applications of Electrochemistry is now given by Dr. Thompson, who intends to supplement it in the coming year by a seminar in which electrometallurgical and thermo-chemical calculations will be illustrated by practical problems.

The local dynamo plant in the Walker Building, which, with the special transformers used in connection with it, was designed by Professor Derr, had just been completed at the date of the last Report. The experience of the past year has shown it to be well adapted to meet the requirements of the Department. Several additions have been made by which the use of the power furnished by it is greatly facilitated.

The Department has been most substantially aided by various gifts which have been received during the past year. Of these the largest is that made to the Institute by Dr. W. W. Jacques, a graduate in the Course in Physics in 1876, of the sum of one thousand dollars per annum for five years, for the purchase of

physical apparatus of such a character as is not provided for by the usual annual appropriation. This generous donation furnishes us most substantial help. A considerable sum has already been expended for the purchase of machinery for the shop, particularly a bench lathe and an upright drill.

A most important advance which has just gone into effect in connection with the instruction in Physics is the requirement of a certain knowledge of that subject of all students entering the Institute. Too much ought not to be expected from this, but it is hoped that the possession of a certain amount of elementary knowledge of the subject by the students at the beginning of our more extended course will allow a broader and in some respects more philosophical treatment than has hitherto been practicable. The results of the first examinations set for entrance are not wholly encouraging, as with a very large proportion of the applicants the preparation was not what it should have been, although the papers set were not intended to be difficult and were not so considered by those taking the examinations. The chief difficulty seemed to lie in an absence of clear thought and accurate definition on the part of many students. It is hoped that better results will be reached hereafter; but even a very slender knowledge of the subject will be better than none at all. It will allow illustrations from all branches of Physics to be introduced to make clear the earlier portions of the course, and will make possible from the outset the use of certain assumptions the truth of which the student will at least recognize, even if he does not possess a clear perception of their derivation or extent.

CHARLES R. CROSS.

DEPARTMENT OF GEOLOGY.

Course XII was reorganized during the winter of 1904–5. The name of the Course was changed from Geology to Geology and Geodesy. The new Course provides two Options, the first in Geology, the second in Geodetic Surveying. The

latter permits a student to take the Bachelor's degree in the astronomical and topographic branches of Civil Engineering. These subjects have been offered in the past only as graduate work in the Department of Civil Engineering. Stress is laid on field work in both Options and the fourth-year programme is partly elective, permitting the student to specialize according to his professional aim.

In 1905 four students of the Course in Mining Engineering graduated in the geological Option of that Course. The graduation theses of these men were based on field studies in Massachusetts, Rhode Island, and Alaska. Ten students of the class of 1906 are enrolled in this Option. In 1904–5, the total registration in studies under the Department was seven hundred and eight.

Professor Jaggar was engaged during the summer in writing the text of the Geologic Folio of the Spearfish-Sturgis district of South Dakota for the United States Geological Survey. He has given some time during the past year to field experimentation with a telemeter-alidade designed for making sketch maps of small areas in geological surveying.

Professor Crosby is engaged in the investigation of the auriferous formations of Admiralty Island and the Juneau district in Alaska, and he has also examined some gold mines in Shasta County, California. The publication of his work on the Rocks of the Lower Neponset Valley marks another step in the progress of his valuable researches on the Geology of Eastern Massachusetts.

Professor Warren in the Mineralogical Laboratory has been engaged in making a mineralogical examination of river and sea sands and ores chiefly from the Pacific States under the auspices of the United States Geological Survey. A portion of his time has been occupied with economic problems connected with building stones.

Professor Johnson spent a month in the early summer in the study of drainage modifications in the headwaters of the Savannah and Chattahoochee rivers. A gift of three hundred

and fifty dollars from Mrs. Henry Pickering for the work in Topographic Geology at the Institute has made possible the purchase, mounting, and framing of maps and photographs, and the acquisition of new lantern slides. Professor Johnson gave the greater part of the summer to the preparation of this equipment. The course in Topographic Geology has been extended throughout the entire year.

Dr. Shimer visited type stratigraphic localities in New Jersey and Pennsylvania during the summer, and began work on the Cortland Quadrangle for the New York Survey. He continues his work on the fossils and fossil-bearing localities of Eastern Massachusetts. He reports many valuable additions to the paleontological collections, mostly the gifts of former students. The courses in Paleontology at the Institute are devised principally to teach students to use fossils in determining geologic horizons in the field. This work is of the utmost importance in preparation for service on state or federal geological surveys.

The Department is in need of more space, and there are four objects for which money is much needed. Three of these are collections:—namely, rocks, maps, and photographs; the fourth is the instrumental equipment of the mineralogical laboratory. The Department has an excellent collection of fossils, but the collection of rocks, especially for the courses in Petrography and Field Geology, needs continual extension, and microscopical preparations are needed in order to make it serviceable.

The gift above referred to has made possible a beginning in the selection and mounting of maps; but for the maintenance and extension of this collection a considerable outlay is required. The use of the stereopticon is in no subject more valuable for teaching than in Geology. As yet, however, the Institute can hardly be said to have the nucleus of a collection of geological lantern slides. Gifts for this purpose from those interested in the development of the geologic sciences could not be more profitably expended. Lastly, there is need for a large research microscope, for crystallographic instruments, and for platinum

vessels,—all expensive apparatus which it will require years to obtain without special aid.

T. A. JAGGAR, JR.

DEPARTMENT OF NAVAL ARCHITECTURE.

The only notable change in the Course in Naval Architecture comes from the time made available for professional work in consequence of added entrance requirements put in force two years ago. A part of that time has been assigned to the course in Differential Equations, making it sufficient for the requirements of the theoretical instruction in Naval Architecture, and in consequence there is a notable gain in efficiency of that instruction, although the number of lectures is not increased. The remainder of the available time has been applied to extending the work in Ship Design and to providing courses of lectures in Ventilation and Drainage of Ships and in Technical Chemistry, which latter will deal with the chemical nature of materials entering into the structure of the ship, their tendencies to corrode or deteriorate, and methods of preservation by painting and otherwise.

During the school year of 1904–05, numerous lectures were given by experts in ship-building and in cognate arts, and a similar course is in progress the present school year, all through the interest of Dr. Weld, who has also furnished means for members of the Department to collect materials for lectures at first hand. In addition to the advantage that students have from hearing and meeting such eminent men in the profession they have chosen, we have the further advantage of collecting in the best way information which will be applied to strengthening and broadening our own instruction. In particular may be mentioned a good beginning already made in collecting photographs and lantern slides of shipyards, ships under construction, and ship tools and appliances, from prominent yards and works both in this country and abroad.

The Course for Naval Constructors has been somewhat

changed, mainly following changes in the Course in Electrical Engineering, so as to take advantage of improvements in that Course. It may be noted that two classes of naval constructors have already been graduated from the Institute, and that twelve constructors now in active service have taken our Course. There are now seventeen constructors under instruction, six having been assigned to the Course this fall. In addition two private students are taking the parallel work of our Graduate Course in Naval Architecture which, like the Course for the constructors, leads to the master's degree. Mr. John A. Ross, Jr., of the Class of 1901, who has since graduation been employed by the Construction and Repair Department of the Navy, has been obtained to assist Professor Hovgaard in Warship Design, and will be able to give more efficient assistance than has before been available. Even with such assistance, the work in Warship Design, on account of the large number of students and the special nature of their work, remains arduous.

As has been noted in several annual Reports, the regular work of the year is supplemented during the term or in the summer vacation by practice in cutting models of ships designed by the students and by practice in mould-loft work. The latter has been carried on by a method in vogue in some of the leading American and European shipyards. For this method the lines of a ship are drawn and faired to a large scale (one inch to a foot); and from these, faired dimensions for a full-sized set of lines may be obtained with all the accuracy desired in practice. These dimensions are then used to lay down a body plan on the drawing-room floor, which has ample size for that work. The key to the process is the accurate construction of the large-scale drawing at an inch to the foot, which must be made on a surface that will not change with atmospheric conditions. Dr. Weld has provided the Department with four tables for this purpose, with tops made of a special opaque white glass that was used last year with complete success, and it is believed to be better than any material hitherto used for this purpose. It may be noted that in the model shop there were cut during

the last school year forty-five models, of which eight were made by naval constructors. Many of the models made in this shop are finished for exhibition and use in the drawing-rooms, and a number have been shown at expositions with the Institute exhibits.

The present depression of the ship-building industry is naturally reflected in the diminished sizes of the classes in Naval Architecture at the Institute. Such diminution will, doubtless, be temporary and will be followed by an increase with the revival of ship-building which has already begun. So far as known, none of the graduates of the Department has suffered from lack of employment, though a considerable number have gone over into general Engineering. When a demand for trained naval architects shall again be brisk, these men will be available with a broadened horizon that goes with a wider experience, though some part will undoubtedly succeed so well in allied branches of construction that they will not be willing to leave. The Course in Naval Architecture, like its allied Courses of Engineering, is broad and well founded, and the field for usefulness of its graduates has a corresponding breadth.

C. H. PEABODY.

DEPARTMENT OF MATHEMATICS.

The only important change in the mathematical curriculum since the publication of the last Report is the increase in the time allotted to the Elements of Differential Equations in the third year of the Courses in Mechanical and Chemical Engineering and Naval Architecture. This has been rendered possible in connection with certain general changes in the third-year work, and is of much advantage to the mathematical instruction.

While there have been no substantive changes in the mathematical entrance requirements in recent years, certain modifications have been made in the application of these require-

ments with a view to making them a more thorough test of candidates for admission to the first year. In Algebra the former single two-hour examination has been replaced by two examinations, each covering one hour and three-quarters. This has rendered it possible to cover the subject-matter more completely than previously and in better relation to its intrinsic importance. There has also been an effort to make the mathematical examinations a better test of thinking power on the part of the candidates, rather than of mere facility in mechanical execution, by including the problems and a larger proportion of simple original exercises. The proportion of failures has been increased, at least temporarily, by these changes, but can scarcely be considered abnormal, except perhaps in Algebra B. It is the belief of the Department that the requirements as represented by the present examinations do not make it unduly difficult for a candidate to secure admission if he has the mathematical aptitude essential for subsequent success in an engineering Course.

During his leave of absence for the months of March, April, and May, Professor Tyler gained some acquaintance with the aims and methods of mathematical instruction in Paris and Zürich. The present activity in the improvement of instruction in elementary Mathematics abroad is of particular interest in connection with the plans under consideration for the revision of our own courses.

H. W. TYLER.

DEPARTMENT OF DRAWING AND DESCRIPTIVE GEOMETRY.

The changes in the methods of instruction begun two years ago are now for the most part completed and the wider and better results obtained seem to justify the methods adopted.

Last March Professor Adams's notes on mechanical drawing were published in book form. The book is eight and one-half inches by eleven inches, contains two hundred and ten pages,

two hundred and forty-three illustrations, and twenty-two full-page plates. The intention in preparing it was to bring together sufficient and appropriate material to meet the needs of the regular first-year students, to permit of specialization when desirable for a particular professional Course, and to take care of students required to make up deficiencies in Mechanical Drawing. As regards the regular work, the detailed treatment of the various processes and topics which the book offers has in a measure compensated for a necessarily somewhat deficient individual instruction.

The work in Descriptive Geometry has progressed favorably. Lectures are given as usual in Huntington Hall. For this work a series of some sixty to seventy wall charts, four feet by five feet, will have been prepared by the end of this year. The lectures are supplemented by printed notes and cuts. During the past summer there was prepared and printed a set of study plates in Descriptive Geometry containing some twenty-five sheets of data.

An important step was taken this year in the forming of a class in Descriptive Geometry for students entering with advanced standing. Heretofore these men have been obliged to make up deficiencies as best they could, often beginning with the second-year class at a point two-thirds through the subject and making up the preceding portion by tutoring or attendance in the first-year class. The result has been for obvious reasons generally unsatisfactory. In the special class, held daily, except Saturday, after four o'clock, the subject is taken up at the beginning and the whole ground is quickly covered in the first term. Some twenty-eight students joined the class. Attendance and interest in the work have been thoroughly satisfactory, and it is expected that there will be a marked proportional increase in the number passing the subject.

The special difficulty which the first-year class has in mastering Descriptive Geometry should again be pointed out. This difficulty appears to be due to lack of imagination on the part of the student, coupled with insufficient time for the subject

and too little individual teaching. The subject is taught from the standpoint of its application in engineering and architectural drawing. The methods followed in the lectures are those believed to be most readily assimilated by the beginner, and correspond in the main to those adopted in the French schools. The subject, however, is at best difficult for the beginner. The student's lack of imagination,—the kind necessary to visualize the solution of geometrical problems in space,—is probably due to the entire absence of preparatory training calculated to develop this power. Perhaps in no other subject is the want of preparation so keenly felt. The remedy appears to be an entrance examination in Projections, which might also include a requirement in elementary instrumental execution. As bearing upon such a requirement may be quoted a recent remark of the State Agent of Drawing: "When the Institute requires an entrance examination in drawing, the demand will undoubtedly be met." As to individual instruction, there should be enough teachers to make it possible to divide the class into sections of not more than twenty students each without giving too many sections to an Instructor. The number of teachers at present is nearly twenty per cent. less than it was two years ago. The smaller class this year makes the loss less noticeable, but much which might be accomplished with a larger teaching force must be left undone. This is particularly the case with the written criticism which should be placed on all drawings and exercises. It is desirable that a way be found to lighten the work of the teachers, and to make the compensation such as will enhance their interest in the Department as well as make it possible to secure the best men to fill vacancies. On the whole it may be said that results are as good as can fairly be expected under present conditions of equipment and teaching force.

Attention may again be called to the poor equipment of the Department. Huntington Hall is for several reasons not suitable for the lectures. The main drawing-room, which is used by some three or four hundred students, including all

sections, is the worst lighted of any drawing-room in the Institute. Many of the drawing tables are of an inconvenient, obsolete type. Cases are needed in which to place the drawing models now scattered about the room. More models and of a better type are needed, and also a blue print outfit. A large number of examples of drawing to be placed on the walls await framing. An improved equipment would materially assist the teachers in the performance of their work.

During the past year Messrs. Eugene S. Foljambe and J. Russell Putnam have resigned. Their places are filled by Messrs. Stephen A. Breed, S.B. '94, and Samuel E. Gideon. The latter is engaged for half time.

CHARLES L. ADAMS.

DEPARTMENT OF MECHANIC ARTS.

The total number of students receiving instruction in the Mechanical Laboratories is three hundred and thirty-one. Some of these attend in more than one class, the numbers attending in the several subjects of the first term being as follows:

Carpentry and Wood Turning, II.	92
Joinery and Pattern Work, VI.	43
Forging, II. and XIII.	91
Metal Turning, VI. and VIII.	46
Machine Tool Work, II. and XIII.	68
Pipe Fitting, XI.	6
Total in classes	346
Students taking work in two or more classes, and counted more than once	15
Total number of students	331

The total number of students attending last year was three hundred and fourteen. Many students have been excused from attending the Carpentry, Wood Turning, and Forging classes, and a smaller number from Pattern Work, on account of satisfactory work done in preparatory manual training schools.

The proportional number of excuses granted in these earlier subjects is increasing from year to year, but very few students come sufficiently well prepared to permit excuse in the later subjects of Chipping and Filing and Machine Tool Work.

The attendance in the Summer School was forty-eight, a number which shows a falling off of twenty-two as compared with the maximum attendance reached last year. The numbers in the several classes were—

Wood Work	9
Forging	10
Chipping and Filing	3
Machine Tool Work	26
Total	48

The proportionally large attendance in Machine Tool Work will probably continue, on account of the tendency of third-year students of Courses II. and XIII. to anticipate the Mechanic Arts of the fourth year, and thus to secure free time for thesis or other departmental work.

No additions have been made to the equipment during the past year. To maintain the present high standard of work fourteen engine-lathes and a planer purchased in 1876 should be replaced by new and modern machines. A universal grinding machine, a universal milling machine, and a small radial drill are very much needed to carry on successfully the general class-work in the Machine-Tool Laboratory.

The renewal of the equipment in the Forging Laboratory, while desirable, is not recommended, on account of the probable early removal of the Mechanical Laboratories to a new location.

Instruction ampitheatres have been provided in the Wood Working, Forging, and Chipping and Filing Laboratories, and have been found a very great convenience to both students and Instructors.

As stated last year, it is believed that instruction in Foundry Work should be given to every student in Mechanical Engineering, because of the value of a thorough knowledge of this im-

portant subject in many industrial works. The course is now optional and the large classes show a demand for this training. It is again earnestly recommended that a new and larger melting plant be installed, as under present conditions it is extremely difficult to obtain good results. With a larger and improved plant the students might make many of the castings now purchased outside. Should the course be required of students in Mechanical Engineering, an additional Instructor would be needed.

A much-needed improvement has been made in the roof of the laboratory building. The ventilation has been decidedly improved, leakage obviated, and the lighting remains nearly as good as formerly. To remedy still further faulty former conditions an electric lighting plant should be installed in place of the present inadequate gas lighting system, and a new solid plank floor should be laid in the Machine Tool Laboratory.

PETER SCHWAMB.

DEPARTMENT OF ENGLISH.

Several changes have been made during the past year in the details of instruction in English. The distribution of time in the second term of the first-year course in English was altered so that the time allotted to the subject—two hours a week—was all used in the class-room. The result has been most satisfactory. The study of literary form in preparation for second-year Literature was carried forward more successfully than ever before; and the change will be adopted permanently.

The first-year class was also given a drill of two weeks in the use of books of reference. The machinery of this drill need not be described in detail; it is sufficient to say that the effort has been to make the students actually use as many reference-books as possible, and to call their attention to all others in the Library.

During the present term an application of what may be called the laboratory method is being made to the first-year English of the first term. An hour of the time hitherto given to preparation has been added to a recitation period, to make a period of two hours. This is used for the writing of a fairly long theme in class, under the general supervision of the Instructor, the work being required within a given time. This method trains the student in readiness and promptness, and is in the end a time-saving device in that it makes impossible all dawdling, doubting, and indecision. It is too soon to speak with finality of the value of this laboratory method; but the results thus far are most promising.

In the matter of entrance examinations the English Department has taken a new step by breaking away definitely from enforced compliance with the list of the Commission of Colleges in New England. The enthusiastic approval of this move, as expressed in letters received from the heads of fitting-schools, shows that it is at least a step in the direction in which the best thought is moving.

ARLO BATES.

DEPARTMENT OF HISTORY.

There has been no marked change in the work in History required of all regular first-year and second-year students, and of fourth-year students in Architecture. The discontinuance of the Course in General Studies was naturally accompanied by the discontinuance of instruction in the subjects given in that Course only; but the introduction of Options in General Studies in the third year has offered an opportunity to establish new courses in History and Government. These are somewhat briefer and more general in scope than those formerly given in Course IX., but reach a considerably larger number of students.

CHARLES F. A. CURRIER.

DEPARTMENT OF ECONOMICS, STATISTICS, AND POLITICAL SCIENCE.

As a result of the changes in the allotment of time in the third year, the required instruction in Political Economy is now compressed into the first term, the class meeting three times a week instead of twice as in former years. It is believed that this arrangement will be advantageous, as it secures concentration of attention and interest.

The instructors in this Department are developing the practice of individual conferences with students, and it is hoped to emphasize still further this part of the course.

DAVIS R. DEWEY.

DEPARTMENT OF MODERN LANGUAGES.

The work of the Department of Modern Languages has been carried on substantially on the lines indicated in the last annual Report. Attention has been directed chiefly to the proper proportioning of oral and written work, and to giving students a symmetrical training in the directions of pronunciation and conversation on one side and of reading and translation on the other. The number of text-books has been diminished, and the vocal use of the languages encouraged.

Students admitted to the courses in Modern Languages have generally had little or no training in pronunciation. With a view to repairing this deficiency, the recitation rooms of all the French sections have been equipped with charts giving exercises for practising pronunciation. Students are marked separately on pronunciation and on other work, and given the mean of the two as a general or record mark. A thorough inquiry has been made into the various graphophones or talking machines that are offered for sale as aids in imparting and acquiring pronunciation, and the purchase of a number of such machines

of a particular pattern for the use of the Department is likely to be recommended.

In addition to pronunciation charts and talking machines, the section rooms should, if practicable, be provided with simple pictures to which the teacher might point to designate objects which he wishes to bring to the minds of the students without making use of English; such pictures as are especially designed for class-room use, as the German "Anschauungsbilder." These and such other objects as foreign calendars, posters, and photographs might help materially to make the courses in Modern Languages more instructive. Mechanical and other technical drawings are especially needed. The text-books in common use in scientific reading are very defective in respect to illustration.

The number of students who failed to meet the entrance requirements in Languages made it expedient to provide instruction for them in French I. and German I. It is expected that the same condition will obtain next year.

At the beginning of this school year a section was formed in Italian, but had to be abolished, as the only available Instructor, Mr. Erhardt, had to give his whole time to other languages. In view of this fact, the increasing demand for Spanish, and the present size of the sections, it appears that the Department has, or soon will have, employment for an additional Instructor.

The work devolving upon the several Instructors has been performed with zeal and efficiency. Professor Vogel edited and published through Heath and Company a German reader entitled "Geschichten aus der Tonne," by Theodor Storm.

JOHN BIGELOW, JR.

Reports of Administrative Officers.

REPORT OF THE SECRETARY OF THE FACULTY.

The Faculty business of the year has consisted largely in the conclusion of certain curriculum changes to which reference has been made in previous Reports, and in the preparation of a report to the Corporation on the Proposed Agreement with Harvard University.

The changes of the curriculum, now in operation for all classes except that of 1906, have comprised the substitution for two hundred and seventy hours' work in French or German of one hundred and twenty hours in elective work in Economics, English, Modern Languages, or History (including History of Science), and of the remaining one hundred and fifty hours in professional subjects. This has fortunately not meant as a rule an increase in the number or variety of professional subjects, but rather the allotment of more time to those already included. The changes have affected primarily the third year and to a less extent the second and fourth.

The distribution of third-year students among the several General Electives for the present term is as follows: Economic History, 37; Advanced English Composition, 9; English Literature of the Eighteenth Century, 35; French III, 7; German III, 17; French Sight Reading, 15; German Sight Reading, 15; Spanish, 75; Comparative National Government, 14, International Law, 62; History of Science, 53.

One of the principal difficulties in the whole arrangement consisted in the reservation of hours for the electives which would admit of the participation of students from all Departments. It was found practicable to reserve a single hour in

the Tabular View for this purpose, subjects requiring more than one hour being then relegated to the 4–5 P.M. period for the remainder.

Among other departmental changes may be mentioned the further development of the Geological Option (3) in Mining Engineering and Metallurgy, in which there are this year nine candidates for graduation; the announcement of the discontinuance of Landscape Architecture as an undergraduate Option; important changes in the Courses in Chemistry and Chemical Engineering; and the remodelling of Course XII (Geology) into a Course in Geology and Geodesy. Fuller details in regard to these changes may be found under the respective departmental reports.

A change in connection with requirements for graduation, particularly affecting candidates who fall short of completing the Course in four years, is embodied in the following rule adopted by the Faculty:

"The degree of the Institute represents not only the formal completion of the subjects in the selected Course of study, but also the attainment of a satisfactory standard of general efficiency. Any student who does not show in the fourth-year work of his Course that he has attained such a standard may be required before receiving the degree to take such additional work as shall test his ability to reach that standard. This additional work shall consist in the preparation of a thesis during the last term of residence, unless otherwise provided by a special vote of the Faculty, and in the pursuance of such new studies and the repetition of such of those previously taken as may be required by the Faculty; and, in general, an amount of work per term substantially equivalent to that involved in the regular Courses of study will be required during any subsequent period of residence."

The entrance requirement in Physics announced last year has become operative for the present first-year class. The examinations of the present year were made relatively simple, and the proportion of failures was not unexpectedly great. It

is hoped that preparatory work in this subject will be favorably affected by the Institute requirement.

The attention of the Faculty during the spring was largely occupied with the consideration of the proposed agreement with Harvard University, which was exhaustively discussed in all its bearings at numerous meetings, both of the entire Faculty and of the special committee of heads of Departments to which the matter was referred. The report of the Faculty to the Corporation has been published in an extra issue of the *Technology Review* for April, 1905.

The Secretary having been granted leave of absence from March 1st, the administrative work in his charge was most efficiently conducted by Professor Merrill as Acting Secretary, with the co-operation of the other administrative officers and of Professor Currier and Mr. Robinson. It has fortunately proved possible to secure Professor Merrill's services as Acting Dean during Dean Burton's absence.

H. W. TYLER, *Secretary.*

REPORT OF THE DEAN.

The work of the Dean's office for the past year has been of the same general character as that of the two preceding years, with a noticeable increase in the number of students voluntarily consulting the Dean. During the absence of Dean Burton in Europe the work is being carried on along the lines which he has so successfully followed in the past.

As in previous years, each new student has been assigned to some member of the Instructing Staff, who acts as his adviser. So far as possible these assignments were made on the two days immediately preceding the opening of the term, when members of the Committee of Advisers met new students in the General Library for the purpose of assisting them in the arrangement of their programmes of work and in registration. It was intended that during this time there should always be present

one or two members of each professional Department, as well as members of the Faculty Committees on First-Year Students, Five-Year Students, and Provisional Students, so that special advice might readily be obtained.

The usual notes of inquiry were sent to the principals of the preparatory schools last attended by new first-year students, and the replies received were in many instances helpful to a better understanding of the needs of the student concerned, or a fairer estimate of his ability.

The Walker Club, following its precedent of last year, gave an informal reception at the Technology Club, to which all students entering the Institute from other colleges were invited. About seventy-five men took advantage of this opportunity to meet members of the Faculty and to become acquainted with each other.

The room and boarding-house register, comprising a list of two hundred and thirty-five houses in Boston and its immediate suburbs, was consulted by a much larger number of students than in the past year, and a seemingly greater number of men found accommodations outside of the city proper.

The employment bureau was more successful in finding employment for under-graduates during the past year than in the previous year, although the work offered was seldom in the line of their professional Courses at the Institute. There were in all about fifty applications for student help from persons not connected with the Institute. A few of these opportunities were for work during the school year, but the greater number were for the summer. In almost every instance we were able to supply the desired assistance, although the nature of the work was varied and included applications for chauffeurs, draftsmen, book agents, tutors, and hotel help. Thirty-five students asked for aid in finding employment during the school year, and one hundred and ten made application for summer work.

Gymnasium.—The work in the gymnasium has, in general, been carried on along the same lines as last year, but the attendance has been larger and much more regular. More attention has been paid to heavy gymnastics than in the past, and a team has been formed which gave two very successful exhibitions. The development of this branch added interest to the regular work and was a large factor in increasing the attendance. The Track Team and the Basket Ball Team used the gymnasium two days a week and called out a large number of men.

Physical examinations were given, at the beginning of the year, to each man intending to take regular class work, and the exercises were laid out on the basis of these examinations. A second examination was given at the end of the year, and in all cases there was marked improvement. The Cabot Medals for Improvement in Physical Training were awarded to G. B. Mayer, '05, A. T. Heywood, '06, A. H. Keleher, '06, A. E. Hartwell, '07, and H. G. Pastoriza, '07. The committee of award, consisting of Professors Wendell and Bailey, Mr. Towne and the Dean, decided on account of the large number of contestants and their high percentage of gain to award five medals this year instead of three as last year.

The lease of the land on which our Exeter Street Gymnasium was situated ran out on May first and, as the lessors, desiring to use the land themselves, did not wish to renew, other quarters had to be secured. After careful consideration the Institute decided to build a gymnasium on the Garrison Street property, next to the Mechanical Laboratories. The new gymnasium, which was built during the summer and early fall, is an entirely suitable building and is well adapted for our present needs. Its decided superiority over the old gymnasium should be a great stimulus to a more widespread interest in gymnasium work at the Institute.

STATISTICS OF ILLNESS FOR THE SCHOOL YEAR.

1904-1905.

Fourth-year Class.

There were three hundred and forty students, regular and special, in the fourth-year class. Of these twenty-five were reported ill during the school year 1904–1905. Classified by diseases, there were the following cases: appendicitis, 1; acute mental exhaustion, 1; diphtheria, 1; eye trouble, 2; general debility, 1; grippe, 5; jaundice, 1; severe cold, 3; tonsillitis, 1; typhoid fever, 2. In seven cases the illness was not specified.

Third-year Class.

The whole number of students in this class was four hundred and twenty-five. Of this number thirty-nine were reported ill during the school year 1904–1905. Classified by diseases, there were the following cases: abscess, 2; appendicitis, 1; carbuncles, 1; catarrhal trouble, 1; eye trouble, 6; grippe, 5; injury to hand, 1; lung trouble, 1; mumps, 1; neuralgia, 1; nervous trouble, 3; rheumatic fever, 1; severe cold, 1; tonsillitis, 2; eleven cases were not specified.

Second-year Class.

The regular and special students in this class numbered three hundred and sixty-one. Forty-six of these were reported ill during the school year 1904–1905. Classified by diseases, there were the following cases: appendicitis, 2; bronchitis, 1; carbuncle, 1; compound fracture of arm, 1; eye trouble, 1; fever, 3; diphtheria, 1; grippe, 8; indigestion, 3; knee trouble, 1; nerve exhaustion, 1; pharyngitis, 1; pneumonia, 1; rheumatic fever, 1; septic finger, 1; tonsillitis, 2; typhoid fever, 1; whooping-cough, 1; there were four cases of less serious nature, and nine unspecified cases.

First-year Class.

The first-year class numbered four hundred. Of this number thirty-eight were reported ill during the year. Classified by diseases, there were the following cases: abscess, 2; appendicitis, 1; broken leg, 1; chicken pox, 1; carbuncle, 1; fever, 1; grippe, 2; hemorrhage, 1; measles, 1; malaria, 1; mumps, 1; pneumonia, 1; severe cold, 2; sore throat, 1; sprained ankle, 1; tonsillitis, 7; trouble with eyes, 4; ulcerated tooth, 2; operation, 1. Six cases were unspecified. There was one death in this class, that of Mr. J. F. Leonard, on October 31st, due to pneumonia.

SUMMARY.

	No. in Class.	*No. Ill.*	*No. of Deaths.*
Fellows and Graduates	32	—	—
Fourth Year	343	25	—
Third Year	425	39	—
Second Year	361	46	—
First Year	400	38	1
	1,561	148	1

A. L. MERRILL, *Acting Dean.*

REPORT OF THE MEDICAL ADVISER.

There have been no important changes in the work of the Medical Adviser during the past year. Office hours have been held in the Pierce Building twice a week throughout the school year, and the time set apart for medical visits has been fully utilized.

The work of the Medical Adviser, which was begun in 1902, increased rapidly and steadily during the years 1903 and 1904 as the students became accustomed to the new arrangement and took advantage of it. In January, 1904, it was found that more students came for advice at every office hour than could be seen between four and five o'clock, and, in order to provide for this increased number of students, the time of consultation was extended when necessary, so that each student who came for advice should get it. The new plan has been continued throughout the past year.

The following table gives the number of office visits made, and the number of students seen. A few figures for the year 1903 to 1904 are given for comparison.

	1904.	1905.
Total number of office visits made	349	406
Total number of different students seen	185	191
Greatest number of students seen per day		12
Least number of students seen per day		2
Average number of students seen per day	6	7
Number of students making more than one visit		60

The moderate increase in the work in the last year, in comparison with the rapid annual increase in previous years, seems to indicate that the time at present devoted to giving medical advice to the students is practically sufficient, and that the work of the medical office is at or near its maximum.

All the patients were men, and usually most of them found it necessary to come only once, for the treatment of some acute condition. Only seven men made more than five visits apiece. Six of these were surgical cases requiring frequent dressings, and one, a man of poor constitution, who was advised to leave the Institute.

There is no abuse of the medical office by the students. Those who ask for advice have a definite ailment. It seems characteristic of the men that they do not waste time over imaginary ills. The practice of asking the Medical Adviser for excuses from class-work without sufficient reason, which is sometimes met with in our colleges, is practically unheard of at the Institute. Even excuses from drill are very rarely asked for, and almost invariably with good and sufficient reasons.

On the other hand, occasionally a man is found, who, in his enthusiasm for work, does not take very good care of himself, neglects physical exercise, and cuts short his sleep. These mistakes in hygiene are not the necessary consequences of the Institute course, but rather the results of the student's own carelessness or poor judgment as to how to get the most out of himself.

The records of the gymnasium attendance show clearly that many more students living in or near the city proper could use the gymnasium regularly with great benefit to themselves, particularly during the winter months.

The most frequent conditions treated were diseases of the nose and throat, digestive disturbances, and minor surgical diseases. About a dozen men suffered from severe illnesses, such as pneumonia, grippe, pleurisy, appendicitis and Bright's disease. Two men had to leave the Institute on account of

pulmonary tuberculosis. Almost all the illnesses, however, were acute and promptly curable.

A small number of students were referred to specialists for treatment of the eye, ear, and skin. A small number of students were sent to the Massachusetts General Hospital for treatment of such acute diseases as pneumonia, pleurisy, grippe, appendicitis, et cetera, while others were taken care of at small private hospitals.

When we consider the fact that between eight hundred and nine hundred Institute men are living away from home in Boston and its suburbs under conditions which render it almost imperative to go to a hospital in case of illness, and that at least fifty men each year (counting those seen by the Medical Adviser, and those reported by other physicians) suffer from severe illnesses, it may be worth while to consider the possibility of having a small Institute hospital or infirmary to care for our own students.

It would be a great help to the Medical Adviser in keeping informed about the health of the students if each man who is absent from class-work for more than a day on account of illness, should be required to present on his return a card signed by his physician, if he has one, stating what the illness has been. Occasionally the reports sent in by sick students to explain their absence are very informal.

In addition to the work at the Institute office, I have seen about fifty men at my private office, and have been called to attend a smaller number at their houses.

The number of contagious diseases among Institute men is very small. During the last year two cases of mumps, one of measles, one of diphtheria, one of chicken-pox, and one of whooping-cough were reported. This small number of contagious cases is probably the result of the scattered residences of our men and our insistence on the necessary period of isolation after a contagious illness.

In addition to students who were sick, fifteen men were examined for the United States Civil Service or for athletic teams.

Three talks on personal hygiene were given by the Medical Adviser to the whole first-year class, covering the following subjects:—bathing; exercise; care of the eyes; the use of tobacco and alcohol; minor ailments, such as constipation, headaches, colds, etc., and emergencies; also the prevalence and dangers of venereal disease.

FRANKLIN W. WHITE, M.D., *Medical Adviser.*

THE LIBRARIES.

The number of gross accessions to the Libraries of the Institute during the year 1904–05 is 4,915, as follows:—

TABLE OF GROSS ACCESSIONS CLASSIFIED BY SOURCES.

By Purchase	1,161
By Binding	927
By Gift	1,827
Total	4,915

The cost of these accessions and of placing them upon the shelves, exclusive of salaries, etc., as shown by the bills approved in this office, amounts to the following:—

Books and Binding	$4,462.72
Periodicals	1,910.32
Supplies	175.87
Total	$6,548.91

After deducting losses and books counted twice, the net increase in the Libraries of the Institute amounts to 3,943 volumes, 707 pamphlets, and 193 maps; making the total contents of the Libraries 71,304 volumes and 20,458 pamphlets and maps. The particulars of the growth of the several Libraries in volumes, pamphlets, and maps, with the amount expended for each library, and the present total contents are shown in the following table:—

TABLE OF THE NET INCREASE WITH THE COST OF THE SAME DURING THE YEAR 1904–05, AND THE TOTAL CONTENTS OF THE LIBRARIES OF THE INSTITUTE, SEPT. 30, 1905.

LIBRARIES.	Net Increase.				Total Contents.	
	Volumes.	Pamphlets.	Maps.	Cost.	Volumes.	Pamphlets and Maps.
General Library:						
General	262	254	—	$169.42	6,882*	4,981
English	87	—	—	124.91	3,315	44
Military Science	2	2	—	2.00	334	9
Walker Memorial	106	—	—	—	477	—
Drawing	6	1	—	34.86	28	1
Totals General Library	463	257	—	$331.19	11,036	5,035
Architecture	269	5	—	150.87	3,805	241
Biology	100	3	—	179.42	3,126	620
Chemistry	445	53	—	666.65	9,827	1,804
Electrical Engineering	197	9	—	378.87	1,018	42
Engineering	520	143	—	906.38	11,935	4,442
Geology	112	81	193	100.93	2,654	2,678
History and Economics	422	47	—	396.94	11,507*	3,564
Margaret Cheney Room	—	—	—	20.60	670	13
Mathematics	105	6	—	229.16	1,495	214
Mining	243	24	—	373.39	3,907	653
Modern Languages	507	20	—	68.19	1,610	49
Naval Architecture	350	39	—	233.39	1,059	104
Physics	210	20	—	426.74	7,655	999
Totals	3,943	707	193	$4,462.72	71,304	20,458

The list of periodicals and other serial publications taken by the Institute has been increased during the past year by 17, making the total number now currently received 961. The following table shows the number and cost of the serial publications charged to each account and for each Department:—

* 1,025 volumes transferred from History and Economics to General.

TABLE OF PERIODICALS AND OTHER SERIAL PUBLICATIONS RECEIVED DURING THE YEAR 1904–05, CLASSIFIED BY DEPARTMENTS AND METHOD OF PAYMENT.

LIBRARIES.	Number Received.					Estimated Cost.			
	Gifts.	Charged to Department.	Periodical Account.		Totals.	Dept. Account.	Periodical Account.		Totals.
			Exch.	Subs.			Exch.	Subs.	
General	34	14	18	23	89	$43.38	$36.00	$69.39	$148.77
Architecture	8	9	2	32	51	41.69	4.00	150.04	195.73
Biology	7	10	14	33	64	30.66	28.00	233.97	292.63
Geology	12	3	3	7	25	20.64	6.00	38.69	65.33
Chemistry	15*	40	17	30	102*	133.53	34.00	171.63	339.16
Engineering	38	56	63	65	222	165.21	126.00	225.73	516.94
Electrical Engineering	5	12	9	4	30	44.55	18.00	24.10	86.65
History and Economics,	53	42	2	41	138	83.05	4.00	139.69	226.74
Mathematics	—	2	—	17	19	2.05	—	71.68	73.73
Mining	9	9	37	28	83	23.45	74.00	121.50	218.95
Modern Languages	3	2	—	17	22	4.91	—	74.16	79.07
Naval Architecture	4	9	5	6	24	43.83	10.00	19.08	72.91
Physics	16	16	22	21	75	66.67	44.00	74.19	184.86
Walker Memorial	9	—	—	—	9	—	—	—	—
Military Science	1	1	—	1	3	2.00	—	2.65	4.65
Margaret Cheney Room,	4	1	—	—	5	1.50	—	—	1.50
Totals	218	226	192	325	961	$707.12	$384.00	$1,416.50	$2,507.62

During the year 7,625 cards were added to the General Catalogue, and a like number distributed to the Departmental Catalogues. The total number of entries in the General Catalogue now amounts to 73,159. There were issued 2,020 orders for the purchase of new books and periodicals, and 1,303 orders for binding.

In 1899, which was the end of the tenth year after the establishment of the Library as a separate administrative Department of the Institute, a report was made, showing the growth of the Library for the 10 years, and now, in view of the discussion which has been invited in regard to the future needs of the Institute, it seems desirable to continue these statistics to the present time. The following table shows the growth of the Library as a whole for the six years from 1899–1900 to 1904–05. During this time the Library has increased by 21,155 volumes, making a yearly average of 3,526,

* Not including Experiment Station Reports.

or 4.95 per cent. of the present contents, as against an average growth during the previous 10 years of 3,260, or 4.6 per cent. of the total contents in volumes.

GROWTH OF LIBRARIES DURING SIX YEARS ENDING SEPT. 30, 1900–1905.

	1900	1901	1902	1903	1904	1905
Net Accession: Volumes	3,702	3,567	3,309	3,545	3,089	3,943
Total Volumes September 30	53,851	57,418	60,727	64,272	67,361	71,304

Average 1900–05 3,526 = 4.945% of 71,304
Average 1890–99 3,260 = 4.572% of 71,304

For the purpose of determining the needs of the Library in the future, it is more important to know the growth of the separate Departmental Libraries, and this is shown for the last six years in the following table:

DEPARTMENTAL LIBRARIES.
ANNUAL INCREASE IN VOLUMES, 1900–1905.

LIBRARIES.	Average.	Per cent.	Maximum.	Minimum.
General	569.8	5.2	740	431
Architecture	226.5	6.0	323	174
Biology	156.8	5.0	245	100
Chemistry	378.5	3.8	445	323
Electrical Engineering (2 years, 1903–04 and 1904–05)	186.5	18.3	197	176
Engineering	637.0	5.3	779	520
Geology	120.5	4.5	143	96
History and Economics	504.6	4.4	653	412
Mathematics	98.1	6.6	129	75
Mining	263.6	6.7	350	196
Modern Languages	161.3	10.0	507	24
Naval Architecture (1 year, 1904–05)	350.0	33.1	350	350
Physics	268.3	3.5	333	210

It will be noticed that the growth has been on the whole steady, the growth of most of the Departmental Libraries being between 4 per cent. and 6 per cent. of their present con-

tents. Two of the Libraries, Electrical Engineering and Naval Architecture, have been established very recently; the one only three years ago, the other only two years ago, and their growth is naturally at present much more rapid. If they had increased during the six years at the rate that they have increased as shown in the table, the average for the six years for the Library as a whole would have amounted to 3,930 volumes. These tables show that the Libraries may be expected to increase by 50 per cent. of their present contents within the next 10 years, or to double in size in the next 20, and as the Libraries now are all filled practically to the full capacity of their shelves, it will be necessary to add a corresponding proportion of shelf room to that already provided.

In this connection it may be of interest to compare the contents of the Library of the Institute with that of other similar institutions. Data for the current year are unfortunately wanting, but in the following table the position of the Institute at the present time is compared with that of 14 other technical schools in this country, as given in the first volume of the Report of the U.S. Commissioner on Education for 1903, pp. 764 to 1017.

LIBRARIES OF THE AMERICAN SCHOOLS OF TECHNOLOGY EXCEEDING 6,000 VOLUMES.

1.	Massachusetts Institute of Technology (1905)	71,304
2.	U.S. Military Academy	50,000
3.	U S. Naval Academy	44,650
4.	Kansas State Agricultural College	27,210
5.	Mass. Agricultural College	24,258
6.	Michigan Agricultural College	24,003
7.	Colorado State Agricultural College	19,000
8.	Michigan College of Mines	18,060
9.	Armour Institute of Technology	16,279
10.	Virginia Military Institute	12,509
11.	Purdue University	12,206
12	Rose Polytechnic Institute	10,000
13.	Stevens Institute of Technology	9,000
14.	Rensselaer Polytechnic Institute	6,787
15.	Colorado School of Mines	6,437

While the Institute stands at the head of the American technical schools in the size of the Library, it also holds a very

respectable position when compared with the foreign schools, for which we have data taken from *Minerva* for 1905–06. Unfortunately no data are available for Paris, but in the other technical schools listed below it will be found that the Institute occupies at least the sixth place in size of library. The figures for St. Petersburg are, however, somewhat doubtful.

LIBRARIES OF SOME FOREIGN TECHNICAL SCHOOLS COMPARED WITH M. I. T. LIBRARY.

1.	St. Petersburg, Mining Inst. of Katherine II.	250,000
2.	Hanover, Technische Hochschule	163,000
3.	Vienna " "	94,912
4.	Berlin, Technische Hochschule, Charlottenburg	86,000
5.	Budapest, Polytechnikum	76,469
6.	Boston, Massachusetts Institute of Technology	71,304
7.	Aachen, König. tech. Hochschule	60,200
8.	Dresden, König. S¨chs. tech. Hochschule	46,606
9.	St. Petersburg, Highway and Hydraulic Eng'g Inst.	40,000
10.	Stockholm, K. Tekniska Högspolan	24,600
11.	Brünn, Kais. Konig. deut. tech. Hochschule	27,120
12.	St. Petersburg, K. Nikolaus, Inst. für Civilingenieure	12,500
13.	Naples, Reg. Scuola d' Applicazione per gli Ingegneri	7,000

Compared with American Universities and Colleges, other than technical schools, the Institute holds the 18th place, as shown by the list given below.

LIBRARIES OF UNITED STATES UNIVERSITIES AND COLLEGES EXCEEDING 50,000 VOLUMES. (1903).

1.	Harvard University	607,100
2.	University of Chicago	367,000
3.	Columbia University	362,000
4.	Yale University	350,000
5	Cornell University	285,000
6.	Princeton University	268,000
7.	University of Pennsylvania	224,000
8.	Brown University	140,000
9.	University of California	126,000
10.	University of Michigan	123,362
11.	Johns Hopkins University	115,000
12.	University of Minnesota	111,570
13.	Dartmouth College	100,000
14.	Lehigh University	84,657
15.	Georgetown University	83,956
16.	University of Wisconsin	78,600
17.	Bowdoin College	76,240
18.	Massachusetts Institute of Technology (1905)	71,304
19.	University of Notre Dame	70,000
20.	Western Reserve University	68,500

21.	University of Vermont	66,000
22.	Oberlin College	63,715
23.	Wesleyan University	63,000
24.	Syracuse University	62,000
25.	Amherst College	60,000
26.	University of Illinois	57,594
27.	Wellesley College	56,328

It is impracticable to preserve statistics showing completely the use of the Libraries of the Institute, but the following figures will give some information on that point:

CIRCULATION.

General Library	1,343 vols 289 pamphlets and periodicals
Biological	211 vols.
Chemical	1,586 vols.
Engineering	1,381 vols. 237 pamphlets and periodicals
Mining	737 vols. for home use 916 vols. for reference

For the General Library the attendance in the evening has been noted. The total attendance for the 154 days from October 4, 1904, to June 1, 1905, was, during the hours from 5 to 7, 1,389; from 7 to 10, 555, making a daily average of 9 for the first period, and 3.6 for the second.

As already stated, the total number of gifts received by the Library has amounted to 1,827 volumes, pamphlets, and maps. Among these may be noted: 106 volumes received for the Library of the Walker Memorial, from Frank Harvey Cilley, Class of '89, making a total of 477 volumes which he has contributed to this library. By his death the Institute has lost a benefactor who took a very personal interest in her welfare. Mr. Cilley began his contributions to the Library in the fall of 1902, after consulting with the Dean and the Librarian as to the best methods of making his gift. These books were all selected by him personally, and most of them were examined by him carefully before they were sent to the Institute. They include a considerable range of subjects, dealing not only with gymnastics and athletic sports, but also with out-door life in general; with hygiene, physiology and anatomy, an under-

standing of which Mr. Cilley deemed essential for a pure and wholesome life.

Dr. Charles G. Weld, of the Corporation, is credited on our record of accessions with 165 volumes. A portion of these, however, were reported in the previous year as part of the Bryant collection, but had not then been entered in our record of accessions.

We have received from President William R. Harper, of the University of Chicago, 10 volumes of the University of Chicago Decennial Publications.

From Samuel Cabot, Esq., of the Corporation, 31 volumes of books on Chemistry have been received.

From Mrs. Thomas Gaffield we have received a collection of books belonging to the library of her husband, consisting of 19 manuscript books containing copies of letters, correspondence, and notes on the manufacture of glass, and relating to Mr. Gaffield's experiments in photography and the action of sunlight on glass; of 34 volumes of bound pamphlets, containing the published essays of Mr. Gaffield on the action of sunlight on glass, and pamphlets of other authors on related subjects. Among the printed books were 32 volumes on stained glass, ceramics, decorative art, etc.; 48 volumes on glass making, including 141 volumes of considerable historic interest; 7 volumes on other industrial arts; 24 volumes on Chemistry and Physics, including books on light and color; 18 volumes on Mineralogy and precious stones; 6 on Microscopy; and 24 on science and art.

From Mr. John Alden, Class of '77, we have received Ostwald's Allgemeine Chemie, 2 volumes; Moniteur Scientifique, 11 volumes; and the Encyclopédie Chimique, 47 volumes.

ROBERT P. BIGELOW, *Librarian.*

REPORT OF THE REGISTRAR.

The Catalogue, this year, shows the total number of members of the Instructing Staff in all grades to be one hundred twenty-five, inclusive of those concerned with the Mechanic Arts, but exclusive of the Research Associates and Assistants and those who are announced as lecturers for the year only. Counting all, there are two hundred forty-eight this year, a gain of fifteen over those published in last year's Catalogue. Without counting the Research Associates and Assistants or the lecturers, the number of members of the Instructing Staff to that of students bears the proportion of one to eleven and seven tenths.

The number of students registered for the current year has dropped from fifteen hundred and sixty-one of last year to fourteen hundred and sixty-six. In the fourth and second years there is a gain in the number of regular and special students; in the third and first years there is a loss in the number of regular students of both years and of special students of the first year, and a gain in the number of special students in the third year. Though the total number of regular students is less than last year, the total number of specials is greater.

The number of new students this year is four hundred seventy-six, or thirty-two per cent. of the school; last year there were five hundred seventy-five, which was thirty-seven per cent. Of the new students this year more than one third took their places in classes above the first year, while less than one third did so last year; the corresponding per cents of these students for the two years are thirty-nine and thirty-one, respectively.

The greatest change in the distribution of regular students above the first year and among the professional Courses is the decrease of twenty-three in the Course in Mining Engineering and Metallurgy from a total of seventy-seven last year. There is a similar change in the courses in Chemistry (forty-six to thirty-six), Sanitary Engineering (twenty-two to thirteen), and

Naval Architecture (forty-nine to thirty-eight). There are no regular students in the Course in Geology and Geodesy or in the Course in General Science.

Ten more students have registered as regular five-year students this year than last.

The number of graduate students has risen from one hundred eighty-two to two hundred one, and the number of universities and colleges represented by these students is now thirty-three universities and fifty-two colleges as compared with thirty-seven universities and fifty colleges last year.

The registration in the Summer School (two hundred and sixty-six) was greater this year than in any previous year; the number of students (forty) from other colleges or schools was, however, smaller than last year. There was a decrease in the number of those who attended to make up failures or deficiencies, while there was a marked increase in those who were anticipating work. Courses were anticipated principally in Mechanic Arts, Descriptive Geometry, Architectural Design, Languages, Mechanical Drawing and Surveying; chiefly by former students.

While the registration this year is less than that of last year the number of states represented by the student body is two more than last year; one less territory is represented. The number from Massachusetts has fallen off from eight hundred and eighty-nine to eight hundred and seven, which reduces the Massachusetts students from fifty-seven to fifty-five per cent. of the student body. The drop in the number of students from Massachusetts is divided among the following counties: Barnstable (3), Bristol (4), Essex (24), Franklin (2), Hampshire (2), Middlesex (17), Suffolk (28), and Worcester (11). The number of foreign students has increased from sixty to sixty-six.

In the states that are represented there has been an increase of two or more students from California (5), Iowa (4), Kansas (3), Minnesota (4), Missouri (4), Pennsylvania (2), Rhode Island (6), Texas (3), Virginia (3), and Wyoming (2); and a decrease of two or more from the District of Columbia (4),

Georgia (2), Kentucky (3), Louisiana (4), Maine (4), Massachusetts (82), Montana (2), New Hampshire (4), New Jersey (5), New York (23), Oregon (3), Wisconsin (2), and from the Philippine Islands (2). By districts there has been a loss in only the North Atlantic and the South Central States.

The Faculty Committee on Undergraduate Scholarships, at its annual meeting for the awards for the current year, entertained two hundred sixty-six applications for aid. One hundred eighty-seven awards, amounting in all to $23,425, were made. Thirty-four of these awards were replaced wholly or in part by State aid, to total amount of $3,950. The number who made applications for State aid and did not ask for Institute aid was fifty-seven. This makes a total of three hundred twenty-three applications for Scholarship aid. The fifteen State awards to those who received no Institute assistance, added to the one hundred eighty-seven Institute awards, gives a total number of two hundred two students who are receiving scholarship assistance.

Last year at the request of the State Bureau of Statistics of Labor the occupations of the fathers of the students were asked for; this year the students were asked for similar information with the result shown in the following table. The tabulation which is given is based on the second term of last year and the first term of this year.

Occupations.	1904–05 Second Term		1905–06 First Term.	
	Number.	Per Cent.	Number.	Per Cent.
Business	637	44.9	583	39.8
Professional	165	11.6	197	13.4
Government Officials	49	3.5	43	2.9
Farmers	48	3.4	30	2.0
Wage Earners	153	10.8	258	17.6
Retired or Deceased	116	8.2	219	15.0
Not Given	250	17.6	136	9.3
Total	1,418	100.0	1,466	100.0

The usual tables of statistics for the current year are presented below.

WALTER HUMPHREYS, *Registrar.*

THE CORPS OF INSTRUCTORS.

The following table shows the distribution among the several classes of instructors, in comparison with last year:—

	1904-05.			1905-06.		
Professors	28			35		
Associate Professors	18			15		
Assistant Professors	20			24		
		66				74
Instructors	67			72		
Assistants	56			53		
		123				125
Research Associates	5			6		
Research Assistants	6			4		
		11				10
Lecturers	33	33		39	39	
Total	233					248

STUDENTS AND GRADUATES.

The following table shows the registration of successive years from the foundation of the Institute:—

Year.	No. of Students.	Year.	No. of Students.
1865-66	72	1886-87	637
1866-67	137	1887-88	720
1867-68	167	1888-89	827
1868-69	172	1889-90	909
1869-70	206	1890-91	937
1870-71	224	1891-92	1,011
1871-72	261	1892-93	1,060
1872-73	348	1893-94	1,157
1873-74	276	1894-95	1,183
1874-75	248	1895-96	1,187
1875-76	255	1896-97	1,198
1876-77	215	1897-98	1,198
1877-78	194	1898-99	1,171
1878-79	188	1899-1900	1,178
1879-80	203	1900-1901	1,277
1880-81	253	1901-1902	1,415
1881-82	302	1902-1903	1,608
1882-83	368	1903-1904	1,528
1883-84	443	1904-1905	1,561
1884-85	579	1905-1906	1,466
1885-86	609		

STUDENTS BY CLASSES.

The aggregate number of students for 1905–06 is divided among the several classes, as follows:—

Fellows	13
Graduate students, candidates for advanced degrees	13
Regular students, Fourth Year	243
" " Third "	169
" " Second "	199
" " First "	215
Special students	614
Total	1,466

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.
Fellows and Graduates of the M.I.T.	26	—	26
Fourth Year	243	138	381
Third Year	169	189	358
Second Year	199	210	409
First Year	215	77	292
Total	852	614	1,466

THE COURSES OF INSTRUCTION.

The following table presents the number 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 Science.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture	Total.
4th Year Class	44	63	28	21	15	32	1	3	–	9	5	–	22	243
3d " "	44	35	11	13	11	28	–	4	–	8	5	–	10	169
2d " "	46	51	15	10	10	40	–	6	–	12	3	–	6	199
Total	134	149	54	44	36	100	1	13	–	29	13	–	38	611

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

Year.	Civil Engineering.	Mechanical Engineering.	Mining Engineering and Metallurgy.	Architecture.	Chemistry.	Electrical Engineering.	Biology.	Physics.	General Course.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Total.
1894	88	111	19	48	50	137	5	9	19	35	13	1	20	556
1895	88	118	25	67	59	126	7	11	14	25	10	3	22	575*
1896	99	117	24	65	66	106	7	11	11	34	8	–	25	573*
1897	109	119	38	71	60	90	8	9	10	36	7	1	26	578
1898	93	108	52	64	64	94	6	8	12	38	7	1	33	574
1899	99	113	60	53	58	84	8	7	11	30	14	1	38	575*
1900	89	127	69	53	50	87	6	4	8	34	17	1	38	582
1901	102	129	76	40	35	96	6	13	9	30	14	1	39	590
1902	129	133	83	43	58	118	2	20	9	30	12	1	65	703
1903	132	161	91	53	55	126	4	23	6	27	14	1	72	765
1904	140	158	77	41	46	98	4	13	—	32	22	1	49	681
1905	134	149	54	44	36	100	1	13	—	29	13	—	38	611

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

Year.	Total.	Course.												
		I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.
1st . . .	2	–	–	–	–	–	–	–	–	–	–	–	–	–
2d . . .	10	6	1	1	–	–	–	–	–	–	2	–		–
3d . . .	13	3	5	2	1	1	1	–	–	–	–	–	–	–
4th . . .	17	4	6	1	–	–	1	1	–	–	2	–	–	2
5th . . .	2	–	2	–	–	–	–	–	–	–	–	–	–	–
	44	13	14	4	1	1	2	1	–	–	4	–	–	2

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

* Deducting those counted twice.

	First Year.	Second Year.	Third Year.	Fourth Year.	Total.
Mathematics	287	374	152	5	818
Chemistry	293	110	103	103	609
English	265	338	47	–	650
French	224	–	19	–	243
Physics	–	380	340	66	786
German	178	184	53	–	415
Mechanic Arts	–	136	71	94	301

SUMMER SCHOOL.

TABLE SHOWING THE NUMBER OF STUDENTS REGISTERED IN EACH OF THE COURSES OF THE SUMMER SCHOOL FOR THIS YEAR AND THE YEAR BEFORE.

	1904	1905
Air, Water and Food Analysis	5	0
Analytic Geometry	26	30
Applied Mechanics	21	24
Bacteriology	2	2
* Carpentry and Wood Turning	6	8
Chemistry, Inorganic and Analytical	42	42
Chipping and Filing	12	3
Descriptive Geometry	38	36
Design	3	6
Drawing Design	0	1
Forging	16	10
French	13	14
German	10	19
Integral Calculus	11	12
* Joinery and Pattern Work	1	6
Machine Drawing	0	4
Machine Tool Work	32	26
Mechanical Drawing	20	19
Mechanical Engineering Drawing	0	4
Mechanism and Valve Gears	13	6
Organic Analysis	2	0
Organic Preparation and Reactions	5	0
* Pattern Work	6	8
Physical Laboratory	8	15
Physics	44	43
Shades and Shadows	3	5
Surveying	7	27

* Wood work.

RESIDENCE OF STUDENTS.

States.	Candidates for Advanced Degrees.	Fourth Year.	Third Year.	Second Year.	First Year.	All Regular Students.	Special Students.	Total.
Alabama	–	–	–	–	1	1	–	1
Arkansas	–	–	–	–	1	1	–	1
California	–	3	1	1	3	8	15	23
Colorado	–	6	3	1	2	12	5	17
Connecticut	1	4	4	9	6	24	26	50
Delaware	–	–	–	–	1	1	–	1
Dist. of Columbia.	1	3	2	–	1	7	6	13
Florida	1	–	–	1	–	2	1	3
Georgia	–	–	–	–	1	1	7	8
Hawaii	–	–	–	–	–	–	1	1
Illinois	1	6	7	5	2	21	21	42
Indiana	2	1	–	2	2	7	3	10
Iowa	–	–	1	2	2	5	8	13
Kansas	–	1	1	2	–	4	3	7
Kentucky	–	–	1	1	–	2	3	5
Louisiana	–	–	–	–	–	–	1	1
Maine	–	6	3	1	1	11	11	22
Maryland	–	–	3	3	2	8	11	19
Massachusetts	14	143	93	133	146	529	278	807
Michigan	–	–	1	–	1	2	8	10
Minnesota	–	2	2	–	1	5	8	13
Mississippi	–	–	3	–	1	4	–	4
Missouri	–	6	1	2	4	13	16	29
Montana	–	–	–	–	–	–	3	3
Nebraska	1	–	–	1	–	2	2	4
Nevada	–	–	–	–	–	–	1	1
New Hampshire	1	5	3	4	3	16	16	32
New Jersey	–	4	1	4	–	9	2	11
New York	1	13	10	9	8	41	30	71
Ohio	2	6	5	–	2	15	19	34
Oregon	–	3	–	–	–	3	2	5
Pennsylvania	1	8	10	7	3	29	29	58
Philippine Islands,	–	–	–	–	–	–	2	2
Porto Rico	–	1	–	–	1	2	3	5
Rhode Island	–	2	2	3	5	12	12	24
South Carolina	–	–	–	–	–	–	1	1
Tennessee	–	–	–	–	–	–	2	2
Texas	–	4	3	1	2	10	6	16
Utah	–	–	–	–	–	–	–	–
Vermont	–	–	–	–	–	–	2	2
Virginia	–	4	1	1	1	4	1	5
Washington	–	3	1	–	–	4	3	
West Virginia	–	1	–	–	–	1	1	
Wisconsin	–	6	1	1	2	10	2	12
Wyoming	–	–	–	–	–	–	2	2
Foreign Countries.								
Armenia	–	–	–	–	1	1	2	3
Australia	–	–	–	–	1	1	2	3
Bermuda	–	–	–	–	–	–	1	1
Brazil	–	1	–	–	–	1	–	1
Chile	–	–	–	2	–	2	–	2
China	–	–	–	–	–	–	8	8
Cuba	–	–	1	–	1	2	2	4
Denmark	–	–	–	–	–	–	1	1
England	–	1	–	1	1	3	2	5
Egypt	–	–	–	–	1	1	–	1
France	–	–	1	–	–	1	–	1
India	–	–	–	–	–	–	1	1
Ireland	–	1	–	–	–	1	1	2
Italy	–	–	2	–	–	2	–	2
Japan	–	–	–	–	1	1	2	3
Mexico	–	–	–	–	1	1	6	7
New Brunswick	–	–	–	–	–	–	4	4
Nova Scotia	–	–	–	–	1	1	–	1
Ontario	–	–	–	1	–	1	5	6
Peru	–	–	–	–	–	–	1	1
Quebec	–	–	–	–	–	–	1	1
Scotland	–	–	–	1	–	1	–	1
Transvaal	–	–	–	–	–	–	3	3
Turkey	–	1	–	–	–	1	–	1
Uruguay	–	–	–	–	2	2	–	2
Total	26	243	169	199	215	852	614	1,466

Forty-two states of the Union and one territory, besides the District of Columbia, Porto Rico and the Philippine Islands, are represented on our list of students. Of the total number of 1,466, 807 are from Massachusetts, or 55 per cent. of the whole; 133 are from other New England states; 526 are from outside New England. Of these 66 are from foreign countries.

A TABLE TO SHOW THE NUMBER OF STUDENTS IN EACH YEAR, FROM 1899, COMING FROM EACH STATE OR TERRITORY.

STATES AND TERRITORIES.	1899.	1900.	1901.	1902.	1903.	1904.	1905.
North Atlantic.							
Connecticut	29	35	42	43	44	48	50
Maine	25	22	30	35	34	26	22
Massachusetts	731	779	837	935	869	889	807
New Hampshire	29	26	31	34	23	36	32
New Jersey	12	8	6	8	13	16	11
New York	61	68	79	96	104	94	71
Pennsylvania	33	37	36	44	52	56	58
Rhode Island	32	35	38	40	28	19	24
Vermont	12	15	15	12	11	5	5
Total	964	1,025	1,114	1,247	1,178	1,189	1,080
South Atlantic.							
Delaware	4	4	3	4	3	2	1
Dist. of Columbia	7	13	14	17	15	17	13
Florida	1	1	1	2	2	4	3
Georgia	3	3	4	6	4	6	8
Maryland	8	13	16	27	25	18	19
North Carolina	2	2	6	6	7	1	–
South Carolina	1	1	2	4	–	–	1
Virginia	2	3	5	7	7	4	7
West Virginia	1	1	1	–	–	–	1
Total	29	41	52	73	63	52	53
South Central.							
Alabama	–	1	2	1	1	1	1
Arkansas	–	1	1	1	1	–	1
Kentucky	4	5	9	11	9	8	5
Louisiana	1	2	1	2	2	5	1
Mississippi	–	–	–	–	4	4	4
Tennessee	4	6	4	3	5	2	2
Texas	2	4	7	9	11	13	16
Total	11	19	24	27	33	33	30
North Central.							
Illinois	36	39	44	49	44	43	42
Indiana	5	7	11	14	6	10	10
Iowa	6	10	8	8	6	9	13
Kansas	–	–	1	1	1	4	7
Michigan	10	8	12	10	9	9	10
Minnesota	10	7	10	10	9	11	13
Missouri	11	13	19	20	22	25	29
Nebraska	3	4	3	5	4	5	4
North Dakota	–	–	–	1	1	1	–
Ohio	27	27	27	43	37	35	34
South Dakota	1	1	2	1	3	2	–
Wisconsin	7	8	11	11	13	14	12
Total	115	124	148	173	155	168	174
Western.							
California	9	10	9	15	19	18	23
Colorado	7	8	6	10	11	16	17
Idaho	–	–	1	–	–	–	–
Montana	3	5	4	3	2	5	3
Nevada	1	1	–	–	–	–	1
New Mexico	–	–	–	1	1	2	–
Oregon	2	1	2	4	7	8	5
Utah	6	7	7	2	3	3	2
Washington	4	2	4	3	3	2	2
Wyoming	–	–	–	1	–	–	2
Hawaii	–	1	–	–	1	1	1
Philippine Islands	–	–	–	–	–	4	2
Porto Rico	–	–	1	2	2	4	5
Total for the United States	1,152	1,244	1,372	1,561	1,478	1,505	1,400

A TABLE TO SHOW THE NUMBER OF STUDENTS IN EACH YEAR, FROM 1899, COMING FROM EACH FOREIGN COUNTRY.

FOREIGN COUNTRIES.	1899.	1900.	1901.	1902.	1903.	1904.	1905.
Armenia	–	–	–	–	1	1	3
Australia	–	–	–	2	3	1	3
Austria	–	–	1	–	–	–	–
Bermuda	–	1	2	1	1	–	1
Brazil	–	–	4	5	3	3	1
Central America	–	–	–	–	–	1	–
Chili	–	–	1	1	1	1	2
China	–	–	1	1	2	3	8
Cuba	–	–	1	2	3	4	4
Denmark	1	1	1	1	1	1	1
Dutch Guiana	1	–	–	–	–	–	–
Ecuador	–	–	–	–	–	1	–
Egypt	–	–	–	–	–	–	1
England	1	3	3	3	4	4	5
France	2	4	1	–	–	1	1
Germany	1	2	3	1	2	–	–
India	–	–	–	–	1	1	2
Ireland	–	–	–	1	1	–	2
Italy	–	–	–	–	–	–	2
Jamaica	1	1	1	–	–	1	–
Japan	2	2	2	1	2	1	3
Korea	–	–	–	–	–	2	–
Malta, Island of	–	–	–	–	1	1	–
Manitoba	–	–	–	1	1	–	–
Mexico	7	7	7	10	8	4	7
New Brunswick	3	2	2	2	1	2	4
Nova Scotia	–	2	6	8	9	4	1
Ontario	–	–	3	2	2	5	6
Peru	–	–	–	–	–	–	1
Quebec	3	4	2	–	1	2	1
Russia	1	1	1	–	–	–	–
Scotland	–	–	–	1	1	2	1
Sweden	–	–	–	–	–	1	–
Syria	–	–	–	–	1	1	–
Transvaal	–	–	–	–	–	1	3
Turkey	–	3	1	4	–	2	1
Uruguay	–	–	–	–	–	–	2
Total	26	33	43	47	50	56	66
Total in school	1,178	1,277	1,415	1,608	1,528	1,561	1,466

RESIDENCE OF MASSACHUSETTS STUDENTS.

It has been said that 55 per cent. of our students are from Massachusetts. All the counties of the State except Nantucket send students to the Institute. One hundred forty-five cities and towns are on the lists. The first column of the following table shows the number of cities and towns in each county sending pupils: the second column gives the aggregate number from each county. It appears that Middlesex sends two hundred

fifty-seven and Suffolk two hundred twenty-seven pupils; Essex comes third, with one hundred four; Norfolk, fourth, with eighty-five.

County.	No. of Towns.	No. of Students.	County.	No. of Towns.	No. of Students.
Barnstable	3	3	Hampshire	1	3
Berkshire	8	16	Middlesex	33	257
Bristol	12	34	Norfolk	26	85
Dukes	1	2	Plymouth	15	28
Essex	24	104	Suffolk	4	227
Franklin	4	4	Worcester	10	24
Hampden	4	20			
			Total	145	807

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

Boston	210	Framingham	11	Milford	7
Newton	52	Medford	10	Milton	7
Cambridge	29	Salem	10	New Bedford	7
Brookline	22	Wakefield	10	Wellesley	7
Somerville	22	Hyde Park	9	Beverly	6
Waltham	19	Lynn	9	Pittsfield	6
Malden	18	Chelsea	8	Abington	5
Lowell	15	Melrose	8	Arlington	5
Haverhill	13	Quincy	8	Brockton	5
Newburyport	13	Springfield	8	Dedham	5
Lawrence	12	Belmont	7	Revere	5
Taunton	12	Gloucester	7		

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 first 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.
1896–97	1,198	758	440	263	177
1897–98	1,198	757	441	277	164
1898–99	1,171	769	402	278	124
1899–1900	1,178	764	414	275	139
1900–1901	1,277	789	488	312	176
1901–1902	1,415	844	571	396	175
1902–1903	1,608	949	659	432	226
1903–1904	1,528	1,042	486	249	237
1904–1905	1,561	986	575	295	280
1905–1906	1,466	984	482	213	269

AGES OF STUDENTS.

The next table exhibits the ages of our students upon entrance, after taking out two who are repeating the first year, and eleven persons of unusual ages. These deductions leave two hundred two as the number of students whose ages have been made the subject of computation.

Period of Life.	1904–1905.		1905–1906.	
	Half-year Groups.	Yearly Groups.	Half-year Groups.	Yearly Groups.
16 to 16½ years	1	—	1	—
16½ to 17 "	8	9	4	5
17 to 17½ "	22	—	13	—
17½ to 18 "	40	62	28	41
18 to 18½ "	47	—	42	—
18½ to 19 "	51	98	34	76
19 to 19½ "	41	—	30	—
19½ to 20 "	40	81	23	53
20 to 20½ "	15	—	14	—
20½ to 21 "	10	25	6	20
21 to 22 "	9	9	7	7
	284	284	202	202

The results appear in the table above in comparison with the corresponding results of 1904–05.

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

In this connection are presented the ages, at graduation, of the class which left us in June. The two hundred forty-four members of the class were distributed among the different periods of life as follows:—

Under 20½	3
Between 20½ and 21	12
" 21 " 21½	23
" 21½ " 22	30
" 22 " 23	63
" 23 " 24	53
24 and over	60
Total	244

The average age was twenty-three years and three months.

The special students this year constitute forty-two per cent. of the whole body, as against thirty-five per cent. last year and thirty-two per cent. the year before.

GRADUATE STUDENTS.

The number of students who are graduates of this and other institutions is two hundred one. Of these twenty-six are candidates for advanced degrees, sixteen being our own graduates.

One hundred seventy-five are graduates of the following institutions, and are pursuing undergraduate courses of study with us either as regular or as special students.

Universities.

Boston	2	Northwestern	1
Brown	5	Ohio State	2
California	2	Ohio Wesleyan	1
Chicago	1	Pennsylvania	2
Cornell	1	Princeton	12
De Pauw	1	Rochester	1
Ferrara (Italy)	1	Saint Louis	3
Georgia	1	Southwestern	1
Georgetown	2	Spanish	1
Harvard	18	Texas	3
Illinois	1	Tientsin (China)	1
Indiana	1	Vermont	2
Johns Hopkins	5	Washington and Lee	1
Maine	1	Wesleyan	2
Mercer	1	Wisconsin	3
Michigan	1	Yale	10
Montevideo (Uruguay)	2		92

Colleges.

Acadia	1	New Hampshire Agricultural	1
Amherst	1	Oregon Agricultural	1
Anatolian	1	Pennsylvania Military	2
Bates	5	Radcliffe	1
Beloit	5	Randolph-Macon	1
Boston	3	Rock Hill	1
Bowdoin	1	Rose Polytechnic Institute	1
Bradley Polytechnic Institute	1	Royal College of Science for Ireland	1
Case School of Applied Science	2	Saint Mary's Institute	1
Centenary of Louisiana	1	Saint Vincent	1
Central Technical, London	1	Saint Francis Xavier	1
Centre	1	Texas Agricultural and Mechanical	3
Colby	2	Throop Polytechnic Institute	2
Dartmouth	5	U.S. Military Academy	1
Earlham	1	U.S. Naval Academy	17
Fordham	1	Virginia Military Institute	2
Franklin and Marshall	1	Wabash	1
Geneva	1	Washington and Jefferson	2
Hamilton	1	Wellesley	1
Iowa	1	William and Mary	1
Iowa State	1	Williams	5
Kansas	1	Wittenberg	1
Kansas State Agricultural	2		113
Kentucky State	1		
Lafayette	1		
Maryland Agricultural	1		
Massachusetts Institute of Technology	19		
Middlebury	1	Total	205
Milton	3	Deduct names counted twice	4
Missouri School of Mines	1		201

WOMEN STUDENTS.

The number of women pursuing courses with us is twenty-seven. Of these four are graduates of colleges. Of the total number four are regular students of the fourth year, one of the third, and five of the first year. One is working for an advanced degree. Sixteen are special students. Of the five regular students of the upper classes two take Course IV., Architecture; and three, Course V., Chemistry. Of the special students, four devote themselves to Architecture, nine to Biology, one to Geology, and one to Mechanical Engineering, while one is a first-year student.

STATISTICS OF ADMISSION.

Of the 1,466 students of the present year, 476 were not connected with the school in 1904–05. Of these 190 were admitted as regular students of the first year upon the basis of their entrance examinations. The 286 remaining comprise (1) those who had previously been connected with the Institute, and have resumed their places in the school; (2) those

who were admitted provisionally without examinations; (3) those who were admitted by examination as regular second-year or as special students; (4) those who were admitted on the presentation of diplomas or certificates from other institutions of college grade. In addition to the 190 who were thus admitted to the first year on examination, and have taken their place in the school, 57 were admitted on examination, but have not entered the school.

In the case of the 222 persons who were admitted on examination, and have joined the school as regular students or as special students, the results of the examinations, embracing both those of June and those of September, were as follows:—

	Regulars.	*Specials.*
Admitted clear	130	7
" on one condition	47	15
" on two conditions	10	8
" on three conditions	3	2
	190	32

Of the 698 persons who presented themselves in June for examination, 25 Complete, 39 Final, 108 Preliminary, and 28 Partial candidates, a total of 200, were rejected. In September 32 Complete, 19 Final, and 11 Preliminary candidates were rejected. 246 candidates including those for advanced standing attended the September examinations.

GRADUATES BY COURSES.

Year.	Civil Engineering.	Mechanical Engineering.	Mining Engineering.	Architecture.	Chemistry.	Metallurgy.	Electrical Engineering.	Natural History or Biology.	Physics.	General Course.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Total.
1868	6	1	6	–	–	–	–	–	–	1	–	–	–	–	14
1869	2	2	–	–	1	–	–	–	–	–	–	–	–	–	5
1870	4	2	2	–	1	–	–	–	–	1	–	–	–	–	10
1871	8	2	5	–	2	–	–	–	–	–	–	–	–	–	17
1872	3	1	5	–	3	–	–	–	–	–	–	–	–	–	12
1873	12	2	3	1	7	–	–	–	–	1	–	–	–	–	26
1874	10	4	1	1	–	–	–	–	–	2	–	–	–	–	18
1875	10	7	6	1	1	–	–	–	1	2	–	–	–	–	28
1876	12	8	7	–	5	1	–	2	3	4	–	–	–	–	42
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	7	8	2	4	–	2	–	–	1	–	–	–	–	28
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	14	24	5	3	8	–	17	1	1	2	–	–	–	–	75
1890	25	28	3	5	13	–	18	3	2	6	–	–	–	–	103
1891	18	26	4	6	11	–	23	3	3	1	7	–	1	–	103
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	14	11	–	33	1	3	5	12	3	–	–	138
1895	25	30	3	15	14	–	33	–	2	4	11	4	–	5	144*
1896	26	34	10	24	17	–	48	3	3	7	7	4	3	5	190*
1897	25	40	7	16	20	–	33	2	3	7	12	4	1	9	179
1898	32	41	7	29	25	–	33	3	4	6	9	3	–	7	199
1899	30	37	9	22	22	–	32	2	2	1	10	1	–	8	173*
1900	32	34	21	21	19	–	23	3	3	5	11	4	–	9	185
1901	37	39	18	21	17	–	25	1	1	6	14	4	1	16	200
1902	24	46	14	18	14	–	35	5	3	3	9	7	–	14	192
1903	26	37	27	15	13	–	39	1	4	1	10	4	1	12	190
1904	34	45	32	24	15	–	34	3	13	5	7	2	1	17	232
1905	46	54	26	12	23	–	31	3	3	3	13	5	1	24	244
Totals	605	742	306	287	345	1	571	52	59	96*	144	51	12	126	3,392*

Names counted twice, students graduating in two different years . . .	16
Bachelors of Science	3,376*
Masters of Science, not included in the above	14
Total . . .	3,390*

* Deducting names counted twice (students graduating in two courses).

The Society of Arts.

To the President of the Massachusetts Institute of Technology:

Sir,—On behalf of the Executive Committee I have the honor to present the annual report of the Society of Arts for the year ending May 11th, 1905.

During the past year the Society of Arts has held meetings as provided by the by-laws, the first having been on October 13, 1904. These meetings have been well attended, thus providing evidence of the position of the Society as a factor in the dissemination of scientific information to the public. The average attendance was one hundred and twenty-five.

The following papers have been read:—

Geology as an Experimental Science, by Professor Thomas A. Jaggar, Jr.

A Practical Color System Based upon Photometric Measurements, by Mr. Albert H. Munsell.

Sanitary Plumbing and our Plumbing Laws, with Suggestions for their Revision and Simplification, by Mr. J. Pickering Putnam.

On Manila and the Philippines as they are To-day, by Mr. Desmond Fitzgerald, C.E.

Mont Pelée and the Eruptions of 1902; the Growth of the Wonderful Spine, by Mr. Edmund Otis Hovey.

The Evolution and Improvement of Domestic Plants, by Dr. H. J. Webber.

The Orientation of Buildings; or the Planning of Buildings and Streets with Regard to Light, by Mr. William Atkinson.

The Hookworm Disease: a New and Important Parasitic Disease of Man, by Dr. Charles Wardell Stiles.

Purification of Public Water Supplies in the Middle West, by Erastus G. Smith, Ph.D.

Wireless Telegraphy, by Mr. John Stone Stone.

The Abolition of Grade Crossings in Chicago by Track Elevation, by Mr. Charles B. Breed.

The Physiography and Geography of Hawaii, by Professor George H. Barton.

Storage Batteries, by Mr. Philip W. Davis.

The Work of the Massachusetts Railroad Commission, by Mr. James F. Jackson.

Of the foregoing several were of special scientific importance, and awakened much interest, notably those by Messrs. Munsell, Putnam, Webber, Stiles, and Smith; and the papers by the two first-named gentlemen have appeared in an expanded form in the *Technology Quarterly*.

The membership in the Society has remained practically constant, numbering three hundred and sixty-two.

The *Technology Quarterly*, under the editorship of Dr. Bigelow, has appeared at the regular intervals, and has contained the usual abstract of the Proceedings of the Society of Arts, together with such of the papers read before the Society as had been prepared in manuscript.

Various Departments of the Institute have contributed a number of important papers. Professor W. O. Crosby and Mr. G. F. Loughlin have begun a "Descriptive Catalogue of the Building Stones of Boston and Vicinity," considered in their geological and economical relations, with references to buildings in which they have been used. Professor Noyes has contributed a second part to his "System of Qualitative Analysis," and his address read before the International Congress of Arts and Sciences on the "Physical Properties of Aqueous Salt Solutions in Relation to the Ionic Theory." Other contributions from the Chemical Department have been an article by Professor Gill and Mr. Foster on "White Lead and its Protecting Properties," one by Professor W. H. Walker and Mr. Bourne on the "Hydrolytic Enzyme Contained in Castor-oil Seeds," and four contributions from the Laboratory of Sanitary Chemistry. From the Sewage Experiment Station, Mr. Phelps has contributed a paper on the "Interpretation of a Sewage Analysis," and Mr. S. DeM. Gage, of the Experiment Station in Lawrence, has published the results of his studies

on the "Bacteriolysis of Peptones and Nitrates." The activity of the Mining Department is shown by three valuable papers by Professor Hofman and his students.

The book reviews have become a permanent and valuable feature of the *Quarterly*. During the year fifteen books have been reviewed, chiefly by members of the Institute.

At the forty-third annual meeting, held on May 11, 1905, the following-named gentlemen were elected officers of the Society for the year 1905–06:—

Executive Committee.—George W. Blodgett, Edmund H. Hewins, Charles T. Main, James P. Munroe, and A. Lawrence Rotch.

Secretary.—Samuel C. Prescott.

Board of Publication.—W. T. Sedgwick, Dwight Porter, H. E. Clifford, and R. P. Bigelow.

Respectfully submitted,

SAMUEL C. PRESCOTT, *Secretary*.

Publications.

MECHANICAL ENGINEERING.

G. LANZA.—Applied Mechanics. New and revised edition.

G. LANZA.—Memoir of Professor L. Tetmayer. *Proceedings of the American Society for Testing Materials*, 1905.

G. LANZA.—Report of Committee on Standard Methods of Tests. *Proceedings of the American Society for Testing Materials*, 1905.

E. F. MILLER.—Practical Instructions on the Use and Care of the Crosby Steam Engine Indicator. E. F. Miller, editor.

S. H. WOODBRIDGE.—Report to Congress on Central Plant for Executive Building.

MINING ENGINEERING AND METALLURGY.

R. H. RICHARDS.—Progress in Gold Milling during 1904. *The Mineral Industry*, Vol. XIII.

R. H. RICHARDS.—Review of the Literature on Ore-dressing in 1904. *The Mineral Industry*, Vol. XIII.

R. H. RICHARDS.—Notes on Mining, third-year, second Term. Published by the Institute.

H. O. HOFMAN.—Recent Improvements in Lead Smelting during 1904. *The Mineral Industry*, Vol. XIII.

H. O. HOFMAN.—Die Darstellung des Zinks auf Electrolytischen Wege. Review. *American Chemical Journal*, Vol. XXXIII., p. 608, 1905.

C. E. LOCKE.—The Copper Mines of Lake Superior (Rickard). Review. *Technology Quarterly*, Vol. XVII., p. 313, 1905.

CHEMISTRY AND CHEMICAL ENGINEERING.

H. P. TALBOT.—Thomas Messinger Drown, LL.D. *Technology Review*, 1905.

H. P. TALBOT (with A. A. BLANCHARD).—The Electrolytic Dissociation Theory and Some of its Applications. New York, Macmillan Co., 1905.

A. A. NOYES.—The Ideals of the Institute. *The Technology Review*, Vol. VII., pp. 150–9.

W. H. WALKER.—Some Present Problems in Technical Chemistry. *Popular Science Monthly*, March, 1905; *Electrochemical Industry*, Vol. III., p. 27.

W. H. WALKER.—What Constitutes a Chemical Engineer. *The Chemical Engineer*, Vol. II., p. 10.

W. H. WALKER.—The Fixation of Atmospheric Nitrogen. *Report of the New England Association of Chemistry Teachers*, 1905.

W. H. WALKER.—The Influence of Phenols and Equivalent Bodies upon the Properties of Cellulose Acetate. United States Patent, No. 774,713–4. *Official Gazette*, Vol. CXIII., pp. 515–6.

W. H. WALKER (with E. C. SMITH and E. W. WIGGINS).—The Products of the Distillation of Pine Wood. *Technology Quarterly*, Vol. XVIII., p. 301.

W. H. WALKER (with H. S. MORK and A. D. LITTLE).—Process for the Manufacture of Artificial Silk. United States Patent, No. 792,149. *Official Gazette*, Vol. CXVI., p. 1805.

HENRY FAY (with F. W. SNOW)—Some Experiments on the Fuel Value of Bituminous Coal Ashes. *Journal of the American Chemical Society*, Vol. XXVII., p. 609.

A. H. GILL.—Engine Room Chemistry. *Power*, New York, May–November, 1905.

A. H. GILL.—A Short Handbook of Oil Analysis. Fourth edition. Philadelphia and London, J. B. Lippincott Co., 1905.

F. H. THORP.—Outlines of Industrial Chemistry. Second

edition, revised and enlarged. New York, Macmillan Co., 1905.

ELLEN H. RICHARDS.—First Lessons in Food and Diet. Boston, Whitcomb & Barrows, 1905.

ELLEN H. RICHARDS.—The Art of Right Living. Boston, Whitcomb & Barrows.

ELLEN H. RICHARDS.—The Cost of Shelter. New York, Wiley & Sons.

ELLEN H. RICHARDS.—Meat and Drink. Health Education League Booklet.

ELLEN H. RICHARDS.—Healthful Homes. Health Education League Booklet.

ELLEN H. RICHARDS.—An Often Neglected Factor in Sewage Analysis. *Technology Quarterly*, Vol. XVIII., No. 2, 1905.

ELLEN H. RICHARDS.—The Source and Significance of Nitrites in Streams. *Transactions of the American Public Health Association*, 1905.

G. W. ROLFE.—The Polariscope in the Chemical Laboratory. New York, Macmillan Co., 1905.

G. W. ROLFE.—Quartz-plate Readings in Saccharimetry. *Technology Quarterly*, p. 294, 1905.

W. T. HALL (with J. W. PHELAN).—Translation of Josef Yettmar's "Theory and Practice of Leather Manufacture." *Hide and Leather Journal.* Continued through 1905.

J. W. PHELAN.—See W. T. Hall.

A. G. WOODMAN.—The Detection of Cane Sugar in Maple Products. *Technology Quarterly*, p. 146, 1905.

A. A. BLANCHARD.—See H. P. Talbot.

M. S. SHERRILL.—Translation of E. Heyn's "The Constitution of Iron-Carbon Alloys." *The Iron and Steel Magazine*, Vol. IX., p. 407 and p. 510; Vol. X., p. 42.

R. C. TOLMAN and A. P. HALL.—The Peat Industry. *Engineering and Mining Journal*, Vol. LIX., 1905.

RESEARCH LABORATORY OF PHYSICAL CHEMISTRY.

Serial Publications of the Research Laboratory.

No. 7.—A. A. NOYES and W. H. WHITCOMB.—The Solubility of Lead Sulphate in Ammonium Acetate Solutions. *Journal of the American Chemical Society*, Vol. XXVII., pp. 747–759, 1905.

Other Publications by Members of the Research Staff.

A. A. NOYES.—The Preparation and Properties of Collodial Mixtures. *Journal of the American Chemical Society*, Vol. XXVII., pp. 85–104, 1905; *The Popular Science Monthly*, July, 1905.

W. C. BRAY.—On the Use of the Differential Equation in Calculating the Results of Kinetic Measurements; the Reaction between Arsenic Acid and Potassium Iodide near the Equilibrium. *Journal of Physical Chemistry*, Vol. IX., pp. 573–587, 1905.

E. C. FRANKLIN and C. A. KRAUS. The Electrical Conductivity of Liquid Ammonia II. *Journal of the American Chemical Society*, Vol. XXVII., pp. 191–222, 1905.

G. N. LEWIS.—Hydration in Solution. *Zeitschrift für physikalische Chemie*, Vol. LII., p. 224, 1905; *Bulletin of the Philippine Government Laboratory*, No. 30.

G. N. LEWIS.—Autocatalytic Decomposition of Silver Oxide. *Zeitschrift für physikalische Chemie*, Vol. LII., p. 310, 1905; *Bulletin of the Philippine Government Laboratory*, No. 30.

G. N. LEWIS and R. F. JACKSON.—Galvanic Polarization on a Mercury Cathode. *Proceedings of the American Academy of Arts and Sciences*, December, 1905.

G. N. LEWIS and P. WHEELER. The Electrical Conductivity of Solutions in Liquid Iodine. *Proceedings of the American Academy of Arts and Sciences*, December, 1905.

ELECTRICAL ENGINEERING.

H. E. CLIFFORD.—Alternating Current Machinery. Notes prepared for students of the Fourth Year in Electrical Engineering.

H. E. CLIFFORD.—Theoretical Electricity. Notes prepared for students in the Third Year in Electrical Engineering.

H. E. CLIFFORD.—High Tension Power Transmission. Review. *Technology Quarterly*, 1905.

W. L. PUFFER (with LOUIS BELL).—The Tantalum Incandescent Lamp. *Proceedings of the National Electric Light Association*, 1905; *Electrical World and Engineer*, June, 1905.

F. A. LAWS.—A Convenient Form of Oscillograph. *Electrical World and Engineer*, May 6, 1905.

F. A. LAWS.—American Meter Practice. Review. *Technology Quarterly*, 1905.

R. R. LAWRENCE.—Notes on the Testing of Dynamo Electric Machinery.

W. V. LYON.—Armature Reaction in Alternators. *Technology Quarterly*, 1905.

G. I. RHODES.—A Study of a Single Phase Series Motor. *Technology Quarterly*, 1905.

BIOLOGY, AND SANITARY RESEARCH LABORATORY AND SEWAGE EXPERIMENT STATION.

Contributions from the Sanitary Research Laboratory and Sewage Experiment Station, Vol. I., pp. 1–129, containing six of the following papers. Boston, June, 1905. (Out of print.)

W. T. SEDGWICK.—The Relations of Public Health Science to Other Sciences. Address before the Public Health Section, International Congress of Arts and Science, St. Louis, September, 1904. *Science*, N.S., Vol. XXI., No. 546, pp. 906–914, June 16, 1905; *American Medicine*, Vol. IX., No. 24, pp. 975–979, June 17, 1905.

W. T. SEDGWICK.—Why Dirty Water is Dangerous. *Journal of the Massachusetts Association of Boards of Health*, Boston, December, 1904. (Also separately as a Leaflet.)

S. C. PRESCOTT.—The Efficiency of Commercial Pasteurization and its Relation to the Milk Problem. *Technology Quarterly*, Vol. XVIII., No. 3, p. 247.

C.-E. A. WINSLOW.—Elements of Applied Microscopy. A Text-book for Beginners. New York, John Wiley and Sons, 1905.

C.-E. A. WINSLOW (with W. L. UNDERWOOD).—Report on the Sanitary Problems Relating to the Fresh Pond Marshes and Alewife Brook. Appendix No. 2 to Report on Improvement of the Upper Mystic River and Alewife Brook by John R. Freeman, C.E. Metropolitan Park Commission, Sept. 21, 1904.

C.-E. A. WINSLOW (with ANNE F. ROGERS).—A Revision of the Coccaceae. Preliminary Communication. *Science*, N.S., Vol. XXI., p. 669, April 28, 1905; *Technology Quarterly*, Vol. XVIII., p. 240, September, 1905.

C.-E. A. WINSLOW (with EARLE B. PHELPS).—The Chemical and Bacterial Composition of the Sewage Discharged into Boston Harbor from the South Metropolitan District: with Special Reference to Diurnal and Seasonal Variations. *Contributions from the Sanitary Research Laboratory and Sewage Experiment Station*, Vol. I., p. 7; *Journal of Infectious Diseases*, Supplement No. 1, May, 1905, p. 175.

C.-E. A. WINSLOW.—The Number of Bacteria in Sewage and Sewage Effluents Determined by Plating upon Different Media and by a New Method of Direct Microscopic Enumeration. *Contributions from the Sanitary Research Laboratory and Sewage Experiment Station*, Vol. I., p. 41; *Journal of Infectious Diseases*, Supplement No. 1, May, 1905, p. 209.

C.-E. A. WINSLOW (with G. E. WILLCOMB).—Tests of a Method for the Direct Microscopic Enumeration of Bacteria. *Contributions from the Sanitary Research Laboratory and Sewage Experiment Station*, Vol. I., p. 119; *Journal of Infectious Diseases*, Supplement No. 1, May, 1905, 273.

C.-E. A. WINSLOW.—A Winter Visit to Some Sewage Disposal Plants in Ohio, Wisconsin, and Illinois. *Journal of the Association of Engineering Societies*, Vol. XXXIV., p. 335, June, 1905.

C.-E. A. WINSLOW.—The Deeper Significance of Scientific Education. *Technology Review*, Vol. VII., p. 410, October, 1905.

P. G. STILES (with C. S. MILLIKEN).—On the Supposed Equivalence of Sodium and Lithium Ions in Skeletal Muscle. *American Journal of Physiology*, Vol. XIV., No. IV., Oct. 2, 1905.

P. G. STILES (with W. H. BEERS).—On the Masking of Familiar Ionic Effects by Organic Substances in Solutions. *American Journal of Physiology*, Vol. XIV., No. II., Aug. 1, 1905.

A. W. WEYSSE.—Biology in a Liberal Education. *Bostonia*, Vol. V., No. 2, July, 1905.

E. B. PHELPS.—The Interpretation of a Sewage Analysis. *Technology Quarterly*, Vol. XXVIII., No. 1, pp. 40–59.

E. B. PHELPS.—The Interpretation of an Analysis of the Effluent from a Sewage Filter. *Technology Quarterly*, Vol. XXVIII., No. 2, pp. 123–141.

E. B. PHELPS.—Experiments on the Storage of Typhoid Infected Water in Copper Canteens. Read before American Public Health Association, Boston meeting. To be published in January in *Journal of Infectious Diseases*.

E. B. PHELPS.—See C.-E. A. WINSLOW.

E. B. PHELPS (with F. W. FARRELL).—The Mode of Action of the Contact Filter in Sewage Purification. *Contributions from the Sanitary Research Laboratory and Sewage Experiment Station*, Vol. I., p. 61, 1905.

E. B. PHELPS.—A Critical Study of the Methods in Current Use for the Determination of Free and Albuminoid Ammonia in Sewage. *Contributions from the Sanitary Research Laboratory and Sewage Experiment Station*, Vol. I., p. 87, 1905.

E. B. PHELPS. The Determination of the Organic Nitrogen in Sewage by the Kjeldahl Process. *Contributions from the Sanitary Research Laboratory and Sewage Experiment Station*, Vol. I., p. 101, 1905.

E. G. SMITH.—Grain and Organisms Resembling Bacillus Coli Communis. *Science*, N.S., Vol. XXI., p. 710.

ANNE F. ROGERS.—See C.-E. A. Winslow.

W. L. UNDERWOOD.—See C.-E. A. Winslow.

PHYSICS.

C. R. CROSS.—The Rumford Fund of the American Academy of Arts and Sciences. Published by the Academy, 1905.

H. M. GOODWIN. Elements of the Precision of Measurements. Printed by the Institute, 1905.

H. M. GOODWIN (with R. B. SOSMAN).—On Billitzer's Method for Determining Absolute Potential Difference. *Transactions of the American Electrochemical Society*, Vol. VII., p. 83, 1905; *Physical Review*, Vol. XXI., p. 129, 1905.

H. M. GOODWIN (with R. D. MAILEY).—The Physical Properties of Fused Magnesium Oxide. *Electrochemical and Metallurgical Industry*, 1905.

L. DERR.—Notes on the Principles of Dynamo and Transformer Design. Third edition, rewritten and enlarged. Printed by the Institute, 1905.

G. V. WENDELL.—Problems in Physics. For the Use of Students in Second-year Physics. Second edition, rewritten and enlarged. Printed by the Institute, 1905.

C. L. NORTON.—Composition Roofing. *Report No. XVI.*, *Insurance Engineering Experiment Station*, January, 1905.

C. L. NORTON.—Fireproof Wood. *Report No. XVIII.*, *Insurance Experiment Station*, August, 1905.

M. DEK. THOMPSON, Jr. (with H. K. RICHARDSON).—On the Edison Storage Battery. *Transactions of the American Electro-Chemical Society*, Vol. VII., p. 95, 1905.

GEOLOGY.

T. A. JAGGAR, Jr. (with CHARLES PALACHE).—The Bradshaw Mountains Folio. *Geologic Atlas of the United States, No.* 126, *United States Geological Survey*, 1905.

W. O. CROSBY.—Rhode Island. *Contributions to the Hydrology of Eastern United States*, pp. 119–125; *United States Geological Survey, Water Supply and Irrigation Papers*, p. 102.

W. O. CROSBY (with L. LA FORGE).—Massachusetts. *Contributions to the Hydrology of Eastern United States*, pp. 94–117; *United States Geological Survey, Water Supply and Irrigation Papers*, p. 102.

W. O. CROSBY.—The Limestone-Granite Contact Deposita of Washington Camp, Arizona. *Transactions of the American Institute of Mining Engineers*, Vol. XXXVI. (Victoria meeting, July, 1905); *Technology Quarterly*, Vol. XVIII., No. 2, pp. 171–190, June, 1905.

W. O. CROSBY.—Genetic and Structural Relations of the Igneous Rocks of the Lower Neponset Valley, Massachusetts. *American Geologist*, Vol. XXXVI., pp. 34–47, 69–83; *Technology Quarterly*, December, 1905.

D. W. JOHNSON.—The Tertiary History of the Tennessee River. *Journal of Geology*, Vol. XIII., pp. 194–231, figs. 1–9, 1905.

D. W. JOHNSON.—The Biological Evidence of River Capture. *Bulletin of the American Geographical Society*, Vol. XXXVII., pp. 154–156, 1905.

D. W. JOHNSON.—The Distribution of Fresh-water Faunas as an Evidence of Drainage Modifications. *Science*, N.S., Vol. XXI., pp. 588–592, 1905.

D. W. JOHNSON.—The Relation of the Law to Underground Waters. *United States Geological Survey, Water Supply and Irrigation Paper*, No. 122, pp. 1–57, 1905.

D. W. JOHNSON.—Youth, Maturity, and Old Age of Topo-

graphic Forms. *Bulletin of the American Geographical Society*, Vol. XXXVII., pp. 648–653, figs. 1–3, 1905.

H. W. SHIMER.—Upper Siluric and Lower Devonic Faunas of Trilobite Mountain, Orange County, New York. *Report of New York State Paleontologist*, pp. 175–269, figs. 1–11, 1904.

H. W. SHIMER.—A Peculiar Variation of Terebratalia Transversa Sowerby. *American Naturalist*, Vol. XXXIX., pp. 691–694, figs. 1–5, 1905.

NAVAL ARCHITECTURE.

W. HOVGAARD.—The Cruiser. An article presented to the Society of Naval Architects and Marine Engineers.

MATHEMATICS.

H. W. TYLER (with E. B. WILSON).—Report of the Third International Congress of Mathematicians at Heidelberg, August, 1904. *Bulletin of the American Mathematical Society*, December, 1904.

ENGLISH.

A. T. ROBINSON.—Technical Education at the Massachusetts Institute of Technology. *Open Shop*, March, 1905.

A. T. ROBINSON.—Instruction in Dictation for Fourth-year Students. *Technology Review*, April, 1905.

A. T. ROBINSON. Note Taking. Boston, D. C. Heath & Co., 1905.

C. H. COLLESTOR.—Narcissus Plays Distinguished. *Modern Language Notes*, May, 1905.

ECONOMICS.

C. W. DOTEN.—Recent Railway Accidents in the United States. *Publications of the American Statistical Association*, Vol. IX., pp. 155–173, March, 1905.

MODERN LANGUAGES.

FRANK VOGEL.—Storm's Geschichten aus der Tonne. Boston, D. C. Heath & Co., 1905.

GENERAL STATEMENT

OF THE

RECEIPTS AND DISBURSEMENTS BY THE TREASURER

FOR THE YEAR ENDING SEPT. 30, 1905

STATEMENT OF THE TREASURER.

The Treasurer submits the annual statement of the financial affairs of the Institute for the year ending September 30, 1905.

The most striking feature in this year's report is the large reduction in the deficit. This has been brought about mainly by the following changes:—

There has been an increase in students' fees of about $23,000, and at the same time a reduction in other items, in round numbers, as follows: in repairs, $2,000; insurance, $2,400; fuel, $2,500; electricity, $600; department supplies, $21,000; and in the St. Louis Exposition account, about $3,000.

To offset this, the salary account increased over $6,000, and there were additions to some other items making the net result a deficit, in the current expense account for the year, of $10,582.32, instead of $55,405.66 for last year; a decrease of $44,823.34.

The increase in students' fees was due mainly to the fact that the increased rate of tuition applied to one more class than the year before.

There have been certain losses and expenditures which do not enter into the current expense account. The Gymnasium has long stood on land which belonged to the Boston & Albany Railroad corporation. The terms granted to the Institute in this matter were generous, and have been allowed to continue for a long period, but the railroad corporation has now found it necessary to use this land, and as a result it was found best to sell the old gymnasium, although this involved a loss of nearly $7,000, and to erect on our Garrison Street land a new gymnasium for which thus far there have been payments amounting to about $4,000.

The following legacies and gifts have been received:—

From the estate of Mrs. Edna Dow Cheney, $13,741.66 as a fund for the benefit of the Margaret Cheney Reading Room. With this legacy came a portrait of Miss Margaret S. Cheney. Those who knew Miss Cheney testify to the excellence of the likeness, and it is most appropriate that this work of art should adorn the room which is itself a memorial to her. For the Sanitary Research Laboratory Fund, $5,000 from the same anonymous friend who has made the previous payments for this purpose. From the estate of the late George B. Upton, $5,000. From Lucius Clapp, Esq., for scholarship purposes, stock valued at $4,900. From the estate of Susan E. Dorr, in addition to previous amounts, $1,790.07. From Charles G. Weld, M.D., for

the Department of Naval Architecture, $1,543.31. For the Physico-Chemical Research Fund, the trustees of the Hale Fund gave $1,000, and Samuel Cabot, Esq., $200. Mr. Cabot also gave $1,000 to constitute the Cabot Medal Fund. $1,000 were given by William W. Jacques, Ph.D., for the Physical Department, and $500 by an anonymous friend for salaries. From Mrs. Henry Pickering $350 were received for the Department of Topographical Geology, and Mrs. William B. Rogers contributed $208.50 for the purchase of periodicals, the branch of the library for which she has done so much in the past.

Additional subscriptions to the Walker Memorial Fund have been paid, amounting to $5,000, and the whole fund, including accumulated income, is now $103,545.06.

Securities Sold or Paid, General Fund.

$50,000 Ch. Terminal & Transfer Co. 4s	1947	$48,500.00
5,000 American Tel. & Tel. Co. 5s	1907	5,106.25
3,000 Ozark Equipment Co. 5s	1910	3,000.00
5,000 Dominion Coal Co. 1st 6s	1913	5,500.00
64 Rights Boston Real Estate Trust		304.00
		$62,410.25

Securities Bought or Received as Legacies, General Fund.

50,000 Oregon Short Line R.R. 4s.	1929	48,500.00
5,000 Terminal Asso. St. Louis 4s	1953	5,012.50
3,000 Lake Shore & Mich. Southern 4s	1928	3,000.00
5,000 American Tel. & Tel. Co. 4s	1929	4,825.00
50 Shares Union Pacific R.R. Pref.		4,900.00
		$66,237.50

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

Dr.

Cash balance, Sept. 30, 1904		16,353.09
RECEIPTS FOR CURRENT EXPENSES.		
Income of funds for salaries	4,324.00	
" " " " Fellowships	2,100.00	
" " " " scholarships (students' fees)	9,950.00	
" " " " Joy "	162.50	
" " " " W. B. Rogers Scholarships	425.00	
" " " " Library	480.00	
" " " " general purposes	25,975.19	
" " Rogers Memorial Fund	10,815.00	
" " Charlotte B. Richardson Fund	1,495.15	
" " Rotch Prize Funds	400.00	
" " Rotch Architectural Fund	1,000.00	
" " Edward Austin Fund, Scholarships	7,412.50	
" " " " " Awards	5,910.15	
" " Teachers' Fund	5,700.00	
" " Ednah Dow Cheney Fund	49.97	
Letter Box Fund	75.00	
Students' fees	320,585.55	
State Scholarships	4,000.00	
United States Act of 1862	4,191.96	
United States Act of 1890	8,333.34	
Gift of State of Massachusetts	25,000.00	
Laboratory supplies and breakages	12,877.43	
Rents, per Table (page 12)	10,606.50	
Gifts	3,251.81	
Interest	2,599.59	
Boston University	94.50	
Sale Printed Lecture Notes	4,032.15	471,847.29
GIFTS AND BEQUESTS FOR SPECIAL PURPOSES.		
Increase Scholarship Funds	824.14	
" Edward Austin Fund	1,077.35	
" Susan E. Dorr Fund, additional	1,790.07	
" Lucius Clapp Fund	4,900.00	
" Ednah Dow Cheney Fund	13,741.66	22,333.22
GIFTS AND BEQUESTS FOR GENERAL PURPOSES.		
George B. Upton Legacy		5,000.00
SECURITIES SOLD OR PAID.		
General Fund, page 3		62,410.25
SUNDRIES.		
Income credited to Bond Premium Acc't	4,190.50	
" " " Rogers Bond Premium Acc't	668.00	
Copley Society of Boston, on acc't	666.66	
Walker Memorial Fund	9,385.24	
Cabot Medal Fund	1,000.00	
Sale of Old Gymnasium	1,000.00	
Sanitary Research Laboratory Fund, additional	5,000.00	
Physico-Chem. Research Fund	1,200.00	
Students' Notes	67.75	
Acc'ts Payable and Fees paid in advance	6,029.50	29,207.65
		$607,151.50

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

FOR THE YEAR ENDING SEPT. 30, 1905.

Cr.

EXPENSES.

Salaries, per Table (page 12)	346,689.88	
Fellowship paid from Savage Fund	750.00	
" " " Dalton Grad. Chem. Fund,	750.00	
" " " Swett Fund	400.00	
" " " H. Saltonstall Fund	200.00	
Edward Austin Fund, Awards	5,910.15	
Teachers' Fund "	5,700.00	
Prizes, Rotch Funds	400.00	
Repairs, per Table (page 13)	9,973.39	
General Expenses, per Table (page 13)	17,439.36	
Fire Insurance	2,413.65	
Fuel	16,451.69	
Water	3,279.83	
Gas	2,637.23	
Electricity	1,383.84	
Printing and Advertising	7,826.56	
" Lecture Notes	6,416.61	
" Annual Catalogues and Reports	4,169.49	
Physico-Chemical Research Fund	3,000.00	
Department Supplies, per Table (p. 12)	45,039.59	
Society of Arts	1,235.20	
St. Louis Exposition	313.17	
Margaret Cheney Reading Room	49.97	482,429.61

(Expenses more than Income, $10,582.32)

SECURITIES BOUGHT OR RECEIVED AS LEGACIES.

General Fund, page 3		66,237.50

SUNDRIES.

Cabot Medal Fund	793.75	
Equipment Electrical Engineering Building	732.09	
Sanitary Research Laboratory Fund	6,126.86	
Physico-Chem. Research Fund	4,720.53	
Dormitory Fund	875.00	
Walker Memorial Fund	16,367.50	
New Gymnasium	3,953.26	
Teachers' Fund used	1,700.00	35,268.99
Cash balance Sept. 30, 1905, less October coupons,		23,215.40
		$607,151.50

E. and O. E.

GEORGE WIGGLESWORTH,
Treasurer.

The following account exhibits the property held by the Institute, as per Treasurer's books, Sept. 30, 1905:—

INVESTMENT OF THE W. B. ROGERS MEMORIAL FUND.

31,000.00	N.Y. Central & H. R. R.R. Deb. 4s,	1934	30,225.00
6,000.00	Baltimore & Ohio R.R. 3½s . . .	1925	5,310.00
27,000.00	Kansas City Belt R.R. 6s	1916	27,000.00
3,800.00	Republican Valley R.R. 6s	1919	3,800.00
4,000.00	Cin., Ind., St. Louis & Chicago R.R. 6s	1920	4,000.00
4,000.00	Kansas City, Fort Scott & Gulf R.R. 7s	1908	4,000.00
1,000.00	Lincoln & Northwestern R.R. 7s . .	1910	1,000.00
1,000.00	Atchison & Nebraska R.R. 7s . .	1908	1,000.00
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
37,500.00	Detroit, G. Rapids & Western R.R. 4s,	1946	37,500.00
25,000.00	Atchison, Top. & St. Fé R.R. 4s . .	1995	24,470.00
7,000.00	Chesapeake & Ohio R.R. 5s . . .	1939	7,000.00
38,000.00	Chi. Junc. & Union Stock Yards 5s	1915	38,000.00
	Advances to Bond Premium acc't .		6,743.00
			248,873.00

INVESTMENTS, GENERAL ACCOUNT.

6,000.00	Bur. & Mo. River (Neb.) R.R. 6s, non-exempt	1918	6,000.00
2,000.00	Bur. & Mo. River (Neb.) R.R. 6s, exempt	1918	2,000.00
5,000.00	Chicago, Burlington & Quincy R.R. 4s	1922	4,100.00
3,000.00	Hannibal & St. Joseph R.R. 6s . .	1911	3,000.00
65,000.00	Boston & Maine R.R. 4½s	1944	65,000.00
26,000.00	Am. Dock & Improvement Co. 5s .	1921	26,000.00
3,000.00	Illinois Central R.R. 4s	1951	3,000.00
8,000.00	Chi. Junc. & Union S. Yards 5s . .	1915	8,000.00
2,000.00	New England Tel. & Tel. Co. 6s . .	1907	2,000.00
100,000.00	West End Street Ry. 4s	1917	100,000.00
50,000.00	Utah & Northern R.R. 1st 7s . . .	1908	50,000.00
120,000.00	Illinois Steel Co., non-conv. 5s . .	1913	119,586.25
43,000.00	Chesapeake & Ohio R.R. 5s . . .	1939	43,000.00
100,000.00	Long Island R.R. 4s	1949	96,137.50
7,000.00	K. C., Clinton & Springfield R.R. 5s,	1925	6,289.21
8,500.00	K. C., Mem. & Birmingham R.R. 4s,	1934	8,287.50
13,000.00	K. C., St. Jo. & Council Bluffs R.R. 7s	1907	13,000.00
50,000.00	Kansas City Stock Yards 5s . . .	1910	50,000.00
25,000.00	Atchison, Top. & St. Fé R.R. 4s. .	1995	25,000.00
50,000.00	Rio Grande & Western R.R. 4s . .	1939	49,180.06
50,000.00	Oregon R.R. & Navigation Co. 4s,	1946	50,000.00
50,000.00	Union Pacific R.R. 4s	1947	50,000.00
100,000.00	Chic. & W. Michigan R.R. 5s . .	1921	100,000.00
105,000.00	American Tel. & Tel. Co. 4s . . .	1929	104,700.00
50,000.00	New England Tel. & Tel. Co. 4s .	1930	50,000.00
50,000.00	Chi. Junc. & Union S. Yards 4s . .	1940	49,250.00
50,000.00	K. C., Fort Scott & Memphis R.R. 6s	1928	50,000.00
25,000.00	Southern Ry., St. Louis Div. 4s . .	1951	24,875.00
14,000.00	Ozark Equipment Co. 5s	1910	14,000.00
50,000.00	Northern Pac. Gt. Northern Joint 4s,	1921	48,500.00
34,000.00	Baltimore & Ohio R.R. 3½s . . .	1925	30,090.00
30,000.00	Chi., Mil. & St. Paul R.R. 7s . . .	1910	30,000.00
52,000.00	N.Y. Cent. & H. R. R.R. (L. S.) 3½s,	1998	46,046.65
50,000.00	Oregon Short Line 4s	1929	48,500.00
5,000.00	Terminal Asso. St. Louis 4s	1953	5,000.00
3,000.00	Lake Shore & Mich. Southern 4s .	1928	3,000.00
	Advances to Bond Premium acc't .		33,597.00
			1,417,139.11
	Amount carried up		$1,666,012.11

	Amount brought up				$1,666,012.11

STOCKS.

Shares.					
172	Boston & Albany R.R.	par	100	34,456.50	
80	Chi., Milwaukee & St. Paul R.R. Pf.	"	100	9,908.00	
50	Union Pacific R.R. Pref.			4,900.00	
12	Cocheco Manufacturing Co.	"	500	6,000.00	
56	Hamilton Woolen Co.	"	100	5,390.00	
31	Great Falls Manufacturing Co.	"	100	3,472.00	
2	Dwight Manufacturing Co.	"	500	1,600.00	
17	Pepperell Manufacturing Co.	"	100	2,789.50	
27	Essex Co.	"	50	3,780.00	
64	Boston Real Estate Trust	"	1000	68,605.64	
1	Boston Ground Rent Trust	"	1000	900.00	141,801.64

INVESTMENT OF THE JOY SCHOLARSHIP FUND.

Massachusetts Hospital Life Insurance Co.	5,000.00	
Deposits in Savings Banks	5,346.31	10,346.31

INVESTMENT SWETT SCHOLARSHIP FUND.

Massachusetts Hospital Life Insurance Co.	10,000.00

INVESTMENT OF RUSSEL FELLOWSHIP FUND.

2,000.00	Conveyancers Title Ins. Co. Mortgage 4s .	1908	2,000.00
	Amount carried up		$1,830,160.06

Amount brought up			$1,830,160.06

REAL ESTATE.

Rogers Building		200,000.00	
Walker "		150,000.00	
Land on Garrison Street	50,840.00		
Mechanic Arts Building	30,000.00	80,840.00	
Land on Trinity Place	76,315.69		
Engineering Bldg. A, Trinity Place	90,000.00	166,315.69	
Gymnasium Building		3,953.26	
Engineering Building, B		57,857.10	
Engineering Building, C		47,561.08	
Lot No. 2, Trinity Place		137,241.60	
Lot No. 3, " "		282,286.35	
Henry L. Pierce Building, Trinity Place		154,297.05	
Boiler and Power House, " "		26,916.74	
Clarendon St. Land and Building		142,762.94	
Real Estate, Massachusetts Ave., Cambridge		16,154.38	
Real Estate, Brookline, Mass.		112,964.32	
Aug. Lowell Lab. Elec. Eng. Bldg., 1902		121,790.93	1,700,941.44
Equipment, Engineering Building		16,555.24	
" Mechanical Laboratories		20,628.56	
" Elec. Eng. Building		87,282.24	124,466.04

SUNDRIES.

Notes Receivable		12,000.00	
Loans to Copley Society of Boston		6,999.99	
Students' Notes		695.50	
Physics Chem. Research Fund		525.28	
Cash Balance, Sept. 30, 1905, less Oct. coupons		23,215.40	43,436.17
			$3,699,003.71

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

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

William Barton Rogers Memorial Fund		250,225.00	
Richard Perkins Fund		50,000.00	
George Bucknam Dorr Fund		49,573.47	
Martha Ann Edwards "		30,000.00	
Nathaniel C. Nash "		10,000.00	
Sidney Bartlett "		10,000.00	
Robert E. Rogers "		7,680.77	
Albion K. P. Welch "		5,000.00	
Stanton Blake "		5,000.00	
McGregor "		2,500.00	
Katharine B. Lowell "		5,000.00	
Samuel E. Sawyer "		4,764.40	
John W. and Belinda L. Randall Fund		83,452.36	
James Fund		163,654.21	
George Robert Armstrong Fund		5,000.00	
Arthur T. Lyman Fund		5,000.00	686,850.21
Amount carried up			$686,850.21

Amount brought up		686,850.21
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	
George A. Gardner, " "	20,000.00	
Sarah H. Forbes, salaries	500.00	108,100.00
SCHOLARSHIP TRUSTS.		
Richard Perkins Fund	53,363.61	
James Savage "	14,304.53	
Susan H. Swett "	10,332.95	
William Barton Rogers Fund	10,867.50	
Joy Fund	10,308.81	
Elisha Thatcher Loring Fund	5,400.75	
Charles Lewis Flint "	5,308.93	
Thomas Sherwin "	5,000.00	
Farnsworth "	5,000.00	
James H. Mirrlees "	2,869.29	
William F. Huntington "	5,253.45	
T. Sterry Hunt "	3,242.33	
Elisha Atkins "	5,000.00	
Nichols "	5,000.00	
Ann White Vose "	60,875.32	
Ann White Dickinson "	40,748.21	
Dalton Grad. Chemical "	5,739.09	
Willard B. Perkins "	6,919.28	
Billings Student "	50,000.00	
Henry Saltonstall "	10,000.00	
Isaac W. Danforth "	5,400.00	
Charles C. Nichols "	5,200.00	
Richard Lee Russel "	2,080.22	
Lucius Clapp "	4,900.00	333,114.29
OTHER TRUSTS.		
Charlotte Billings Richardson Ind. Chem. Fund,	37,378.78	
Susan Upham Fund	1,305.72	
Susan E. Dorr "	18,164.02	
William Hall Kerr Library Fund	2,000.00	
Charles Lewis Flint " "	5,000.00	
Rotch Architectural " "	5,000.00	
Rotch Architectural Fund	25,000.00	
Rotch Prize "	5,200.00	
Rotch "Special" Prize Fund	5,200.00	
Edward Austin "	376,476.72	
Teachers' "	106,400.00	
Saltonstall "	41,830.22	
Ednah Dow Cheney "	13,783.29	
Letter Box "	20.50	642,759.25
Aug. Lowell Lab. Electrical Eng. Fund		68,000.00
George B. Upton Legacy, 1905		5,000.00
M. I. T. Stock Account		1,816,645.92
MISCELLANEOUS.		
Cabot Medal Fund	206.25	
Walker Memorial Fund	8,562.96	
Roëntgen-Ray Experiment Fund	981.50	
Sanitary Research Laboratory Fund	2,853.57	
Dormitory Fund	2,694.20	
Students' Fees received in advance	16,860.00	
Supplies " " "	2,046.55	
Acc'ts Payable	4,329.01	38,534.04
		3,699,003.71

Comparative Statement of Funds, etc.

	Sept. 30, 1904.	Sept. 30, 1905.
Trusts for general purposes	686,850.21	686,850.21
" " Salaries	108,100.00	108,100.00
" " Scholarships	327,797.08	333,114.29
Other Trusts per page 9	627,443.24	642,759.25
Henry L. Pierce Legacy	848,000.00	
Arioch Wentworth Legacy	100,000.00	
Joseph B. Glover Legacy	5,000.00	
M. I. T. Stock Account	879,597.34	1,816,645.92
Aug. Lowell Lab. Electrical Eng. Fund	68,000.00	68,000.00
George B. Upton Legacy		5,000.00
Miscellaneous, per page 9	44,277.66	38,534.04
	$3,695,065.53	$3,699,003.71
Increase,		
Consisting of:		
Bequests for Special Purposes, etc. (See page 4),	22,333.22	
Gifts and Bequests for General Purposes. (See page 4)	5,000.00	
Net gain on Bonds sold	1,598.75	28,931.97
Less Expenses more than Income	10,582.32	
" Loss on Sale of Gymnasium	6,967.85	
" Teachers' Fund used,	1,700.00	
" paid on Miscellaneous	5,743.62	24,993.79
		$3,938.18

INCOME FROM GENERAL INVESTMENTS, AND APPLICATION THEREOF.

Applied to Salaries	4,324.00	From Bonds	63,769.95
" " Scholarships	10,375.00	" Dividends, Railroad Stocks	2,065.00
" " Fellowships	1,700.00	" " Manufacturing Stocks	1,431.00
" " Charlotte B. Richardson Fund	1,495.15	" Real Estate Stocks	2,915.00
" " Teachers' Fund	4,000.00		
" " Edward Austin Fund	14,400.00		
" " Rotch Prize Funds	400.00		
" " Rotch Architectural Fund	1,000.00		
" " Cheney Fund	49.97		
" " Library	480.00		
" " General Purposes	25,975.19		
" " Samuel Dorr Annuity	1,000.00		
" " Increase of Funds	712.64		
" " Advances to Bond Premiums	4,269.00		
	$70,180.95		$70,180.95

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

Paid Massachusetts Institute of Technology	10,815.00	Received Income from Railroad Bonds	11,483.00
Credited to Advances Bond Premiums	668.00		
	$11,483.00		$11,483.00

DETAILS OF SOME ITEMS IN TREASURER'S CASH ACCOUNT.

Rents.

Huntington Hall, for Lowell Lectures	3,500.00	
Land and Building, Clarendon St., on account	5,500.00	
Use of Rooms and Gymnasium	1,178.44	
Cambridge Real Estate	428.06	$10,666.50

Department Supplies

Applied Mechanics	1,436.52	
Architecture	1,307.36	
Biology	1,000.52	
Brookline Athletic Field	994.78	
Chemistry	14,019.42	
Civil Engineering	1,852.64	
Drawing	320.66	
Economics	400.02	
Electrical Engineering	3,272.45	
English	245.62	
Equipment Electric Chemistry	102.06	
General Library	2,000.00	
Geology	947.04	
History	599.64	
Mathematics	207.40	
Mechanic Arts	2,450.50	
Mechanical Engineering	2,521.30	
Military	210.62	
Mining	3,327.86	
Modern Languages	199.15	
Naval Architecture	1,197.33	
Physical Culture	79.10	
Physics	5,847.74	
Special Dynamo Plant	499.86	$45,039.59

Salaries.

Instruction	265,577.73	
Administration	39,119.23	
Labor	41,992.92	$346,689.88

General Expense.

Window Shades		52.52	
Furniture		631.25	
Stationery and Office Supplies		1,649.39	
Postage		1,172.80	
Electrical Wiring, Lamps, etc.		571.49	
Sundries		2,061.55	
Express		208.70	
Janitor's Supplies		1,437.47	
Examinations		499.25	
Diplomas and Commissions		732.85	
Washing		805.49	
Telephone Service, Installing Stations, Rentals, Repairs, etc.		1,195.98	
Engine Room Supplies:			
Oil	316.00		
Waste	110.75		
Sundries	123.11	549.86	
Ice		357.34	
Examination Books		230.36	
Graduation Exercises		125.55	
Removing Ashes		145.90	
Glass		66.14	
Union Safe Deposit Vaults (two years)		150.00	
Legal Services		2,341.72	
Medical Services		60.00	
Taxes, Brookline		393.75	
Technology Alumni		2,000.00	$17,439.36

Repairs.

Department Improvements:			
Architecture		115.16	
Biology		52.77	
Chemistry		1,169.94	
Civil Engineering		53.10	
Drawing		126.23	
Economics		31.80	
Electrical Engineering		785.41	
General Library		53.92	
Geology		134.80	
Mechanic Arts		94.59	
Mechanical Engineering		359.94	
Mining		188.35	
Modern Languages		8.50	
Naval Architecture		88.45	
Physical Culture		6.30	
Physics		572.85	3,842.11
Rogers Building			1,220.54
Walker "			388.60
Engineering Buildings, A and B			596.09
Pierce Building			209.66
Engineering Building, C			360.25
Lowell Building			935.69
Gymnasium Building			176.10
Mechanical Laboratories			118.15
Boiler and Power House			399.53
Tech. Union			12.31
Turbine Pump			450.00
Sundries			1,264.36
			$9,973.39

BOSTON, December 1, 1905.

Mr. Edward L. Parker, a public accountant, employed by this committee, has examined the accounts of the Treasurer of the MASSACHUSETTS INSTITUTE OF TECHNOLOGY for the year ended September 30, 1905, and has verified the Students' Notes and the cash at office and in banks, and his report is hereto annexed.

We have verified the list of securities held by the Institute.

CHARLES C. JACKSON, } *Members of the*
JAMES P. TOLMAN, } *Auditing Committee.*

BOSTON, December 1, 1905.

To the Auditing Committee of the
Massachusetts Institute of Technology:

GENTLEMEN,—I have audited the accounts of Mr. George Wigglesworth, Treasurer, for the year ended September 30, 1905.

They are correct, payments duly vouched, and the receipts from students' fees and all other income duly accounted for. The cash at office and in banks, according to the deposit books, is correct, and the Students' Notes are on hand. The account of property held by the Institute and the funds and balances, as shown in the Treasurer's report of September 30, 1905, is in accordance with the books.

Respectfully submitted,

EDWARD L. PARKER,
Public Accountant.