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REPORT

OF THE

PRESIDENT AND TREASURER

PRESENTED AT THE DECEMBER MEETING OF THE CORPORATION

JANUARY, 1905

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Report of the President.

To the Members of the Corporation:

The Report which I present to-day is the fifth which I have had the honor to bring to your attention. The year of which it contains in some measure a history has been an important and eventful one, bringing with it much of hard work, some changes, and new problems of a far-reaching character. In the solution of these problems, involving as they do questions of an educational bearing, of financial importance, and of administrative methods, all parts of the Institute constituency — Corporation, Faculty and Alumni — must share.

CHANGES IN CORPORATION AND FACULTY.

In the Corporation there has been for the year just closed only one change; the Hon. George H. Martin, Secretary of the Board of Education, has become, *ex officio*, a member of this body. The changes in the Faculty, however, have been unusually numerous. Professor Jerome Sondericker, Associate Professor of Applied Mechanics, died in mid-summer, while Professors Rambeau, Baird, Dippold, Duncan, Skinner, Whitney, and Norris have resigned. Of these, three were heads of departments, and the changes which have come from these resignations have brought problems of considerable importance in their solution. Professor Duncan is succeeded *pro tempore* by Professor Clifford, who acts as head of the department until a permanent decision shall have been reached. For the present term, Professor Vogel has taken charge of the Department of Modern Languages in place of Professor

Rambeau, Major John Bigelow having been appointed permanently to this office, his work to begin on February first. Major Fred Wheeler has succeeded Captain Baird in charge of the Department of Military Science.

Professor Sondericker was a graduate of the University of Illinois and died at the early age of forty-four and one-half years. He was a man of great kindness and of sterling character, an able teacher, and one who gave himself freely and heartily to his students. His memory will always be cherished by those who have studied under him. Mr. Kilburn S. Sweet, a member of the instructing staff in Civil Engineering, who also died in mid-summer, has left a memory which his colleagues and students are glad to cherish. His life is particularly interesting because he came into the work of the Institute under great difficulties. Born in a village in Maine, a boy of delicate frame, he came to Boston in 1889 to attend the Bryant & Stratton Business College. For a time he was employed as an errand boy in the office of the Institute of Technology, at which time he attracted the attention of one of the officers of the Corporation, who encouraged him to try the entrance examinations of the Institute. His expenses here were met by his summer earnings, by scholarships, and by contributions from friends. The outcome of his life with its fine product of usefulness and service may well encourage those who have tried to help struggling boys under similar circumstances.

THE SUBJECTS TREATED IN AN ANNUAL REPORT.

It is not always easy to select from the great mass of interesting material which is crowded into a year's programme of a large institution those topics which are most important or most distinctive. In such a statement, as in all other similar attempts, that which is material and visible to the eye is likeliest to receive attention. Changes in methods of instruction, the bringing into the institution of a fresh

mind, the acquisition of a true teacher or investigator, are all of vastly more importance in the intellectual and spiritual life of the Faculty, the students, and the graduates than the erection of a building, the addition of a laboratory, or the increase in tuition. To preserve a fair perspective of all these things is not simple. Educational and financial problems, entrance requirements, the needs of departments,—all press for representation. In the effort to deal with these varying factors and wants, one will find all sorts of solutions in the administrative reports of our larger institutions. In one the attention is given wholly to matters of detail, in another to the educational organization of the institution, while still another deals almost wholly with the larger questions of education and intellectual life. In the Report which I present to you to-day I have endeavored to bear in mind first of all the intellectual and educational needs of the Institute, but not to lose sight of the details of the Institute's life and work; and above all I invite your attention to the statements of the heads of departments in which are presented in their own words the immediate problems which in their judgment press upon them for solution. It is intended not only that these reports should serve the purpose of historical continuity, but also that they should deal with the larger topics of administration and of education.

THE ADMINISTRATIVE DUTIES ASSIGNED TO AMERICAN PROFESSORS.

No one who is familiar with American and foreign institutions of learning can doubt that the American professor has a far less desirable position than his colleague in the continental countries. Not the least of his burdens is that due to the imposition of administrative duties in addition to those of the teacher. With the growth of our institutions of learning, with the stirring competition which exists between them, with the American habit of frequent examinations, an enormous

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amount of administrative work has to be done, and this is thrown in a large measure upon the professors. I am not able to give an estimate of this tax as a part of the working hours of the regular day, but there are very few teachers in the Institute of Technology who do not carry a considerable administrative load, and in many cases this load is so great as to furnish a very serious interference with good teaching, to say nothing of scholarly work and investigation. Several of our professors have returned this year from a year's absence abroad and we expect from these visits the results which ought to come from a fresh view of work as it is done in other institutions. No doubt we shall gain such results, but they will be greatly diminished by reason of the fact that these men have been harnessed at once to the administrative load which the professors in the Institute carry. To one of these was assigned the duty of editing and publishing the Annual Catalogue, a piece of work which has been done in the most admirable manner and with great promptness, but has effectually cut off any opportunity to take up the educational problems which the year's absence might most naturally suggest, problems whose solution would mean more to the cause of education and to the students in the Institute than any amount of administrative detail, however well done. The heads of nearly all of the departments of the Institute are charged with a considerable amount of administrative responsibility. The head of the Department of Mathematics is the Secretary of the Faculty, and his duties as Secretary are constant and onerous. The same thing extends to professors in the other departments, most of whom are charged with duties other than those which naturally come with teaching. All this is a part of our system of education, in which we do for students many things which are not done in foreign countries, and is due particularly to the fact that the work of administration and of teaching have no sharp line of division such as is found in foreign universities and technical schools. It seems to me evident that we must in the near future in American institu-

tions in some measure separate teachers from administrative responsibilities and administrative duties, leaving them free for the work of the teacher and of the investigator, which we sometimes forget is the real work of an institution of learning.

THE PAY OF COLLEGE PROFESSORS.

Notwithstanding the increased duties thus laid upon American college teachers, the remuneration which they receive is relatively diminished rather than increased. I ventured to call your attention to this in my last Report, and to suggest that we should need in the Institute of Technology in the immediate future to face the question of a more adequate compensation for teachers, either by the payment of larger salaries, or by the provision of retirement pensions, or by both. Sir William Ramsay, the eminent English chemist who recently visited this country, in an address delivered in New York just before he sailed, sounded a note of warning in this matter which is well worth our heed, and in which he frankly tells Americans that unless teachers are better paid the institutions of learning in this country are sure to deteriorate. I have no question that this statement is an absolutely true one and that, however large an element in the services of a teacher his devotion to the institution may be, nevertheless in a profession which is relatively underpaid there will be increased difficulty in securing good men. It is well enough to urge upon young men the attractions of a scientific career in our institutions of learning and to lead them to understand that much of the reward of the life must come from the service itself, but I fancy that few men who make these statements take the trouble to see what the financial outlay and the financial reward actually are. The fact is, under the system of specialization which has grown up in the last twenty years, a man who aspires to a professorship may count upon the following programme: First of all he must

spend four years, at considerable cost, at college or university or technical school, with some three years to follow as a specialist, including, as a rule, a year or more at some foreign institution, engaged in work which is quite as hard as that which prepares men for the law or for medicine or for any other profession. After this six or eight years of preparation, he may hope to become an assistant, or at most an instructor, in some institution of learning at a salary of seven or eight hundred dollars a year, and he will be a man of unusual attainments if at the end of ten years he has been advanced to an assistant professorship at fifteen hundred dollars a year, a salary not much better than the wages of a switchman in one of our large railroad yards. Furthermore, the chances are that during this time he will be so burdened with class-room work, with administrative duties, and with other tasks outside those properly belonging to a teacher's life that there will be little time or strength left for quiet study and research. The strenuous life has been introduced into the colleges and universities with consequences as much to be regretted as those which have come in business.

This result is due in part to the multiplication of so-called universities, to the great increase in numbers without corresponding adjustment of the organization, and to the wasteful competition in education which has come about by the great number of institutions all trying to do the same thing. Whatever may be the causes, the condition is evident enough, and some solution must be found which shall give the teacher greater freedom from the administrative side of the work and which may at the same time increase his compensation.

SELF-SACRIFICE OF COLLEGE PROFESSORS.

Under the conditions which I have partly sketched, one cannot but admire the devotion which the great bulk of college professors put into their work. Without hesitation they undertake the additional and burdensome administrative tasks with which they have been loaded, and struggle with them with such success as they may. In many cases they find themselves when past middle life crowded out by younger men, without pensions, and with little opportunity for work in their own calling. Of late years institutions of learning have demanded as remorselessly as have railroad corporations that their employees shall be under forty, and the teacher who loses his place for any cause whatsoever after he is fifty finds increasing difficulty in securing employment. Now and then a man is clear-headed enough at the very outset of his professional career to decline absolutely to be sacrificed to the god of administration. My attention has recently been called to the cases of two men of apparently equal ability, equal opportunity, and equal training, who started together as teachers and investigators. The one declined to accept administrative tasks or to surrender his time wholly to the drudgery of the daily routine; the other good-naturedly accepted at the hands of the college authorities every administrative task placed upon him. Their careers have been interesting illustrations of the working out of this régime. The first is to-day a well-known investigator, with a name established in science on both continents and with a good income; his more good-natured but less fortunate colleague is an ill-paid teacher in a second-rate institution.

STUDENT REGISTRATION AND INCREASED TUITION.

During the past five years there has been considerable fluctuation in the size of the entering classes as follows: —

1900	374
1901	440
1902	479
1903	348
1904	401

This fluctuation is the result of many factors, but is due in considerable measure to the increase in tuition which was announced in 1901 but which did not take effect until October, 1903. The very large entering class of 1902 is no doubt due to the pressure to enter before the rise in tuition should take place, the smaller number in 1903 represented the reaction after that pressure was removed, and the increase for the present year is doubtless a normal entrance class.

The distribution of students continues to be quite as wide as it has been in the past. Two very interesting groups come from the far East, six Chinese boys sent by the government of China and four Philippine students who come as wards of the country. The Chinese students are excellently prepared, having had a fair English education in China, and one of them entered the second year. This action of the Chinese government marks the return to the policy of many years ago. At that time six Chinese students entered with the Class of 1884, but were recalled early in their course. This year China is sending fifty picked students to foreign countries, nearly half of them to Japan, the rest divided between the United States and Europe.

Eight naval cadets entered the Course for Naval Constructors, so that the present group of students from the navy in the Institute numbers twenty. The number of students registering as college graduates is one hundred and eighty-two, and marks a steady and welcome growth in this direction. The colleges from which these men come are scattered over the

whole country, and this fact furnishes a gratifying evidence of the regard in which the Institute is held in other institutions of learning.

The total registration for the present term is one thousand five hundred and sixty-one, a small increase over that of last year. Of these eight hundred and eighty-nine, or fifty-eight per cent., are from Massachusetts, and four hundred and seventy-eight, or thirty per cent., come from outside of New England. Of the entire number now in the Institute five hundred and seventy-five were not connected with the school last year.

The number of graduates has now passed the three thousand mark, and amounts to three thousand one hundred and forty-eight. Two-thirds of these, two thousand and fifty-seven in all, come from the four great engineering Courses in the following proportions: —

Mechanical Engineering	688
Civil Engineering	549
Electrical Engineering	540
Mining Engineering	280

SUMMER SCHOOL COURSES.

The Summer School courses for this year included two hundred and fifty-five students as compared with two hundred and forty-five last year, and the school was somewhat further distinguished from those of former years in that it included more students from other colleges. Our Summer School, however, still remains practically a school either for the preparation of those who are about to enter or for enabling those who have not done the work adequately to supplement the regular courses of the Institute.

THE SOCIAL LIFE OF THE STUDENT BODY.

I wish to commend to the attention of the members of the Corporation the very interesting report of the Dean, in which valuable information is given as to the changing conditions in social life in the student body. The appointment of a Dean who should have time and thought to give to such questions has been one of the factors in bringing about such changes for the better as are going on. I wish to emphasize the point to which he calls attention, that is, that under the present conditions a distinctive form of student gatherings is being developed which is a wholesome one and one which tends toward culture. Of this social life the Technology Club and the Technology Union are the principal centres, and in both of these the idea is constantly developed that the student is asked into a life of moral and intellectual liberty, but a life which carries with it at the same time certain responsibilities, and always the responsibility to be a gentleman.

The action of the students in regard to athletics, their determination to enter into college athletics only so far as is consistent with their work, is a hopeful action and one which is entirely to their credit. In this day, when in most universities athletics have been so developed as to throw college life out of perspective, it is worth while to see an institution undertake the problem of entering athletic contests in a moderate and conservative spirit. The gift of the new athletic field containing a fine track and a ball field will add greatly to the interest of students in these matters, but it is not intended that this shall be the cause of any change in policy.

The statistics given in the report of the Dean as to the character of the apartments in which students live are of great interest. As is seen from this statement, over forty per cent. of the students live in their own homes, about thirty per cent. live in boarding-houses in the city proper, and about

ten per cent. in boarding-houses in the suburbs. The Dean believes from these statistics that a few dormitories accommodating a few hundred men would take care of the cases of almost all men who now live in undesirable surroundings. I trust that within a reasonable time we may have the opportunity to deal with this question.

THE HEALTH OF STUDENTS.

I wish to call the attention of the Corporation to the extremely interesting report of the Medical Adviser for the past year. It will be remembered that this office was established some two years ago, and that to it was appointed Dr. Franklin W. White, a graduate of the Institute and of the Harvard Medical School. Dr. White has entered upon his work with great zeal and intelligence, and the results have been of the most satisfactory character. Not only does he maintain office hours during which he may be consulted without expense by any student, but, in addition to this, at the beginning of each year he gives a few plain, straightforward talks upon personal hygiene, which cannot fail to be of great value, and which, together with his visitations, have brought him into admirable relations with the student body.

At my suggestion he undertook, a year ago, a somewhat extended investigation of the physical condition of the last two graduating classes, with the purpose of determining what the physical status of the men was at the time of graduation. Dr. White gives in his report the list of questions which he sent out and the nature of the replies which were received, disclosing not only the character of the daily work of the students and of their living, but also the amount of work done during the vacation period. Briefly stated, the result of his inquiry is to show that in these two senior classes nearly two-thirds of the men were never absent from class-work a day during the course, that only about ten per cent. had an illness

of any importance during their four years' course in the Institute, and that with few exceptions the men finished in good physical condition.

Dr. White's report is valuable for many reasons, but particularly as showing that where ill-health has resulted it has come almost wholly from either a neglect of physical exercise, or deficiency in the amount of sleep, or some other violation of the laws of hygiene. Such neglect ought to be greatly diminished under the system of lectures to students which is now conducted, and it is along this line that our concern for the health of students needs to be directed. For a normal, healthy boy the amount of work required is no greater than he may be reasonably expected to do.

This result, of course, does not touch the larger side of the educational question. It is entirely possible to keep a boy busy, to give him an amount of work consistent with his strength, and yet to make this work of a sort which shall be disciplinary rather than educational. Against this tendency the technical school needs particularly to watch; and the Faculty is giving its attention from time to time to this matter, making constant examinations of the Courses to determine how they may be made more efficient and how the load may be distributed in such wise as to suit best the needs and the aims of the students.

The whole result of Dr. White's examination is to emphasize the need of cheap and comfortable quarters for that part of the student body which now lives under poor conditions in a quarter of the city not favorable for their social life, and who obtain their board where either insufficient or poor food is often provided.

THE PRESSING NEED FOR ROOM.

I ask your careful consideration of the individual reports of the heads of the various departments, in which they have stated in their own words their condition and their needs. These reports emphasize certain of those things to which I have already called attention, namely, the need for more teachers of the higher grades rather than for additional assistants, and the need of increasing salaries to the point where men may get a fair compensation, together with a fair certainty of provision for old age. Throughout all these reports one need is made evident as the most pressing and immediate, and that is the necessity of additional space. Professor Swain, in his report of the Department of Civil Engineering, states as the first need of his department that of additional space. Professor Lanza refers to the crowded condition of the Department of Mechanical Engineering. Professor Richards says that "to do its present work to the best advantage the Mining Department needs double its present floor space." The Department of Architecture, although installed in its quarters but a few years, finds itself cramped for room. Professor Talbot says, "The need for more adequate accommodation for the work of the Department of Chemistry is more keenly felt each year. Not only are certain branches of the instruction suffering from the congested state of the laboratories allotted to them, but the department as a whole is lessened in efficiency because of the isolation of portions of its work in separate buildings (four in all), away from the chemical library and sources of supplies, and so widely distributed that community of interest among the members of the department working in different lines is seriously diminished. A reunited department in a building designed for the purpose of chemical instruction, with the much-needed supply of small laboratories for research, advanced or special work, is imperatively needed to permit of the development of the departmental work, which has been for some years and is still prohibited by

the impossibility of attempting more in the space at command." Professor Sedgwick asks for one additional room for the Department of Biology. Professor Cross calls attention to the congested condition of the Physical Laboratories, saying "It will be seen that we have practically reached the limit of the capacity of the present Laboratories of General Physics, as a further increase of size of sections, even with a proportional increase in the number of instructors, will unquestionably result in less satisfactory work. To meet, therefore, any further material increase in the size of our classes the laboratory equipment will have to be duplicated and installed in separate rooms, so that independent sections can be accommodated simultaneously." In a word, an inspection of the reports of the heads of departments here presented will show that, in their judgment, we are dealing in our present buildings with as many students as can be efficiently taught in the space at our command, and that for any increase in numbers, and, indeed, for the proper teaching of the present number, we ought to have additional buildings. The pressure for more rooms for lecture halls and laboratories is one of the most difficult questions with which the Faculty and executive officers of the Institute have to deal.

SUITS IN REFERENCE TO THE INSTITUTE'S LAND.

The question of meeting the need to which I have just referred, that of additional buildings, is closely connected with the possible success or failure of the suits which have been brought against the Institute to test the validity of the Act of the Legislature conveying to the Institute the title to its site on Boylston Street in fee simple. As the members of the Corporation are aware, three suits, one by the Massachusetts Society of Natural History and two by owners of abutting property on Newbury Street, have been brought to determine the quality of the Institute's title under this Act. The first

of these suits was argued during the summer, while the last two were argued during the present month, before the Supreme Court. How soon a decision may be expected I cannot say. Should that decision be favorable, the Institute could meet the immediate demands for space by the erection of additional buildings on the vacant portions of the land in question; but, if the suits should be decided against us, the value of the State's gift would be very materially diminished and the problem of furnishing the additional buildings needed for our work would be an entirely different one, and one which would require the earnest consideration of the members of this body.

HARVARD-TECHNOLOGY CONFERENCES.

On May 4, 1904, a Resolution was passed by this body, to the following effect: "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." Acting under these instructions, the Executive Committee appointed a conference committee of two to confer with a similar committee from the Harvard Corporation. Repeated conferences have been had by these two committees, and I am able to report that they have practically agreed upon recommendations which it is hoped may be submitted at an early date to the Corporations of both institutions. The discussions and deliberations of these committees have been conducted upon a plane in which there was preserved not only loyalty to the institutions themselves, but a real desire to serve the higher interests of education and of the State. Neither side has sought to lessen the dignity or the freedom of the other. Any discussion of this matter must necessarily wait until the final report can be presented. I shall hope to give in my next Report a complete

statement of the entire matter. For the present I can only express the hope that, notwithstanding the fact that this proposal has aroused sharp differences of opinion among friends and alumni of the Institute, when the definite proposition has been made known, and when a full and free discussion has been had, we may find ourselves coming, whether we decide in one way or the other, to a fairly accordant result. Whatever else may happen from the discussion of this question, it is most essential that no harm shall come to the Institute itself, and that those who work for it and believe in it, whatsoever their opinion regarding this matter, may in the end unite for the common development and progress of the school.

THE GENERAL PROBLEM OF THE INSTITUTE.

The sketch which I have here given of certain questions of policy or of education which are pending, while incomplete, is, nevertheless, sufficient to show that the Institute has before it large and important questions to solve. These questions are, in the first place, educational. Nothing else is of so much importance to any institution as to maintain a scholarly spirit and an atmosphere which while full of enthusiasm shall be free of dogmatism; a spirit of work which shall be strong but wise; and a co-operation between all parts of the institution which may help to the intellectual and moral upbuilding of the student body. Those things which have to do with the freshening of the methods of instruction, with the improvement of the Courses, with the introduction of higher ideals of work and of study, are first in importance and fall in the main to the Faculty; but closely connected with them are all the secondary problems which have to do with the means and the material facilities for carrying out the work of the Institute. So soon as the suits now pending against the Institute are decided, it seems to me clear that we should settle upon a general policy as to the Institute's location for

the next ten or twenty years, that we may then bend our energies without distraction to the improvement of its work and of its facilities, to the end that it shall be made, to the very best of our ability and means, a place which shall be stimulating and helpful to the students who resort to it. This general question of policy as to where the Institute's work shall be done for the next twenty years is one which should be settled as promptly as the conditions will allow.

TREASURER'S REPORT.

In the course of my statement I have said comparatively little as to the details of the financial conduct of the Institute, first, because I conceive it to be my work to deal in the main with the educational problems and needs of the Institute, and to convey to the Corporation as well as I may the expression of the purpose and aims of the Faculty; and, secondly, for the reason that the financial status of the Institute is admirably presented in the report of our Treasurer, which contains a complete exhibit of the operations of the past year. Like most educational institutions in the East, we present a deficit at the end of our year's operations. Except the State universities, which are by law restricted to the expenditure of fixed sums, most institutions which are growing in numbers and in work show such deficits for the past year. I invite your attention to the items which make up this exhibit and to the statement of the Treasurer in connection therewith.

HENRY S. PRITCHETT.

DECEMBER 13, 1904.

Reports of Departments.

REPORT OF THE SECRETARY OF THE FACULTY.

The recent reorganization of the administrative work of the Institute has made it the duty of the Secretary of the Faculty "to co-operate with the President in the general conduct of Faculty business and administrative work, and to have general oversight of the work of the Registrar and the Recorder." This report is accordingly occupied mainly with a review of such Faculty business of the year as may be of general interest. Some of the larger matters represent the work of special or standing committees of the Faculty.

Changes in the curriculum connect themselves mainly with the discontinuance of the former Course IX., General Studies, and the effect on all Courses of the advance in entrance requirements in modern languages. In February the Faculty was advised of action by the Executive Committee of the Corporation terminating Course IX., after its completion by students then in the Institute, and requesting the Faculty to take the necessary steps for the substitution of an elective Course in general science, the first year of this Course to be in the main that required of other students, the last three years to be given to studies under a free election. These steps have since been taken, but no students are yet registered in the Course.

The advance in entrance requirements in French and German, taking effect in 1903, leads to the completion of modern languages by students of the classes of 1907 and later years at the end of the second year instead of at the end of the third year as heretofore. In the case of Course III., however, it has been deemed necessary to postpone the German from

the second year to the third. In recognition of the fact that modern languages in the Institute curriculum have value as general studies apart from their utilitarian purposes, the Faculty determined that, for the two hundred and seventy hours formerly assigned to exercises and preparation in the third year of French and German, one hundred and twenty hours should be allotted to general studies, with options in various lines, including the history of science. Adjustment of the numerous diverse interests and preferences involved has been a matter of some difficulty, but a definite plan will be presented to the Faculty at an early date for announcement in the forthcoming Programme. It is anticipated that this re-enforcement of the general studies with opportunity for free choice on the part of the students will result in much advantage. The use of the time released for professional subjects has not yet been determined, but will depend mainly on the initiative of the heads of the professional departments. The Course Schemes of the present Catalogue thus represent to some extent a transition stage for students some of whom have entered under the present, others under the former language requirements.

A further recent change in entrance requirements, the addition of physics, has led to the holding of examinations in that subject last summer for a limited number of preliminary candidates and to the substitution of biology for physics in the list of elective subjects in which teachers' certificates are accepted without examinations. It is anticipated that the entrance requirement in physics will tend to relieve the difficulty which has resulted from the corresponding increase in subject-matter appropriated for presentation in the second-year course. These recent changes of entrance requirements have made the test of a candidate's fitness for the Institute work more complete, without creating a gap between the better high schools and our first year. It may be noted, however, in passing that there are evidences of an unfortunate tendency in some quarters to restrict Institute candi-

dates to one among several public high schools of particular cities.

The Summer Courses for the past season were begun at a somewhat later date than usual, with a view to accommodating college graduates and other persons unable to attend before the end of June, and also with a view to facilitating the administrative routine in the case of Institute students whose plans might depend upon the results of their June reports. Attendance upon the summer courses has shown with some fluctuation a general tendency toward increased usefulness, but it is more and more evident that care should be exercised to guard against the disposition of dilatory students to postpone the work of the school year with the often delusive hope of making it up in the vacation. In the case of accidental loss of term work, the summer courses have proved the means of obviating serious hardship, not infrequently saving an entire year for students.

The two most notable events of the year, not merely for the Faculty, but for Institute men generally, have been the Technology Reunion of last June and the Rogers Commemoration of December. While the Reunion was primarily an alumni affair, the Faculty was represented on the Committee of Arrangements, and many of the alumni members of the Faculty were actively engaged throughout the whole undertaking. The closer relations between Faculty and alumni which the Reunion promoted cannot fail to exert a lasting influence for good.

The Rogers Commemoration was given the character of a presentation of the life and work of the founder of the Institute to its present undergraduates. The exercises of the school were suspended and addresses delivered to an audience filling Huntington Hall, and including, beside the undergraduates, members of the Corporation, Faculty and instructing staff, associates of President Rogers in the early years of the Institute, and a small number of guests invited for personal reasons. The addresses are to appear in full in an early

issue of the *Technology Review*. The Commemoration as well as the subsequent commemorative meeting of the Alumni Association have contributed powerfully to make President Rogers' influence a living one to men most of whom knew him only by name.

The work of the Committee on Publications has been notably important the present year. The Catalogue and Programme have been radically changed in form by substituting for the former tabular Schedule of Topics an extended description of courses, of special value to students desiring admission with advanced standing. The committee has adopted the policy of issuing the Programme early in the summer, the Catalogue early in December, and the Register of Graduates in March. The latter has appeared this year for the first time as a distinct publication, making with a geographical register a book of two hundred and fifty-seven pages. The earlier issue of the Catalogue, facilitated by the omission of the Register, has been a considerable gain. For these and the President's Report the committee has adopted a serial form of publication.

The work of the Faculty Committee on Undergraduate Scholarships has grown steadily in difficulty and importance, and the need of additional resources becomes more and more urgent with the increased proportion of students responsible for the higher tuition fee. The committee has at its disposal from $25,000 to $30,000 per year at this time, and could use fifty per cent. more with much advantage, without taking account of the considerable number of earnest students who are led to give up coming to the Institute altogether by reason of the cost. The number of applicants for whom awards have been made by the committee for 1904–05, not including the Massachusetts State scholarships, has been one hundred and seventy-four, the amount awarded, $17,250, an average of $98.57. The forty State scholarships have been assigned to seventy-three candidates, sixty-six receiving half-scholarships.

The Committee on Advanced Degrees and Fellowships has

also experienced in recent years a marked increase in the amount of its business and responsibilities. The appropriations recommended by the committee for the current year have amounted to $5,000 distributed among sixteen persons, ten for resident, six for foreign study; in four instances the awards recommended have been subsequently declined on account of changes in the applicants' plans.

The Committee on Recommendations for Appointments of Graduates has not attempted to expand the scope of its work materially for the cogent reason that under existing industrial conditions the demand for graduates is considerably in excess of the possible supply. It has seemed therefore unnecessary and indeed inexpedient to take any steps which should increase the demand in the absence of an adequate supply. On the other hand, efforts have been made to systematize the committee's correspondence in such a manner as to secure prompt information whenever men have been available. Many of the applications come from other institutions desiring teachers, but the number of Institute graduates who look toward teaching is still smaller than could be wished.

While the matters just outlined connect themselves with the work of every year, there is in each year a considerable number of scarcely less important items which do not recur. One of the most burdensome items for the present year has been the preparation of the Institute's main and collateral exhibits for the Louisiana Purchase Exposition at St. Louis. The main exhibit of the Institute was installed in the Educational Building under the direction of Professor H. W. Gardner. The exhibit was in place and in good order on the opening day of the Exposition. From that time until December first, the day of closing, the exhibit was under the personal care of some present or former student of the Institute. The following men have had charge of the exhibit during periods varying from ten days to two months: Messrs. J. S. Weil, F. M. Chace, J. A. Root, G. B. Jones, E. Burton, C. A. Johnston, R. H. Allen, E. L. Smith, and A. H. Kell-

ing. This arrangement was found to be economical and satisfactory from every point of view. Special thanks are due to these students for the intelligent and conscientious way in which they have fulfilled their duties. The awards reported include,— Grand Prize for General Exhibit; Gold Medal for Mining Engineering Exhibit; Silver Medal for Special Exhibit of Department of Analytical Chemistry; Silver Medal for Special Exhibit of Drawing; Silver Medal for Special Exhibit of Photographs and Students' Work.

Among other items the following subjects have received the attention of the Faculty: the procedure at the end of the term in connection with the consideration of records, the printing of theses, the restriction of the number and length of final examinations in the fourth year, the policy to be adopted in regard to the substitution of work in other languages, particularly Spanish for French and German, and the enforcement of a somewhat higher standard for admission to fourth-year professional subjects.

In connection with the statistical report of the Registrar, attention may be called to the fact that not less than one hundred and fifty-eight students, including seventy-seven graduates, have entered the Institute the present year from other colleges.

The number of students required to withdraw in consequence of low standing in scholarship was as follows. In January, 1904: Fourth Year, 4; Third Year, 1; Second Year, 7; First Year, 2; Total, 14. In June, 1904: Fourth Year, 0; Third Year, 11; Second Year, 16; First Year, 11; Total, 38. Total for the year 52. In addition to these, three students were required to withdraw for other reasons.

H. W. TYLER.

REPORT OF THE DEAN.

During the past year there has been a general increase in the work of this office. The chief duty of the Dean seems to be to act as a general consulting officer.

As in former years, each new student has been referred to

some member of the Committee of Advisers. This Committee numbers sixty, and has been made up this year largely from the younger members of the instructing corps, as being in closer touch with new students. On the two days preceding the opening of the term the Committee met new students in the General Library and gave assistance in arranging their programmes of work and in introducing them to the rather complicated system of registration. In this latter work the Committee was assisted by a number of the older students.

Students at the Institute thoroughly appreciate the difficulty of forming acquaintances among their own number. At the beginning of the year they accordingly arranged several informal gatherings to which all new men were invited. In addition to this, in October, 1904, the Walker Club, a society devoted to fostering interest in non-technical studies, gave a special reception to all students entering from other colleges. About one hundred and seventy invitations were sent out, and there was a large and representative gathering of men who entered this year from different American and foreign colleges, a large majority being graduates.

The social life of the student body is improving every year. Each of the larger professional Courses at the Institute has an active society holding frequent meetings. Many informal dinners of the classes and other organizations are held at the Tech Union. Among these are two notable gatherings of students from different classes, one called the Field Day Dinner, to which all participants in this contest between the first and the second-year students are invited, and the other to which are invited all those taking part in the "Tech Show," a performance in which the participants are drawn from every class and professional Course. At the former about one hundred and fifty were gathered, both the victors and the vanquished celebrating the event on the friendliest terms. To see freshmen and sophomores mingling together in the best of good fellowship after an exciting contest in which class feeling has reached its highest pitch is believed to be a unique

spectacle in an American college. The "Tech Shows" have been given for the last six years, and have attracted the general interest of the student body. The proceeds are devoted to the needs of the Athletic Association. Over one hundred men take part in these shows.

These items in regard to the social life of students are placed in this report because the general public is disposed to think that there is no so-called "student life" at the Institute of Technology. This opinion is due in great part to the fact that the student body has withdrawn from the intercollegiate football and baseball contests and is therefore not brought so frequently to public notice. The students themselves have recognized that there is not time for the development of teams such as can compete satisfactorily with the large colleges in the East, and have held to track athletics as the most suitable expression of the athletic spirit at the Massachusetts Institute of Technology. Under the able management of an alumni Advisory Council, track athletics have flourished and gained considerable attention from a large number of students. Cross-country running, fostered by frequent hare-and-hounds runs, has aroused a strong interest, and several sports, such as hockey, basket-ball, fencing, and general indoor athletics, engage the attention of a fairly large number. The gymnasium, totally inadequate to the whole number of students attending the Institute, is, however, quite large enough for those living in the near vicinity of the city proper.

The Technology man is much more social and gregarious in his habits than he was a few years ago. The affairs which receive the most enthusiastic support are those that appear to have the most distinctive and unique character. The Technology man is not inclined to be imitative, but, if he can originate and build up for himself some custom or tradition, he is likely to support it with great fervor. There is a strong, manly quality that influences the tone of the large social gatherings and is indicative of the temperament of the student body.

The room and boarding-house register, consisting of a list of two hundred and thirty houses in Boston and vicinity, was consulted quite generally by new students, and an increasing number availed themselves of accommodations in the immediate suburbs. It may be of interest in this connection to give a brief summary of the residence of the students for the year 1904–05 : —

Living at Home	685
Living at Chambers or Bachelor Apartments	138
Living at Fraternity Houses	139
Boarding in City Proper	452
Boarding in Suburbs	146

Many of those living in the city proper are in houses where four or more students are gathered. Comparatively few are completely isolated from their fellow students. In the case of those who are trying to practise great economy, accommodations are often inadequate and uncomfortable, the surroundings far from improving, and the food insufficient. The total number of such cases, however, is not great, and a few good houses which could accommodate less than a hundred men would probably solve this difficult problem.

The employment bureau has not been so successful in finding professional work for undergraduates during the past year as in previous years. The majority of those who obtained work were obliged to seek it in other fields than those connected with their Institute Courses.

Gymnasium.— The attendance at the Gymnasium in the regular classes last year varied from ninety to twenty a day, the average attendance during the first six weeks being sixty-four, and during the last twelve weeks eighty-six. Over one hundred and twenty-five students have taken regular class-work. Of the whole number receiving instruction, 10 per cent. were fourth-year men, 15 per cent. third-year, 20 per cent. second-year, 30 per cent. first-year men, and 25 per cent. special students. In addition to the students who take regular class-work, about one hundred and fifty men use the

gymnasium irregularly and have lockers there, and the track team uses it during the winter for practice.

At the beginning of the school year one hundred and sixty-four men received a physical examination in which twenty-four measurements were taken, the different sets of muscles tested by dynamometers, and special attention given to the heart and lungs. A very few students were found to have a slight heart or lung trouble, and these were referred to the Medical Adviser. From these measurements and strength tests an anthropometric chart was plotted for each student. This chart shows clearly what parts of the body are defective in size and development. A second examination was made at the end of the year. This also was plotted on the same chart, and indicates the increase in strength and development during the school year. The Cabot medals for physical improvement were awarded on the basis of these charts and the record of attendance during the year. The Committee of Award consisted of Professor Wendell, Mr. Towne, Mr. G. Defren, and the Dean. Medals were awarded in May, 1904, to J. P. Stow, Jr., '07, F. B. Poole, '05, and J. C. Damon, '04. During the present year it is planned to form a gymnastic team for competition with other college teams, and it is hoped that these contests will add interest and enthusiasm to the routine work.

STATISTICS OF ILLNESS FOR THE SCHOOL YEAR 1903-1904.

Fourth-year Class.

There were three hundred and twenty-two students, regular and special, in the fourth-year class. Of these twenty-one were reported ill during the school year 1903–1904. Classified by diseases, there were the following cases: chicken-pox, 2; grippe, 2; malaria, 2; typhoid fever, 3; tonsillitis, 1. There were four cases more trivial in character, and seven in which illness was not specified. One member of this class, Mr. John A. Fremmer, died, Aug. 8, 1904, of peritonitis.

Third-year Class.

The whole number of students in this class was three hundred and eighty-two. Of this number forty-three were reported ill during the school year. Classified by diseases, there were the following cases: appendicitis, 2; grippe, 2; hernia, 1; jaundice, 3; measles, 2; pneumonia, 2; scarlet fever, 1; tonsillitis, 2. Seven cases were less important, and twenty-one were not specified. There was one death in this class, that of Mr. G. E. Dunham on January 24, 1904, who died at the Massachusetts General Hospital of pneumonia.

Second-year Class.

The regular and special students in this class numbered four hundred and fifty-eight. Forty-four of these were reported ill during the school year 1903–1904. Classified by diseases, there were the following cases: appendicitis, 3, one of which was treated at the Massachusetts General Hospital; bronchitis, 1; congestion of the lungs, 1; grippe, 4; heart trouble, 1; incipient consumption, 1; measles, 2; malaria, 1; mumps, 1; nervous trouble, 3; neuralgia, 1; water on the knee, 1. There were ten cases of a less serious nature, and eleven cases in which illness was not specified.

First-year Class.

The first-year class numbered three hundred and forty-eight. Of this number forty-nine were reported ill during the year. Classified by diseases, there were the following cases: appendicitis, 2; chicken-pox, 1; eye trouble, 3; fever, 2; grippe, 3; incipient consumption, 1; jaundice, 1; mastoid operation, 1; measles, 3; mumps, 2; nervous trouble, 3; pneumonia, 1; tonsillitis, 6; typhoid fever, 2. Five cases were unimportant, and the remaining thirteen were not specified.

SUMMARY.

	No. in Class	*No. Ill.*	*No. of Deaths.*
Fellows and Graduates	18	—	—
Fourth Year	322	21	1
Third Year	382	43	1
Second Year	458	44	–
First Year	348	49	–
	1,528	157	2

ALFRED E. BURTON.

REPORT OF THE MEDICAL ADVISER.

Office hours have been held in the Peirce Building twice a week throughout the school year. The time set apart for medical visits has been fully utilized, and the work of the Medical Adviser has steadily increased.

Late in the fall of 1903, 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, a plan was suggested by the President which has been carried out since the middle of January, 1904. The time of consultation, instead of being limited to one hour, was extended, when necessary, so that each student who came for advice on a given day should get it. The increase in medical work is shown by the fact that in 1903 one hundred and thirty-one men were treated in the second term, and in 1904 two hundred and eleven. This increase required seventeen hours of extra work, or an average of about one-half hour on each occasion. The time spent per day has, naturally, varied. On eight occasions no extra time was needed, and on eight occasions it took an extra hour to see all the students who came for advice. The new plan has proved a satisfactory way to provide for them all.

The following table gives the number of office visits made and the number of students seen. A few figures for the year 1902–1903 are put in for comparison.

	1904.	1903.
Total number of office visits made	349	254
Total number of different students seen	185	156
Greatest number of students seen per day	11	
Least number of students seen per day	2	
Average number of students seen per day	6	5
Number of students making more than one visit	47	

All the students seen were men, and, as in previous years, the majority found it necessary to come only once, usually for the treatment of some acute and promptly curable condition. Only four students made more than five visits apiece; two of these were surgical cases requiring frequent dressings, and

two were cases of bone tuberculosis, who ultimately left the Institute.

The average number of students seen per day was six. This seems to me as large an average number as can get satisfactory individual attention within the hour.

The following table shows the kind of diseases treated and the number of each: —

CLASSIFICATION OF DISEASES.

Surgical Cases, 35.

Abscess	12	Arthritis	2	Contusion	1
Crushed foot	1	Cut	5	Curvature of spine,	1
Cyst	1	Flat Foot	1	Hermatoma	1
Hernia	2	Ingrowing toe nail	1	Sprain	1
Septic finger	4	Synovitis	1	Wart	1

Nose and Throat, 23.

Coryza	9	Pharyngitis	7	Nasal spur	1
Laryngitis	2	Hypertrophy of tonsils,	1	Post-nasal catarrh	3

Stomach and Bowels, 19.

Acute indigestion	2	Constipation	8	Gastric neurosis	3
Intestinal indigestion,	2	Piles	2	Simple diarrhœa	2

Eyes, 15.

Conjunctivitis	6	Foreign body	2	Imperfect sight	6
Pterigium	1				

Skin, 14.

Acne	1	Dermatitis	1	Eczema	3
Herpes	2	Psoriasis	1	Pediculosis	1
Scabies	3	Ringworm	1	Urticaria	1

Specific Infectious Diseases, 14.

Appendicitis	2	Grippe	2	Malaria	2
Measles	1	Tonsillitis	6	Typhoid	1

Lungs, 12.

Asthma	1	Pulmonary tubercu-		Pleurodynia	2
Bronchitis	6	losis	2	Pleurisy	1

Ears, 9.

Impacted cerumen	3	Polyp	1	Otitis media	5

Genito-urinary, 8.

Albuminuria	2	Balanitis	2	Gonorrhœa	2
Periurethral abscess	1	Varicocele	1		

Heart, 2.

Cardiac neurosis	1	Pericarditis	1		

Miscellaneous, 36.

Civil Service Exam.	7	Debility	15	Insomnia	2
Jaundice	1	Lumbago	1	Neurasthenia	10
Athletic Team Exam.,	6	Advice about Tropics,	1		

A large number of conditions was treated, the most numerous being surgical diseases, digestive disturbances, diseases of the nose and throat, and of the eyes. About a dozen men suffered from severe illnesses, such as appendicitis, typhoid fever, Bright's disease, and crushed foot, which were more or less completely cured after appropriate treatment. Two men had to leave the Institute on account of pulmonary tuberculosis, and two on account of heart disease. Most of the illnesses, however, were acute and promptly curable. A small number of students was referred to specialists for treatment of the eye, ear, or skin. A small number of students was recommended for admission to the Massachusetts General Hospital, where the Institute has free beds, for the treatment of such acute diseases as appendicitis, grippe, typhoid, malaria, pleurisy, etc.

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

The number of cases of contagious diseases among Institute men has been very small; there were seven cases of measles, three of mumps, one of scarlet fever, and three of chickenpox. As it was discovered, however, that there was a strong tendency among the students to cut short the necessary period of isolation after contagious diseases and return to their work, an arrangement was made that each student after recovery from any contagious illness should see the Medical Adviser and obtain from him a signed card stating that he had recovered from his illness and was in a fit condition to return to his classes, and it was required that this card be shown to the Dean and instructor when beginning work.

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

A lecture to the first-year class on the hygiene of student life was given by Professor Sedgwick and two talks on personal hygiene by the Medical Adviser, covering the following

topics: bathing, clothing, exercise, sleep, care of the eyes, the use of tobacco and alcohol, minor ailments, such as constipation, headaches, colds, etc., and emergencies. After a consultation with the President and others, it was decided to add to the above topics a short talk on the prevalence and dangers of venereal diseases. In addition to the lectures and actual work of caring for sick students many letters of parents have been answered, advice has been given to instructors and students about isolation in case of contagious diseases, and an inquiry has been made about the health at graduation of the last two senior classes, to determine, if possible, the effect of the Institute course upon their general health and fitness for mental and physical work.

In January, 1904, a letter was sent to each of the graduates of 1903, stating that information for statistical purposes was desired concerning the health of the last graduating class. The following questions were asked: —

1. Were you absent from class for more than a day at a time on account of illness during your course at the Institute, and, if so, in what year?
2. Did you have difficulty in keeping in reasonably good physical condition?
3. Did you take any regular exercise?
4. How many hours did you allow for sleep?
5. Are you up to your usual weight?
6. How many hours of study a day outside of class-work were necessary?
7. Did you do any work in addition to your work as a student?
8. Did you work through the summer vacation?
9. Did you find the work at the Institute difficult? Was any year especially difficult?
10. Did you take a vacation after graduation? How soon did you begin actual work?

Replies were received from a majority of the class of 1903. Similar information was obtained from nearly all the members of the graduating class of 1904; and in addition the

graduates were requested to report in person to the Medical Adviser, in order that he might make a better estimate of their physical condition at the end of the Institute course. One-half of the class reported in person.

Information was obtained in all from about three hundred men, and the two classes will be considered together in one joint report.

One hundred and sixty-eight men were never absent on account of illness during the four years' course. Ninety-four men were out for a few days on account of slight illnesses. Twenty-nine men were out for a week or more with acute illnesses common among young people, such as appendicitis, measles, mumps, typhoid, grippe, malaria, diphtheria, etc. This was no more illness than one might reasonably expect in four years in such a body of young men under favorable conditions.

Thirty-six men said that they had difficulty in keeping in good physical condition, and in many the cause was not far to seek. Sixteen of these men allowed only six or seven hours of sleep, and twenty-five did not take any regular exercise. One man travelled sixty miles a day by rail and had cold luncheons. Six of them did outside work during the school year, and twenty-four worked through the summer vacation. Of the class of 1903, only five, however, considered a vacation at the end of their course a necessity. All the rest were at work within a month of graduation. It is evident that even the weaker members of this class finished their Institute course in reasonably good condition.

One hundred and seventy-five men took no regular exercise: one hundred and twelve men did. In thirty-nine of the latter cases it was limited to daily walks.

The average number of hours allowed for sleep was seven and one-half hours by the class of 1903, and eight hours by the class of 1904. Seventy-two allowed seven hours or less; only thirty-three allowed over eight hours. There is an evident strong tendency to cut short the hours of sleep, and my

experience with the men makes me feel sure that this is done largely for the sake of work, rather than amusement.

Sixty-five men, or about one-fifth of the whole number, did some outside work during the school year, as draughtsman, tutor, reporter, telegrapher, sexton, etc., or in connection with Institute publications or societies. Two hundred and sixteen men, or over two-thirds of the whole number, worked through the summer vacations in one or more years.

The average daily number of hours of study outside of class-work was three and three-quarters hours, the extremes being one, and eight hours per day. One hundred and one men when asked if the work at the Institute was difficult said "no," a few considered it easy, the majority thought it was "about right," "medium," "neither hard nor easy," or "difficult in parts." The third year was usually considered the hardest. Nine men thought the first year the hardest, twenty-two men the second year, ninety-five men the third year and fifty-six men the fourth.

Of the eighty-five men of the class of 1904 who reported in person, one-quarter were in excellent physical condition, nearly three-quarters were in good physical condition, and only one man was evidently over-tired.

To sum up, this inquiry into the health of the senior classes shows that nearly two-thirds of the men were never absent from class-work on account of illness a day during the course, that only about ten per cent. had an illness of any importance during the four years, and that with very few exceptions the men finished in good physical condition and were ready for work as soon as they could get it.

It is evident that a large number of the men in their enthusiasm for work did not take very good care of themselves; a majority neglected physical exercise and worked through their summer vacations, and more than one-third allowed less than eight hours for sleep. These mistakes in hygiene are specially striking in the small group of men who spoke of having some difficulty in keeping in good physical condition.

The Medical Adviser hopes that the talks on personal hygiene to the entering class and his interviews with students during the year may help to remedy these conditions.

FRANKLIN W. WHITE, M.D.

GRADUATE SCHOOL OF ENGINEERING RESEARCH.

Concerning the Graduate School of Engineering Research only a few words need be said. Several inquiries have been received during the year concerning the school, and especially concerning fellowships in it, but, as a rule, these have come from persons obviously unprepared for the high grade of work expected, and no one has this year been registered, either as a member of the school or as a candidate for the degree of Doctor of Engineering.

It is an interesting fact that very few persons in the United States appear to be either desirous or ready as yet to pursue special researches in engineering science. Reasons for this fact are not difficult to conceive, for the largest and most interesting examples of engineering work are to be found only in actual practice, and these therefore, combining as they generally do the attractiveness of novelty and a practical character with size, can hardly fail to compete successfully with experimental work in engineering institutions. Much of the interest and satisfaction of experimentation can often thus be realized, at the same time that the engineer is earning his living or perhaps receiving substantial financial rewards. In these respects engineering research is likely always to be handicapped, and to differ from research in pure science, which must usually be carried on without hope of reward and without other possibilities of realization than under academic, or at least under endowed, auspices. The fact that none of our own graduates has as yet applied for membership in the Graduate School of Engineering Research is, I think, especially interesting and significant, but, in spite of the obvious

difficulties involved in the plan, I believe that the maintenance of the school is important, as an exhibit of a kind of work greatly to be desired at present, and of a standard which ought to be realized in the future.

W. T. SEDGWICK,
Secretary of the Council.

DEPARTMENTS OF CIVIL ENGINEERING AND SANITARY ENGINEERING.

The year just passed has been a successful one. The class graduating in June numbered thirty-six, which was eleven more than the previous class and the largest class ever graduated, with the exception of that of 1901. If these men have not all found positions, it has not been because of any lack of demand, although, on account of the business depression, the demand for our graduates has been less active than during the past few years. The following table shows the applications received by the department from April to August, inclusive, in 1903 and in 1904: —

	1903.	1904.
Railroad	39	9
Structural	19	7
Teaching	7	7
Hydraulics	3	9
Miscellaneous	24	15
Total	92	47

Since August last, however, the demand for our graduates has increased, and many positions have been offered, which could not be filled. It will be noticed that even this year the number of positions offered exceeded the number of students available and, moreover, many graduates obtained positions through their own efforts, so that there were probably twice as many applications as men to be supplied. We already have applications filed in advance for men of the Class of 1905.

The staff of instruction has suffered a great loss during the year by the death of Mr. Sweet, who has been an assistant or

instructor in hydraulic engineering since 1893. Mr. Sweet was a young man of high character and excellent ability. He carried on his work with great care and conscientiousness, and his modest bearing and quiet, unassuming demeanor won for him the affection of both teachers and students. The vacancy caused by Mr. Sweet's death has been filled, temporarily, by the appointment of Mr. S. H. Thorndike of the Class of 1895, as Instructor in Civil Engineering. Mr. Thorndike has been engaged for a number of years in responsible work in the office of the City Engineer of Boston, and will not entirely relinquish his work with that department.

Five of the assistants of last year resigned their positions to engage in outside work. Their positions have been filled by five graduates of the Class of 1904.

It is the policy of the department to encourage the men on the teaching staff to engage in outside work during the summer vacations, and a number of the members of the staff devoted the past summer to such pursuits. Professors McKibben and Spofford have permanent summer occupations. All of the instructors were also employed, Mr. Breed having been in the employ of the Chicago and Eastern Illinois R.R., in charge of some of the work of elevating the tracks in Chicago for the elimination of grade crossings, and Mr. Hosmer having been in the employ of the city of Cambridge. Mr. Sweet was employed at the time of his death. Of the six assistants four were employed during the whole or part of the summer. The importance of this work for members of the teaching force is very great. It not only enables them to look at engineering problems from the practical and economic point of view, but it enables them to arouse more enthusiasm among the students and to command greater respect from them.

The needs of the department may be specified as follows:

1. We need additional space. The Engineering Library is very much cramped and there is room for only thirty or forty men at the most to be seated at tables, while the fourth-year

class in civil and sanitary engineering alone comprises about seventy men. The bookcases are very nearly filled and in a short time the library will be simply a storehouse for books, with no opportunity for students to consult them at tables. This need for space is independent of any further growth of the number of students in the department. The library should be enlarged to take in the whole front of Engineering A, and this would require that we be given a large drawing-room elsewhere capable of accommodating from seventy to eighty students. We also need a large lecture-room, where large classes can be addressed in subjects which do not require division into sections.

2. We need more teachers in the higher grades. I have already called attention to the fact that we need an assistant professor of hydraulic engineering, to relieve Professor Porter of some of his work and to make it possible to give advanced instruction, if it is called for. Further, in railroad engineering and in surveying the classes are growing so rapidly that we need some additional teachers at least of the grade of instructors.

On account of the fact that the teaching staff is so burdened with the regular work of the school, we are able to offer but little graduate work, and none whatever in some branches; and, although we have frequent application from men who wish to come here to take advanced work, we have frequently been obliged to say that we could not offer them certain courses.

3. We could spend more money each year to advantage in improving and enlarging our equipment, both for field instruction and for apparatus in the hydraulic laboratory. I should also be very glad to be able to increase our collection of photographs and slides, and to feel free to engage more outside lecturers if opportunity should offer; and, in various ways, to strengthen and add to the resources of the department. With larger classes, the field equipment is becoming inadequate.

4. I wish very much that our salaries were more in proportion to what a man of ability might earn in the practice of his profession. It is difficult to induce our best graduates to take up teaching, because there are so many attractive opportunities outside. We have many applications each year for young men to teach in other schools, but the salaries are so meagre that they do not tempt the good men. The same thing is true to a certain extent of the Institute, although we generally succeed in persuading some of our graduates to remain a year or so as assistants. During the past summer there were eight applications for teachers, of which we were able to fill only two.

The course of study in civil engineering has been modified for the present year, preliminary to the changes which follow the increased entrance requirements in modern languages. The field of civil engineering is so broad that it is necessary to teach our students a great number of very different subjects, and indeed it frequently seems as if we were endeavoring to cover too much ground. As a matter of fact some other institutions cover as much ground in professional subjects as we do, or more, although they do not require the students to devote so much time to general and linguistic studies. Our students are working all the time under very high pressure, and they are also obliged to turn so rapidly from one subject to another that they find it difficult to concentrate sufficiently to master any one thoroughly. To remedy this, several of the short courses have been omitted, and it is desired in the future to consolidate some of the remaining courses, so that they may be more consecutive and more effective. It would be very desirable if some means could be found for diminishing still further the number of separate courses and examinations which our students are required to take, and if they could be taken up more consecutively rather than simultaneously, in a manner similar to that which is pursued at the Harvard Medical School. No practicable way, however, has yet been suggested for accomplishing the latter object.

In Course XI. some rearrangements and omissions have been made of a similar nature to those which have been made in Course I., and further rearrangement will follow.

The department is convinced of the necessity of having the curriculum arranged so that dependent studies shall be continuous. If one course depends upon a previous one, it should follow it immediately, and every effort should be made to prevent waste and duplication. The arrangement of the courses in Civil Engineering and Sanitary Engineering is and always has been somewhat defective in these respects, but it has not been practicable to improve it. The opportunity now offered for a rearrangement of these courses, consequent upon the advance in entrance requirements in languages, has suggested the advisability of a somewhat radical modification of the curricula. The teaching force of the department believes that such a radical modification, if it can be accomplished, will be accompanied by a great increase in efficiency.

Professor Allen has taken part in the preparation of a report by a committee of the American Railway Engineering and Maintenance of Way Association, and I have had occasion to co-operate in the preparation of similar reports of committees of the American Society of Civil Engineers, the Association for Testing Materials, and the Railway Engineering and Maintenance of Way Association.

The usual Summer School in Civil Engineering was omitted in the year 1904, partly on account of the small number of applicants. This may have been due in part to the business depression and in part to the fact that the third-year men who desired to take the course had taken it the previous summer, while the second-year men preferred to wait until another year. The school will probably be held in 1905.

GEORGE F. SWAIN.

DEPARTMENTS OF MECHANICAL ENGINEERING AND APPLIED MECHANICS.

The number of students to whom instruction is given in the Departments of Mechanical Engineering and Applied Mechanics is even greater than it was last year. In applied mechanics, instruction is given to five hundred and thirty-five, while the number receiving instruction in mechanical engineering subjects is seven hundred and thirty-six.

In last year's report the following statements were made, viz.: —

"In order to keep up with the times, we are in great need of a very considerable amount of additional apparatus, not only to enable us to pursue investigations along new lines of very great importance from an engineering standpoint, but also to provide for our regular laboratory classes the amount of instruction required."

"The above stated needs have been yearly explained in detail in the recommendations made to the Budget Committee, and it is hoped that the Executive Committee may soon see its way clear to supply them."

These statements apply with equal force this year.

We are constantly carrying on investigations, partly by means of thesis work, and partly by means of the regular laboratory work, and many of them are of great importance from an engineering point of view. While a number of examples of such investigations were mentioned last year, only a few will be referred to here.

1. The problem of the strength and other resisting properties of re-enforced concrete is of such general interest to-day that a joint committee, to make a study of this subject, has been formed from four societies, viz.: the American Society of Civil Engineers, the Engineers of Maintenance of Way, the American Society for Testing Materials, and the Cement Manufacturers.

We have been, and are still, making investigations along these lines, and the fact that I am a member of the committee, and the representa-

tive of the American Society for Testing Materials on the joint committee on Plan and Scope, will aid in establishing a co-operation between our work and that of others.

2. Among the investigations in which we are engaged are several of considerable importance to the locomotive builder, and to the motive power department of railroads, which have been undertaken by us because they are live questions, calling for experimental study. Among these may be mentioned the strength and other resisting properties of connecting rods, the strength of locomotive springs, etc.

3. A series of tests has been made of the 1400 horse-power Curtis Steam Turbine plant of the Nashua Light, Heat and Power Co., at Nashua, N.H.

4. A series of tests has been made of an independently fired superheater to determine its efficiency, etc.

5. Measurements have been made of the flow of superheated steam by means of orifices.

In the instruction in mechanism, printed notes have been used heretofore, but Professors Schwamb and Merrill have just published a treatise on mechanism, which will be of great advantage in connection with the instruction in this subject.

The Department of Applied Mechanics has suffered a severe loss in the death, during the past summer, of Professor Jerome Sondericker, who had been with us since 1885.

The work heretofore performed by him has been divided between Professors Fuller and Johnston, while to Mr. H. W. Hayward has been assigned a portion of the work hitherto performed by them. The duties heretofore performed by Mr. Hayward have been assigned to others, and a sufficient number of additional assistants has been employed to carry on their work.

All the graduates of 1903–04 have found employment.

GAETANO LANZA.

DEPARTMENT OF MINING ENGINEERING AND METALLURGY.

The changes to be noted in the apparatus of the department are chiefly those required for taking care of the increased number of students. To these must be added the replacement of a worn-out machine by a new one.

The Ore-dressing Laboratory has received a pair of 12 x 12 belt-driven rolls, made by Allis Chalmers Company, mounted with friction clutches to throw them into gear with the power. It also has a complete new set of screens to be used with these rolls, carefully computed according to Rittinger's scale of sizes. An addition made last year, but not noted in the President's Report, is a new system of tanks to be used with the concentrating machinery, eight of them in all. They are supplied with centrifugal pumps, so that the water can make the circuit, doing its work of concentration on the machines, and returning to the tank to be cleared of fine mud by settling, preparatory to being used again. These tanks are mounted in duplicate, so that, if one tank is charged with the run of yesterday, there is another one ready to make a test to-day.

In the Metallurgical Laboratory, including that used for instruction in heat and metallography, there have been added two resistance heating furnaces and two rheostats.

In the Assaying Laboratory four Becker pulp balances and two Keller button balances have been added.

To increase the efficiency of the reports of the week's work, a neostyle has been supplied for preparing the week's report and placing it in the hands of the students.

On account of the additional demand upon his time in analytical chemistry, Dr. Fay has been obliged to give up the work in metallography, and Professor Sauveur of the Lawrence Scientific School, Harvard University, has undertaken it.

The summer school this year was carried out on new lines, with the title the "George Crocker Summer School of Mining Engineering," and was made possible by the generous gift of $12,000 made by Mr. Crocker. It was attended by students from Columbia University, Harvard University, the Massachusetts Institute of Technology, and Yale University. The students of the Colorado School of Mines were also invited to take part. Mining and milling were studied at Silver Plume and Idaho Springs, and placer work at Breckinridge, Colorado. Six weeks were spent in this line of work; at the end of this period the students of the Institute made a metallurgical trip of one week to visit the smelters and cyanide plants of Denver, Colorado Springs, Cripple Creek, Cañon City, Florence, and Pueblo. The reports from the students and also from the instructors show the summer school to have been a great success.

To do its present work to the best advantage, the Mining Department needs double its present floor space. If it is to expand to advantage, it needs three times the space. From present appearances, we shall probably be able to care for the students this year and next year in the assaying department. We shall, however, have every desk and locker occupied. Metallography is especially cramped, as its only domicile is the two tables in the middle of the museum. The space in the museum has also been called upon for some of the assaying balances.

Professor Richards has completed a new note-book for the third-year mining engineering of the first term, and is now preparing one for the second term. The note-book that was contemplated for the second-term mining engineering of the fourth year is postponed by the offer of Professor Miller to take that class of students.

Professor Hofman's new Notes on the Metallurgy of Iron are ready for use with the present class. They are revised and brought up to date.

Professor Lodge has prepared a new note-book on assaying,

together with a portion of the fourth-year laboratory work. This note-book includes a résumé of the investigations made by students in their theses for the past ten years or more, and is a valuable contribution to the subject. The library has received the missing numbers of the *Comptes Rendus Mensuels*, Société de l'Industrie Minérale; the series begins at the year 1847.

Assistant W. P. Davis has classified and listed the drawings and blue prints of the department, making them handier for use.

The museum has received from Mr. A. L. Davis a fine set of samples of crucible steel, showing fractures of different per cents. of carbon and changes in color and structure in process of annealing.

Professor Richards presented a paper on "The Relation of Mining Engineering to Other Fields," before the International Congress of Arts and Sciences at St. Louis.

ROBERT H. RICHARDS.

DEPARTMENT OF ARCHITECTURE.

Last year was a very successful one for the department. A strong graduate class set the pace to which the undergraduate class finely responded. It was possible to send two exhibits of architectural work to St. Louis, one of which was to represent the Institute as a Land Grant College. In addition to this, the regular exhibition at the end of the term was the best we ever had.

The good influence of the graduate class makes us desire more and more to have the third- and fourth-year classes brought in direct contact with it and its instructors, and to this end we hope that it will be possible to have such necessary changes made in the drawing-rooms as we asked for last year.

The Rotch Prize of $200 for the regular student making

the best record during the four years was given to Miss Eliza Codd, and the one of $200 to the special student doing the best work during two years was equally divided between Mr. L. Schwartz and Mr. A. P. Wadsworth. The Boston Society of Architects also gave two prizes of the value of $50 each in books, one to Mr. O. M. Wiard and one to Mr. H. S. Pitts. These prizes were given for skill in design; the problem being approved by the Society, and ability in solving it decided by a jury of its members.

Mr. G. C. Glover, the first recipient of the Perkins Graduate Scholarship, has recently returned from Europe. His year has been very successful, and a proof of the excellence of his work is shown by its admission to the Paris Salon. Mr. G. B. Ford, who is aided in his studies by the Swett Fellowship, is still in Europe devoting his time mainly to the Ecole des Beaux-Arts at Paris, of which he is a member. Both these young men have met with most gratifying results the responsibility placed upon them, and we sincerely hope that other fellowships may fall to the department for the good of our graduate class.

The fourth-year class of last year showed a just appreciation of the opportunities they had profited by, by establishing a prize for third-year work. The spirit which prompted this act is best shown in their own words. "In consideration of the great benefit to the students of the fourth year resulting from the prizes offered by the Boston Society of Architects, the members of the Class of 1904, desiring to have similar opportunities offered to students of the third year, do hereby pledge themselves to contribute one dollar annually towards the foundation of a fund to be known as the 'Class of 1904 Competition Prize.' From the capital of this fund are to be given two prizes of the value of ten dollars each to the regular and special students whose designs shall be placed first in a competition to be held between the Christmas and the Mid-year recesses."

This year has opened with every table occupied, and with a

large number of college graduates. An interesting feature is that the college-bred man is more desirous of adding the Institute degree to the one he already possesses, or, if he prefers to rest as a "special," he is not so likely to limit himself to the æsthetic side of his profession as formerly, but, in the interest of scientific construction, adds the necessary mathematics to his course. It has been found that the courses at the Paris Beaux-Arts, if the student is to take his degree there, are somewhat more exacting than at the Institute. This has had its good influence here, as shown by the above results. Another cause of this change is undoubtedly the steadily increasing demand for engineering knowledge in all important work; but the fact remains that the association of construction and design is coming to receive its proper recognition.

FRANCIS W. CHANDLER.

DEPARTMENTS OF CHEMISTRY AND CHEMICAL ENGINEERING.

In the withdrawal of Professors Willis R. Whitney and James F. Norris from active participation in its work, the department has lost the services of two of the most valued members of its instructing staff, whether regarded as able investigators in their chosen fields, or as inspiring teachers. Professor Whitney will devote his entire time to the direction of the research laboratories of the General Electric Company at Schenectady, retaining, however, a connection with the department as Non-resident Associate Professor, while Professor Norris has accepted a professorship in chemistry at Simmons College and is in charge of that department of the college work.

The Chemical Department is, however, fortunate in having other instructors at hand who were able and willing to take up the work which Professors Whitney and Norris have laid

down, and who will endeavor to carry it on in the same helpful spirit that has heretofore prevailed. The instruction in theoretical chemistry, formerly in Dr. Whitney's charge, is now given in part by Professor Noyes, in part by Dr. John W. Brown, and in part by Professor Goodwin of the Department of Physics, while the Laboratory of Organic Chemistry and the lecture courses which were formerly under Dr. Norris' care are now intrusted to Professor F. Jewett Moore. This transfer has, in turn, made necessary a re-arrangement of the instructing force in analytical chemistry, by which Professor Fay assumes charge of the entire work in this branch of the department, except that given to first-year students, and, to this end, is relieved from his work in metallography and is given additional assistance. An arrangement of this character is particularly desirable at this time, in view of the many problems presented by the changes in the Course in Mining Engineering, as a result of which the work of students in this Course must undergo extensive revision; and the effect is also likely to be indirectly beneficial with respect to the work of all students in analytical chemistry. This much-desired introduction of this subject into the second year of the Course in Mining Engineering makes it necessary to accommodate about forty additional students in the analytical laboratories. This it has been possible to do for the present year, owing to an apparent slight decrease in the number of students of the second-year class who have elected Courses which include chemical work beyond the first year. Of a total of two hundred and twenty-nine desks, about ten are now unoccupied.

With the opening of the present year there has been a marked and gratifying increase in the number of graduate students in chemistry. These now number eight, of whom seven are now candidates for the degree of Doctor of Philosophy and the other expects to become a candidate for this degree. Of these, five expect to work mainly in physical chemistry, two in inorganic chemistry, and one in organic chemistry. It has been necessary to equip an additional

laboratory in Engineering C for the use of some of these men, a part of whom also find quarters in the Research Laboratories of Physical Chemistry. It is undoubtedly due to the establishment of the Research Laboratory under the direction of Professor Noyes that this graduate work has been stimulated and it should also be stated that the helpful and inspiring influence of this laboratory is manifest in many ways among the members of the instructing staff of the Chemical Department, especially among its junior members.

The Summer School of Industrial Chemistry, under the direction of Professor Thorp, was attended by twelve students, and lasted from the ninth to the twenty-fifth of June, during a part of which period Professor Walker also accompanied the party. In all twenty-eight plants were visited, as follows: —

Arnold Print Works, North Adams, Mass.; Stamford Chemical Co., Stamford, Vt.; West Virginia Pulp & Paper Co., Mechanicville, N.Y.; American Hide & Leather Co., Ballston, N.Y.; International Paper Co., Glens Falls, N.Y.; Union Bag & Paper Co., Fenimore, N.Y.; Salt Springs Solar Salt Co., Syracuse, N.Y.; Crucible Steel Co., Syracuse, N.Y.; Straight Line Engine Works, Syracuse, N.Y.; Onondaga Pottery Co., Syracuse, N.Y.; Empire Portland Cement Co., Warners, N.Y.; Vacuum Oil Co., Olean and Rochester, N.Y.; Worcester Salt Co., Silver Springs, N.Y.; Rochester Glass Works, Eastman Kodak Co., Curtice Brothers, Bartholomay Brewing Co., and Pfaudler Co., (Enameled Steel Tanks) at Rochester, N.Y.; National Battery Co., Lackawanna Steel Co., Larkin Soap Co., Buffalo Pottery Co., Buffalo Smelting Works, Standard Oil Co. (Atlas Works), Pratt & Lambert Co., at Buffalo, N.Y.; Natural Food Co., Niagara Falls Power Co., and Niagara Falls Research Laboratory at Niagara Falls, N.Y.

Every effort was made by those in charge of these plants to promote the interests of our students and in a number of instances luncheons and mementoes of the trip were provided for the entire party. Special courtesies were also extended

by the Institute graduates who are located at the works of the Eastman Kodak Co. As in former years, evening conferences for the comparison of notes and general discussion were an important feature of the instruction. These usually lasted about two hours, and the interest in them was well sustained throughout. The school may be regarded as eminently successful, and the written reports (or abstracts of them), which are also required from each student who took part in the trip, will be placed in the Chemical Library.

The division of the first-year class into two sections with reference to their previous experience in chemistry, referred to last year, has proved to be of as great advantage as was then anticipated, and the tentative effort of last year is being developed into a carefully studied plan which involves a revision of the laboratory work assigned to both sections under the charge of Professor Bardwell, who took up this work this fall after a year's absence for study at Leipsic University.

The changes in the courses of instruction in Chemistry and in Chemical Engineering during the past year have been few. In the former the time devoted to analytic geometry of the first year has been extended, with the consequent omission of the instruction in wood and metal turning, and in the senior year of the Chemical Engineering Course the lecture course in theoretical chemistry has been made a required subject. The demand for graduates from both of these Courses is gratifying in its constancy and has been considerably in excess of the supply for a number of years. This is notably true of the year just past.

The need for more adequate accommodations for the work of the department is more keenly felt each year. Not only are certain branches of the instruction suffering from the congested state of the laboratories allotted to them, but the department as a whole is lessened in efficiency because of the isolation of portions of its work in separate buildings (four in all), away from the Chemical Library and the sources of

supplies, and so widely distributed that community of interest among the members of the department working in different lines is seriously diminished.

A re-united department in a building designed for the purpose of chemical instruction, with the much-needed supply of small laboratories for research, advanced, or special work, is imperatively needed to permit of the development of the departmental work which has been for some years, and is still, prohibited by the impossibility of attempting more in the space at command.

H. P. TALBOT.

RESEARCH LABORATORY OF PHYSICAL CHEMISTRY.

The Research Laboratory has suffered a severe loss in its professorial staff by the withdrawal of Dr. W. R. Whitney from active participation in its work. It has, however, been greatly strengthened on this side by the appointment as Assistant Professor of Physico-Chemical Research of Dr. W. D. Coolidge, to whose co-operation in the equipment and direction of the laboratory and in the supervision of researches the success attained during the past year is in large measure due. Professor H. M. Goodwin continues to take charge of the researches carried out with the help of the grant from the William E. Hale fund. The research staff consists, in addition, of seven research associates and assistants who are devoting their time almost exclusively to original investigations. Among these are graduates of the Institute, of Yale and De Pauw Universities, and of the Universities of Leipsic, Kioto, and California.

Upon the financial side the laboratory has been again assisted by a grant of $1,000 from the William E. Hale Research Fund and by a renewal of the grant of $2,000 from the Carnegie Institution to Professor A. A. Noyes in aid of certain electrochemical investigations which are being carried on in the laboratory. From Mr. Samuel Cabot, too, who

has assisted the Institute in so many other directions, a substantial contribution has been received. The laboratory is also indebted to Captain E. L. Zalinski for a generous gift by means of which the lighting system has been provided with prismatic reflectors.

Up to the present time six contributions to scientific journals, describing the researches made in the laboratory since its establishment in September, 1903, have been published. A list of these, as well as of the other publications of members of the research staff, is included elsewhere. The investigations, referred to in the Report of last year, upon the conductivity of aqueous solutions at high temperatures, upon the conductivity of fused salts, and upon the migration of colloids are being continued by Professor W. D. Coolidge, Mr. A. C. Melcher, and Mr. Y. Kato, by Mr. R. D. Mailey, and by Dr. J. C. Blake, respectively. Researches have been begun upon the solubility of salts in water at high temperatures b3 Mr. R. B. Sosman, upon the dissociation-relations of phosphoric acid by Mr. G. A. Abbott, upon the heat of solution of substances in relation to the ionic theory by Mr. W. H. Whitcomb, upon the properties of liquid ammonia solutions by Mr. C. A. Kraus, and upon the rate of decomposition of minerals by water by Dr. W. Böttger.

Especially worthy of mention seems the fact that the establishment of the Research Laboratory has led a considerable number of graduate students to undertake advanced study at the Institute in the subjects of physical and inorganic chemistry. There are at the present time eight candidates pursuing in the laboratory such courses of study for the degree of Doctor of Philosophy. It is to be hoped that this may be the beginning of a new development of advanced work at the Institute, and that it may soon be possible to start similar research laboratories devoted to other branches of science, especially to the other divisions of physics and chemistry. Such laboratories cannot fail to react in an important way on the character of our undergraduate instruction and on the scientific spirit of our students.

An important feature of the work of the laboratory is the advanced instruction given in connection with it. This consists for the most part of seminar meetings and lecture courses devoted to special topics of physical chemistry, which are varied from year to year. This year the courses embrace the subjects of chemical equilibrium, radio-activity, solid solutions, metals and alloys, photochemistry, and the constitution of inorganic substances in solution. The last-named course is to be given in German by Dr. W. Böttger during the coming term. Instruction on the manipulative side, consisting in a course in glass-blowing under the charge of Mr. C. A. Kraus, is also provided. Once a week, too, all workers in the laboratory meet to discuss the researches in progress there and the recent periodical literature.

A. A. NOYES.

DEPARTMENT OF ELECTRICAL ENGINEERING.

The development of the Electrical Engineering Laboratory during this past year has been such as to bring the instruction into much closer touch with the lectures in theoretical electricity, the experiments being planned to bring out fundamental principles, rather than to be mere tests of efficiency or regulation of electrical apparatus. The new system of laboratory instruction with preliminary reports and conferences is giving most gratifying results, the students showing a marked gain in independence and in understanding of the work. This year for the first time an entire term in the laboratory is devoted to alternating current work.

Considerable use has been made of the power plant for purposes of instruction, including a set of five tests upon the 480-kilowatt unit, with cooling tower, condensing plant, and all auxiliaries necessary to its complete operation as a generating station. The object and results of these tests were thoroughly discussed in the class-room. This present year it is purposed to give the junior students in this department the

major portion of their instruction in mechanical engineering laboratory work in our own power plant. There has been planned a system of excursions, under the supervision of the department, to various electric lighting and power plants of different types situated in Boston and vicinity, and, in connection with these, formal reports are to be presented by the students and discussed in consultation with them.

Many of the senior students have already planned their theses and in some cases the work is well under way. This early determination of thesis subjects, with the possibility of a more careful consideration of the matter for investigation, will be a distinct advantage in the work along these lines.

The Standardizing Laboratory is called upon, not only for the regular work of instruction, but also to provide facilities for the calibration of many instruments used in thesis work in the Electrical Engineering Department and in other departments of the Institute. For direct current work the laboratory is well supplied with apparatus, but for certain alternating current calibrations additions to the equipment are greatly needed. These additions would result in economy of time to those students engaged in thesis work and would enable them to devote their energies to the problems in hand, rather than to the preparation for attacking them.

The facilities of this laboratory are freely offered to other departments of the Institute, and during the past year the Departments of Physics, of Physico-Chemical Research, of Mechanical Engineering, and of Naval Architecture have availed themselves of the privilege. The increasing number of tests involving electrical measurements made by students in mechanical engineering will probably cause this part of the work to assume great importance in the near future.

Considerable attention is given to special devices needed in thesis work. During the past year several recording instruments which served their purposes have been designed, and much time has been devoted to the development of the oscillograph. Experience has demonstrated that the Duddell form

of instrument is unsuited to general laboratory use, on account of its mechanical delicacy and the consequent delay and expense incident to repairs. The form of instrument which has been developed in the department is simple in its mechanical arrangements, the parts are so accessible that repairs are readily made, and the instrument is now one which can be put in the hands of students for regular work.

The Augustus Lowell Laboratories are called on to furnish facilities for many students in other departments of the Institute, there being this year seventy-five students in mining and mechanical engineering who are carrying on optional laboratory work in connection with the course in dynamo electric machinery. This class of students from other departments promises to increase in numbers in the immediate future, and to give them proper instruction it will be necessary to have additional assistance in the laboratory. It is also highly desirable to introduce a greater amount of recitation work than at present exists in connection with some of the lecture courses, and this also will necessitate an increase in the instructing staff of the department. We are in need of two small recitation rooms for our own use exclusively, to be devoted to laboratory conferences and journal meetings. These come at irregular times and cannot, therefore, be planned for definitely at the beginning of each term.

This department is at present assisting the Departments of Mechanical Engineering and Naval Architecture in connection with certain electrical work involved in the proper carrying out of thesis investigations. It will also be called upon this present year to furnish evening instruction to about thirty men belonging to the Lowell Institute School for Industrial Foremen.

Arrangements have been completed for supplying power to the Department of Physics for use in the Laboratories both of Heat Measurement, and of Physical Chemistry. It is interesting to note the demands made by the Walker and Rogers Buildings upon the power plant. Previous to the

completion of this plant, the maximum load of these two buildings was a little less than one hundred kilowatts, including the demand for laboratory work then carried out in the basement of the Walker Building. Since the taking of the entire electrical load by the plant of the Electrical Engineering Department, the maximum demand for these buildings has shown an increase of more than ten per cent. When the equipment now in process of installation comes into use, there will be a still further increase. The present total output of the power plant is about three hundred and ten kilowatts.

During the summer there have been designed and built in the department transformers illustrating the various features of polyphase systems, as well as showing the effect on efficiency and regulation of varying amounts of iron and copper. These transformers are to be used for regular work in the laboratory. A number of alternating current measuring instruments has been added to the equipment, but the supply at present available for purposes of laboratory instruction is inadequate fully to meet the demands. A room has recently been fitted up for an instrument room and a card catalogue of all instruments in the department has been begun. An automatic voltage regulator for maintaining constant potential of distribution has been designed in the department and is soon to be installed. There has also been added a number of lecture-room models and of working diagrams.

It would be of the greatest benefit, both from the standpoint of investigation and also for regular work in the laboratory, if a storage battery of fairly large capacity could be installed in the Lowell Building. This would obviate the necessity for drawing current from the Edison system, with its consequent expense, and with the care which the battery would receive in the department the depreciation should be extremely small.

The pressing needs of the department are then: additional instructors; additional rooms for recitation work; additional

equipment in units of small capacity; additional equipment in measuring instruments; and a storage battery of large capacity.

H. E. CLIFFORD.

DEPARTMENT OF BIOLOGY.

The routine work of the Department of Biology has gone forward smoothly and successfully. Two new courses of instruction have been introduced, namely, one in municipal laboratory methods and one in plant physiology, both in the fourth year. There have sprung up in connection with numerous state and municipal Boards of Health within the last few years laboratories for the chemical and bacterial examination of materials sent in by physicians, for the analysis of water, ice, sewage, milk and the like; for the examination of wall papers for arsenic; and for general usefulness in connection with the practical work of active Boards of Health. Several of our graduates having found useful positions in connection with such laboratories, we have introduced a new course of instruction covering as far as possible the principles and subjects likely to be dealt with in the future by such laboratories. The responsibility for the course has been assigned to Mr. Winslow, Instructor in Sanitary Biology, who is now teaching in the subject a class of four seniors and one graduate student. The course in plant physiology is designed to supplement and broaden that in animal physiology and is given this year by Professor Sedgwick, but will hereafter be taught by Dr. Stiles, who has charge of the lectures and laboratory work in animal physiology.

A much-needed and most welcome gift of six high-power microscopes was made to the department during the year by Dr. Charles G. Weld, and the microscopes have been in almost constant use, ever since their arrival, in our bacteriological and zymological teaching and in advanced work.

The several members of the staff of the department have

been diligently occupied, in addition to their teaching, in scientific or public work in various directions. Professor Sedgwick finished in May his testimony in the Chicago–St. Louis Drainage Canal case, and spent the summer in completing the work upon physiology and hygiene which, in collaboration with Professor Hough formerly of the Department, he has for some time had under way. He was in September one of the two appointed speakers in the Public Health Section of the International Congress of Arts and Science of the Louisiana Purchase Exposition, his subject being "The Relation of Public Health Science to Other Sciences."

Professor Prescott has prosecuted and carried nearly to completion an interesting and important research upon the efficiency of commercial milk pasteurizers,— machines intended for the purification of the milk supply of cities,— especially as regards their efficiency in the destruction of putrefactive and pathogenic micro-organisms. He has also continued his investigations in the technique of the canning industry,— this time studying canned tomatoes,— and has also given some attention to the micro-organisms involved in the production of champagne, and in some processes of the tanning of leather. Together with Mr. Winslow, Instructor in Sanitary Biology, he has published a small but much-needed work on the Bacteriological Examination of Water.

Mr. Winslow, in addition to his duties as instructor, and as Biologist in Charge of the Sanitary Research Laboratory and Sewage Experiment Station, has found time not only to complete the volume just referred to, but also to prepare a work upon applied microscopy for the use of our classes,— chiefly chemists and biologists,— in that subject in the second year. It is hoped that this may be ready for the class during the present session.

Mr. W. Lyman Underwood, Lecturer on Sanitary Biology, who is also Chairman of the Board of Health of Belmont, published in June, 1903, at his own expense a valuable pamphlet on the mosquito nuisance, for the Board of Health of

Belmont. This pamphlet, strikingly illustrated with photographs made by Mr. Underwood, was also published with some modifications in the *Popular Science Monthly* in the autumn of the same year. Not long afterward a request was received from the General Board of Health of Bermuda for a large number of copies of the pamphlet. In compliance with this request Mr. Underwood, after bringing the subject up to date, prepared and sent to Bermuda for the use of the Bermuda Board of Health a large special edition of the pamphlet.

Messrs. Winslow and Underwood have been much engaged during the year in an extensive investigation of the sanitary conditions of the Fresh Pond and Mystic River Marshes at the request, and on behalf of, the Metropolitan Park Commission, and have already reached interesting and valuable conclusions, which will soon be published.

Dr. Arthur W. Weysse, Instructor in Zoölogy, has completed and published a large and important text-book on General Zoölogy, based upon the course of instruction in that subject given by himself for several years past in our department. Toward the end of the college year Dr. Weysse was appointed Assistant Professor of Biology in Boston University, and in consequence has been obliged to give up a large part of his teaching at the Institute. Dr. Frederick A. Woods, formerly a student in the Biological Department, has been secured to take charge for the current year of some of the classes hitherto taught by Dr. Weysse.

The physical conditions of the Department are now, on the whole, good. There are needed, however, (1) a special room for Professor Prescott's investigations in Industrial Biology. For these the research laboratory is inadequate, as considerable space is required for elaborate apparatus and for experiments on a large and practical scale. It is greatly to be desired that Room 20, Engineering B, should be assigned to us for this purpose. (2) We need also a number of microscopes specially provided with micro-spectroscopes and micro-

polariscopes for the use of the class in applied microscopy. (3) We ought to have an entirely new outfit of microscopes for the classes in general biology. A number of our microscopes are not of modern construction and have been in use for many years. Much time and labor might be saved to the students by supplying them with the latest and best working instruments.

W. T. SEDGWICK.

THE SANITARY RESEARCH LABORATORY AND SEWAGE EXPERIMENT STATION.

The work of the Laboratory and Experiment Station, located at No. 786 Albany Street and maintained by the generous benefaction of a donor who desires to remain anonymous, has been actively prosecuted during the year as nearly as possible along the lines indicated by the donor in his deed of gift. The station was equipped during the spring of 1903, and in June of that year work was begun. The present report, therefore, covers the first complete year of work, and is necessarily a report of progress.

As an indispensable preliminary investigation, and the basis of other work, we have carried out an exhaustive study of the chemical and bacteriological composition of the sewage of the South Metropolitan District with special reference to hourly and diurnal variations. This constitutes, we believe, the most thorough study of the composition of the sewage of a great seaboard city which has yet been made anywhere, and prepares the way for a searching examination of the processes of disposal by dilution now employed in the disposal of the sewage of both the North and the South Metropolitan Districts, in Boston Harbor. It will soon be published.

Experiments on a practical scale have also been carried on upon the various methods of sewage purification at present favorably known to engineering science, including intermittent sand-filtration; septic-tank treatment; contact-filtration; and

continuous sand-filtration,— otherwise known as the method of "trickling" filters. Inasmuch as the time element is of fundamental importance in experiments of this character,— the slow clogging of filters under prolonged operation being one of the most serious problems with which municipalities embarking practically upon any one of these methods have to deal,— no conclusions can be drawn at this time as to the final merits of these different methods.

Early in 1904 it became necessary, in view of the experience thus far accumulated, to enlarge the experimental plant, but since that time all experiments have been carried out on parallel and continuous lines. It is now hoped to prepare a full report at the end of another year, although the two years of continuous operation which will then have elapsed are too short a period for securing the best results. Research laboratories and experiment stations of this kind gain in value in increasing measure with time and experience, and the most valuable results can be expected only after years of accumulated experimentation and study. It is intended, nevertheless, to bring together all the results at the end of another year and to publish at that time a full report of the work thus far accomplished as well as a review of all other work and experience in sewage purification, both in this country and abroad. By thus compiling and co-ordinating the results of our own experiments and those of others, all over the world, it is believed that the fundamental principles of sewage purification can be worked out and exhibited far more satisfactorily and in a more practically useful manner than ever before.

A detailed study of the chemical methods of sewage analysis has already been completed by Mr. E. B. Phelps, Research Chemist and Bacteriologist at the Station, with the result of a clarifying of current ideas and a simplification and standardization of methods used. Bacteriological investigations have also been made which throw much light upon the bacteriology of crude and purified sewage, and a new method for the direct microscopical enumeration of bacteria has been developed by

Mr. Winslow, the biologist-in-charge. Two original papers on the methods and results of chemical analysis of sewage, two on the bacteriology of sewage, and one on the chemical changes taking place in the contact sewage filter, are either already published or nearly ready for publication.

In accordance with the expressed wish of the donor, the publication of leaflets more or less closely connected with matters of sewage and sewage disposal has been begun in a series of popular essays entitled "Dirt and Disease." Of these essays three, in the form of simple leaflets, have already been published, namely, No. 1, "Why Dirt is Dangerous," No. 2, "Why Dirty Milk is Dangerous," No. 3, "Why Dirty Water [including sewage] is Dangerous." These leaflets have thus far been prepared by the Director and have had as their place of original publication the pages of the *Journal of the Massachusetts Association of Boards of Health.* They have already had a considerable circulation among Boards of Health, milk contractors, public school authorities, etc., and the demand for them is steadily increasing.

A few minor sewage problems, for one reason or another especially urgent or instructive, have also been attacked at the station, with results more or less satisfactory, namely, the treatment of waste from a glue factory; the treatment of sewage rich in strawboard waste; and the purification of sewage from isolated country houses of large size.

The station has been repeatedly visited by classes from the Institute and other institutions, and has also abundantly proved its practical value for thesis and other investigations by Institute students and workers in sanitary biology, sanitary engineering, and sanitary chemistry.

Our thanks are especially due for numerous and repeated courtesies, and for much valuable assistance, to Mr. Edgar S. Dorr, M. I. T. '75, Chief Engineer of the Sewer Division of the City of Boston, and also to Leonard Metcalf, M. I. T. '92, for the design of a grit chamber for our main sewage intake-pipe.

W. T. SEDGWICK, *Director.*

DEPARTMENT OF PHYSICS.

The rapid increase in the number of students attending the lectures in general physics has caused serious and increasing difficulty for a number of years past; and this not only on account of the limited capacity of our largest lecture-room, but also for the reason that it is not conducive to the most efficient instruction to have over a certain number in attendance at one time. With a course as thorough as our own, it is important that every student should be able readily to hear everything that is said and to see every experiment without difficulty. Matters were brought to a crisis by the unprecedented size of the second-year class in 1903–04, and the difficulty was met in the only possible manner, as had been done a number of years ago in the case of the lectures upon chemistry to the first-year students. The class was divided into two sections, and lectures were given to these upon alternate days. One section was placed in charge of Dr. Wendell, while the writer took charge of the other. The results have proved entirely satisfactory, and it has been a great relief to have only to deal with sections of such size as can be comfortably seated in the lecture-room.

The transference of Professor Clifford to the Department of Electrical Engineering made it impossible for him longer to continue to deliver to the third-year class the course of lectures on heat which he had given successfully for a number of years. They were, therefore, transferred to Professor Norton, an arrangement especially appropriate, as his position in charge of the Laboratory of Heat Measurements allows of a closer connection between the lectures and subsequent laboratory work than would easily be secured under other circumstances.

During the past year the number of students taking work in the Physical Laboratory has been the largest in the history of the school. In the first term instruction was given to two

hundred and ninety-six students per week and in the second term to three hundred and five. To meet the increase, two steps were imperative: first, a very considerable duplication of apparatus, and, second, a material increase in the number of laboratory sections. In order that the number of students should not exceed twenty in each section, a number which experience has shown to be the maximum for efficient instruction, it was found necessary to lengthen the working hours, so that the laboratory is now open continuously during school hours from 9 A.M. Monday until 1 P.M. Saturday.

With a somewhat increased staff of assistants it has been found possible to keep the apparatus in proper repair and to maintain the usual ratio of instructors to students, namely one instructor and one assistant to each section of not over twenty students. The days of small sections and close personal relations between instructor and student have now unfortunately passed for the large general courses.

It will be seen that we have practically reached the limit of the capacity of the present Laboratory of General Physics, as a further increase of size of sections, even with a proportional increase in the number of instructors and assistants, will unquestionably result in less satisfactory work. Good physical manipulation cannot be performed under crowded conditions with the resulting general confusion. To meet, therefore, any further material increase in the size of our classes, the laboratory equipment will have to be duplicated and installed in separate rooms, so that independent sections can be accommodated simultaneously.

An innovation in the instruction has been tried with marked success during the past year, and will be continued the present year. The new laboratory notes by Dr. Goodwin have been issued in two parts, (1) the introductory work on General Physical Measurements and Mechanics, and (2) the more difficult work on Heat. The students are at first allowed to refer to their notes in the laboratory until they become familiar with the more fundamental

instruments and methods, but in the latter part of the course no notes are allowed in the laboratory, all preparation for the work being done previous to the exercise. In carrying out their experiments the students are thus led to rely more and more upon themselves and their acquired knowledge rather than upon printed directions, and insufficient preparation becomes quickly evident.

The enormous labor involved in the critical examination of between 4,000 and 5,000 laboratory reports in the year has been most conscientiously performed by Mr. Drisko, whose individual conferences with the students on these reports and their work form one of the most valuable features of the instruction.

To bring the students into closer contact with the instructors, and to emphasize even more than in the past the value of precision discussions in connection with all experimental work, the lecture course on physical measurements and precision of measurements which accompanies the laboratory work of Courses V., VI., and VIII. will be given hereafter by recitations to small sections. This change will involve a very material increase in the work on the part of the laboratory staff, but it is believed that the advantages to be derived from class-room conferences on this subject warrant the undertaking. The Departments of Mechanical Engineering, Mining Engineering, and Naval Architecture have also been able to introduce this work into their revised schedules which go into effect next year. The introduction of a course in precision of measurements into the schedules of all Engineering Courses has long been desired by the Department of Physics, as it would undoubtedly greatly enhance the value of the whole laboratory instruction to the students in those Courses.

In the Laboratory of Heat Measurements, in care of Professor Norton, the increased size of the classes has necessitated the duplication of much apparatus, and has seriously hampered the development of new work. Owing to the some-

what irregular way in which this laboratory has grown, and because in large part of its being a pioneer in the field, there is now an urgent need of a considerable expenditure of time and money for the reconstruction of much of our most important apparatus, which has chiefly been made from original designs and in our own shop, and which, in the light of the experience acquired in its use, can be greatly improved. The standardizing apparatus for mercury thermometers, the standard air thermometer, the controlled boiling point calibration apparatus, the recording pyrometers, thermal conductivity apparatus, and platinum resistance thermometers, need to be put in permanent shape and in most instances duplicated.

The electrical supply for resistance and carbon-reduction furnaces is now available, and several such furnaces are in use for instruction in the measurement and control of temperatures about 1,500° C.

Through the kindness of Mr. Samuel Cabot and Mr. Henry A. Morss, we have been furnished with the necessary funds to purchase the small refrigerating plant referred to in the report of last year as being greatly needed, and the apparatus will soon be contracted for. This will make it possible to furnish instruction in the measurement of low temperatures, and to determine conductivities and specific heats under the condition of actual service in the art of refrigeration.

During the past year the new Laboratory of Electro-Chemistry, in charge of Dr. Goodwin, has been fully equipped, and the previously announced courses of instruction were given to the members of the fourth-year class, which was the first class to elect the Option in Electro-Chemistry. A description of the arrangement and general equipment which had been planned for this laboratory was given in the President's Report for 1903. This has been followed out without material change, and has given eminent satisfaction in every respect. The general opinion expressed by recent scientific and professional visitors to the laboratory has been that for completeness of equipment and convenience of arrangement it is

unique. The most modern laboratory of the kind in Germany, although much larger, does not at all provide such facilities and equipment for each student as are to be found here. Ten of the twelve desks available were equipped last year, and all were immediately applied for, as is also the case this year. Increase beyond the present numbers is not desirable, at least until the present facilities can be duplicated; for under the present arrangement each student possesses a complete equipment of electro-chemical apparatus, and it is thereby possible to keep the laboratory instruction of the whole class in the closest touch with the lecture-room instruction. As the conditions to be met in dealing with large classes necessitate a wider and wider departure from this ideal system of instruc tion, the effectiveness and value of the instruction would inevitably diminish.

The installation for work in applied electro-chemistry has also given great satisfaction. The graded 50-kilowatt transformer with switchboard has proved admirably adapted for all classes of electric furnace work. This, together with the 25-kilowatt, Holtzer Cabot, direct current generator and the set of large accumulators, provides all the necessary sources of electrical energy at present needed for work on electro-depositions, electrolytic refining and winning of metals in the wet way and in the electric furnace, and on electro-chemical preparations in general. It is the aim of the instruction in the technical work to attempt to carry out processes not on a commercial scale, but rather on a scale sufficiently large to illustrate the principles involved and the chief difficulties to be overcome. In the work of installing the plant and in the development of new laboratory methods, Dr. Thompson has rendered most valuable assistance.

The electrical plant for the supply of electrical power to the Laboratories of Heat Measurements and Electro-Chemistry has been purchased and installed under the direction of Professor Derr, and is now substantially complete. It operates to our entire satisfaction. The original appropriation of

$3500 has not been exceeded, and contrary to expectation there will be no necessity of further expenditure until the laboratories call for a considerably greater supply than is likely to be needed for several years. That so much has been accomplished in proportion to the outlay is largely due to the kindness of Mr. F. C. Sutter, M. I. T. '93, of the Pittsburgh Transformer Co., by which company five of the large transformers were constructed.

The principal items of the plant under consideration are as follows: —

1. One 25-kilowatt motor generator (purchased by Professor Goodwin) complete with switches, bus-bars, voltmeter and ammeters.

2. One 50-horse-power, direct current motor with circuit-breaker and ammeter for driving the alternator, which machine was already in possession of the department.

3. One 50-kilowatt, graded transformer of special design with switchboard, to give currents from 300 to 4,800 amperes, at pressures from 160 to 10 volts.

4. Three 20-kilowatt transformers, for connection to the three-phase circuit from the electrical engineering laboratory, with a switchboard giving four different voltages and currents up to 400 amperes on each side.

5. One 20-kilowatt transformer, for low voltages and currents up to 2,000 amperes. This is mounted upon a truck and can readily be taken to any part of the laboratory.

6. A full set of measuring instruments, in addition to the switchboard voltmeters and ammeters. With them it is possible to measure currents from 1 to 1,500 amperes, voltages from 10 to 160 volts, and power up to the limits of the supply.

The 50-kilowatt transformer and the switchboards are from the designs of Professor Derr.

The statements made in my report of last year regarding the great need of additional rooms for conference purposes and for the proper keeping of the physical apparatus are still

true, and the need becomes more urgent with the growth of the Department. We also greatly need more space for the Optical Laboratory, which is greatly cramped, and for the proper development of a Photographic Laboratory.

CHARLES R. CROSS.

DEPARTMENT OF GEOLOGY.

In Course XII., no significant changes have been made. Two students have been engaged in the work of the Course during the past year. The most important advance in the work of the department has been the establishment of a third option in Course III., mining geology; and arrangement has further been made whereby all students of mining engineering shall in the future gain some acquaintance with practical geological surveying. The class of second-year students in general geology, which numbered one hundred and thirty-eight in 1903–04, and was obliged to meet in Huntington Hall, has been divided in 1904–05, so that the students of Course III. take the work in the first term, those of Course I. in the second. The class is thus enabled to meet in the geological lecture-room, where suitable maps, a stereopticon, etc., are provided. The total registration in studies under the department for 1903–04 was seven hundred and forty-six.

Professor Jaggar conducted an advanced summer course in geological surveying to the Black Hills and Big Horn Mountains in July and August. Six students completed the work, representing six different colleges, one of them being of the class of 1904 of the Institute. Several of these men made field studies which will be published. Professor Jaggar completed, in 1903–04, in collaboration with Professor Charles Palache, the text and maps of the folio of the Bradshaw Mountains, Arizona, for the United States Geological Survey. In the summer he was able to review on the field the work of the Spearfish–Sturgis Folio of the northern Black Hills,

S.D., which he is now finishing. With a grant from the Elizabeth Thompson Science Fund he is preparing a memoir on Experimental Geology, and some progress has been made during the past year on a report dealing with the Caribbean Volcanic Eruptions of 1902. He has under construction a laboratory instrument for measuring the hardness of minerals and metals, in pursuance of investigations begun in 1896 (published in *The American Journal of Science*, December, 1897). In midwinter, 1903–04, he spent the Christmas season in Searchlight, Nevada, making investigations for the Quartette Mining Co. of Boston.

Professor Crosby has begun a systematic investigation of the building stones of Boston, in connection with the thesis study of Mr. G. F. Loughlin. This has in part been published in the *Technology Quarterly*. Professor Crosby gave the summer to original study and investigation, in mining geology: including chiefly the auriferous gravels of the Nome District in Alaska and the Klondike District in Yukon Territory, continuing investigations begun last year; the copper deposits of the Whitehorse District, Yukon Territory; the new coal and oil fields of the Kayak District in Alaska and the deposits of copper and precious metals in the Bingham and Tintic Districts in Utah. This work has resulted, in every instance, in the addition of valuable material to the economic collections of the Institute.

Professor Warren reports some additions to the mineralogical and petrographical collections; and improvements in the course of mineralogical study taken by the students in mining engineering. For the new geological option in Course III. there is great need of more microscopes and microscopical preparations for accommodating the increased number of students in the Petrographical Laboratory. In the Mineralogical Laboratory investigations are in progress on the composition and characteristics of certain "rare earth" minerals, and on the crystallization of minerals from molten solutions. Rock analyses are being made in connection with a petrographical study of a complex of igneous rocks near Cumberland, R.I.

Dr. D. W. Johnson has developed a unique and useful course for students of civil engineering, in topographic geology. Critical study of topographic maps has been made the basis of the work, and some three thousand and five hundred maps have been added to the collection, classified, and mounted for handling by large classes. In the field-work the student learns to correlate land forms, geologic structure, and the topographic map; and this has been systematized by the aid of printed programs with brief outlines of the features studied. With the aid of the stereopticon, features remote from our own field of study are illustrated. Dr. Johnson has further taken charge of the third-year course in economic geology. He spent two weeks in the spring of 1904 in the Chattanooga District of Tennessee, Georgia and Alabama, making special studies of the topography and drainage modifications. The results of this investigation are in press; and he has also completed two other studies for publication as follows: one on "The relation of the law to underground waters" (Water Supply and Irrigation Papers, U.S. G. S.) and one on "The distribution of fresh water faunas as an evidence of drainage modifications."

Dr. Shimer had charge of the work in palæntology and historical geology, and, during the year, rearranged the geological library and recatalogued all the maps in the collection.

T. A. JAGGAR, JR.

DEPARTMENT OF NAVAL ARCHITECTURE.

The quarters provided for the Department of Naval Architecture in the building erected in the summer of 1903 have been found well adapted for the purpose, and I have no suggestion at the present time for alterations. Should, however, the building be enlarged at some future time, I shall desire to ask for some part of such extension. During the summer vacation just closed, an alcove at the north end of the main

drawing-room was enclosed to form a library and reading-room; this provides for the present for an essential feature in the work of the department. It is proper to mention here a very valuable collection of books from the library of the late Henry Bryant, which was presented to the department by Dr. Charles G. Weld, who also provided bookcases for the library.

The model shop, provided through the interest of Dr. Weld, has been kept open by him during the year at convenient times, and about fifty students, including three Naval Constructors, have received instruction in model making. Some of the models made during the previous year were used for laying on the plating of the hull. Several of the models have been properly mounted and hung where they can be used for illustration and reference in future instruction in design. The importance of experience in cutting models to lines which the student has himself designed is emphasized by our experience since the shop was opened.

The department was informed during the summer of 1903 that the pressing demand for officers in the navy precluded the assignment of a new class of officers to study naval architecture; nevertheless, before the fall term was concluded, the Chief Constructor succeeded in obtaining the detail of a class of three men, who began work in January and are doing the regular work of their Course this year.

A new class of eight ensigns entered in regular order at the beginning of this year. This makes a total of twenty officers at the Institute at the present time. The first class from the Course was graduated in June; they had, by special arrangements, completed the Course and been assigned to duty in the preceding April.

Professor Peabody has published a work on Naval Architecture which presents the theoretical instruction in naval architecture given to classes in the department, including the Naval Constructors. This work had formerly been used in the form of type-written notes, and there is an appreciable advantage in the presentation in a well printed book.

Two papers have been presented to the Society of Naval Architecture and Marine Engineers: one on Water-tight Subdivision of War-ships by Professor Hovgaard, and the other on Displacement and Stability Calculations, by Mr. Leland.

Through the interest of Dr. Weld, a course of lectures once a week throughout the school year has been arranged to be given by gentlemen engaged in the practice of the profession, on subjects to which they have given special attention; this course is sure to be interesting and profitable and in particular will give students a broader and juster view of the profession into which they are to enter.

C. H. PEABODY.

DEPARTMENT OF MATHEMATICS.

There have been no important changes in the work of the Department of Mathematics during the past year.

An effort has been made to equalize the difficulty of the courses in algebra and trigonometry in the first half of the first year by transferring the discussion of the principles of logarithms from the algebra to the trigonometry, where it finds its application, and this has made it possible to include in the algebra the more extended use of graphical methods, with expectation of corresponding advantage in taking up the second-term work in analytic geometry. The transition from the more familiar subjects of the first term to the analytic geometry of the second has proved in the past one of great difficulty to first-year students, and whatever will give them a better start in the second-term work will be an important gain in our first-term work.

A recent change in the Faculty rules makes it necessary for students in the principal professional departments to secure mathematical records better than "L" (passed with low standing) for admission to second-year professional sub-

jects. This will tend to secure both better work in the first year and fewer failures in the second.

In calculus Professor Osborne has prepared printed notes supplementing his text-book, in anticipation of the publication of a new edition. The return to the former policy of holding final examinations in calculus has resulted on the whole to the satisfaction of the department.

Efforts to secure closer relations with professional departments have been continued, with the assignment of particular members of the Mathematical Department to corresponding groups of students, so far as the exigencies of the tabular view have permitted this to be done. In this manner one or two instructors, for example, have charge of the work in calculus of students in Civil and Sanitary Engineering, and are expected to inform themselves somewhat as to the applications of the calculus which these students will make in their future work.

Advanced elective courses were given last year by various members of the department on the calculus of variations and minimum surfaces. While we rarely have students who are interested primarily in mathematics, the development of the Course for Naval Constructors and the increasing number of graduate students taking a part of their work in mathematics offer a welcome opportunity for the introduction of advanced courses. A course in the elements of theoretical hydrodynamics is now in progress for the first time.

The personal changes in the department have been unusually numerous. Professor Skinner at the expiration of his leave of absence has preferred not to return, and has terminated his connection with the department, carrying with him in his retirement the cordial good wishes of his colleagues. Dr. Mason has accepted an attractive opportunity at Yale University, and Mr. Camp has returned to Wesleyan University, his Alma Mater. Mr. Miller has been granted leave of absence for the continuation of his mathematical studies, and is now attending the University of Göttingen.

These retirements have been in part offset by Professor Bartlett's return from his year in Europe, and by the appointment of Dr. C. L. E. Moore, a graduate of the Ohio State University and Cornell University. Professor Bartlett has visited most of the German Polytechnics, spending considerable time at Charlottenburg and at Munich, and making briefer stays in Italy and in France. A fuller report will be presented independently, and the results of it will have due influence, not only in his own work, but in that of the department as a whole.

In regard to the needs of the department, it is to be hoped that it may be practicable in the near future to restore the previous annual appropriation of $250, to provide by special appropriation for increasing our collection of models, and for filling certain gaps in our library.

H. W. TYLER.

DEPARTMENT OF DRAWING.

The new system of instruction inaugurated last year by Professor Adams was carried to a successful completion and resulted in a high percentage of good work. Several new pieces of apparatus have been added to the lecture-room, notably a large revolving glass frame for illustrating the principles of descriptive geometry. As many geometrical models and machine castings have been procured as the yearly appropriation warrants. The framed examples of machine drawing and bridge design from the best drafting offices tend to make the drawing-room more attractive in appearance. The notes on mechanical drawing given out by Professor Adams last year have been gathered into book form, and will be published during the present year. A new book on descriptive geometry is in process of preparation; and it is intended in this book to present the subject as a branch of drawing rather than of mathematics.

The summer school in descriptive geometry was in charge of Mr. H. C. Bradley, assisted by Messrs. E. S. Foljambe and J. R. Putnam. It was held somewhat later than usual and on this account attracted more college graduates wishing to anticipate first-year work.

ALFRED E. BURTON.

DEPARTMENT OF MECHANIC ARTS.

The total number of students receiving instruction in the Mechanical Laboratories is three hundred and fourteen. Some take work in more than one class, the numbers attending in the several subjects given during the first term being as follows: —

Carpentry and Wood Turning, II. and X.	71
Joinery and Pattern Work, VI.	33
Forging, II. and XIII.	106
Metal Turning, VI. and VIII.	37
Machine Tool Work, II. and XIII.	86
Pipe Fitting, XI.	8
Total in classes	341
Students taking work in two or more classes and counted more than once	27
Total number of students	314

The total number of students attending last year was three hundred and eighty-two, the reduction in number being mainly due to excuses granted to students who had taken wood-work and forging in manual training schools.

The attendance in the summer school was the largest since its beginning in June, '98, the several classes numbering as follows: —

Wood-work	11
Forging	16
Chipping and Filing	12
Machine-Tool Work	31
Total	70

Had not some twenty-four students anticipated their machine-tool work, the classes in that subject would this year have been larger than could be accommodated.

One engine-lathe, a planer, and a pipe-fitting bench have been added to the equipment of the machine-tool laboratory.

Fourteen engine-lathes and a planer purchased in 1876 should be replaced by new and modern tools, if the present high standard in work is to be maintained. A universal grinding machine, a small radial drill, and a universal milling machine are very much needed to carry out the general class instruction successfully with the present large sections. The attendance during the second term will undoubtedly be larger, and the present equipment will be taxed to its utmost. Judging from present indications, additional lathes will be needed next year.

Moving the filing laboratory to the second floor of the Mechanic Arts Building necessitated the purchase of a double tool grinder. A band saw has been added to the equipment of the wood-working laboratory. The forging laboratory is in as good condition as can be expected after twenty-one years' use, but a renewal of this equipment, while desirable, is not recommended, on account of the probable early removal of the mechanical laboratories from their present location.

Instruction rooms are very much needed in the filing, wood-working, and forging laboratories, and it is earnestly recommended that such be provided this year. With the present arrangement of classes the wood-working and forging laboratories can easily accommodate the classes, but the filing laboratory was taxed to its full capacity this year.

It is believed that instruction in foundry work should be given to every student in Mechanical Engineering, because of the value of a knowledge of this important subject in many industrial works to-day. The course at present is optional, but, according to a vote of the Faculty, instruction is to be given to the students in Chemical Engineering next year, for which provision must be made. The large optional classes show a demand for this training, and it is earnestly recommended that a new and larger melting plant be installed and

that a permanent instructor be appointed. This department can then supply castings which are now purchased outside.

Mr. James F. Leary, Assistant in Chipping and Filing, resigned to accept a position as Instructor in Drawing and Wood-work in the Holyoke high school. Mr. Marshall G. Meriam, a former special student, has been appointed in his place. Mr. J. F. O'Neill, Assistant in Wood-work and Foundry-work, resigned to take charge of the manual training at the Malden high school. Mr. Albert L. Moulton, an experienced wood-worker, has been appointed in his place. The instructing staff now numbers four instructors and five assistants.

PETER SCHWAMB.

DEPARTMENT OF ENGLISH.

The English Department during the past year has been carrying on the policy of connecting its work as closely as possible with the technical studies of the various Courses. The number of technical papers which come to the department for correction has increased, and these, with the written translations from the classes in French and German, help to make the drill in composition continuous and more obviously an integral part of the technical training.

The increase of the time allotted to second-year English literature in Courses I. and XI. has made possible much more satisfactory work in the first term. The whole second-year literature has been further improved by the division of the class into sections, and the introduction of a printed syllabus.

The elimination of Course IX. from the lower years has been cutting off several of the courses formerly given; but some of these have been continued as options in response to demands from men in engineering Courses. Logic, which has been dropped out of the first year, and advanced composition, dropped from the third, are both being given as volunteer courses on account of application made for them by students

in Courses still existing. The arrangement is hardly a satisfactory one, as regards either students or instructors. Neither can satisfactorily plan work in advance, in view of the uncertainty whether such courses will be given; and in any case valuable time is lost in making arrangements.

A vacancy caused by the resignation of Mr. C. H. L. Johnston has been filled by the appointment of Mr. C. L. Collester.

ARLO BATES.

DEPARTMENT OF HISTORY.

The work in history is at present, in some respects, in a transition stage. The subjects required of all regular first- and second-year students, as well as that taken by fourth-year students in Architecture, continue to be given as usual. Course IX., however, as a course in general studies, will cease to exist at the end of the present school year, and accordingly its own special history courses will then be dropped. Next year and thereafter a considerable variety of options in history and government will be offered to students of the third year, who will have a certain amount of time available for studies of a general character.

CHARLES F. A. CURRIER.

DEPARTMENT OF MODERN LANGUAGES.

The work of the Department of Modern Languages has, in general, been carried on along the lines indicated in the last Report.

The following changes in the staff of the department are to be noted. Professors Rambeau and Dippold, and Mr. Goodell have resigned and gone to other fields of usefulness, carrying with them the best wishes of the department. Professor Vogel has been appointed acting head of the department for the first term of the current year. Messrs. Hare and Lenz have been appointed Instructors in Modern Languages for the

year 1904–1905. They come to us as graduates of Harvard College, with a business as well as a teaching experience, added to youthful enthusiasm, and have already shown themselves well qualified for the work intrusted to them.

The Department of Modern Languages offers in 1904–1905 six courses in French, six in German, three in Spanish, and one in Italian. The entire enrolment in these courses at present is nine hundred and forty-five as against nine hundred and twenty-two in all courses offered last year. Courses in conversation and foreign correspondence have been added in French and German, and one course in advanced German literature.

The effect of our new entrance requirements in modern languages is beginning to make itself felt in the distribution of our work.

The total number of students in French I. and German I. (both elementary) at the time of the last report was three hundred and twenty-five, divided as follows: French I., one hundred and six, German I., two hundred and nineteen. This year the total number is only one hundred and forty-one, divided as follows: French I., sixty-six, German I., seventy-five, which numbers will, no doubt, be even smaller in the future. These courses are now given merely as an accommodation for those who have not been able to meet our requirements before entering the Institute. In general, it appears that the preparatory schools have better facilities for meeting our requirements in French than in German. However, improvement is noticeable and in a few years we may hope to have the entrance requirements fully met in each subject. This will tend to make the work in the required courses French II. and German II. in the Institute even more effective and practical.

While the main object of all required modern language work at the Institute must always be the acquisition of a good and ready *reading* knowledge, yet the department aims to do even more than this by rousing an interest in and for

the institutions and life of the people whose language is studied. To this end the department is glad to offer advanced courses adapted to the needs and wishes of the applicants, and at hours suiting their convenience. The interest in these optional and elective courses offered by the members of this department is very gratifying. The course in German sight reading has increased this year to twenty-five members as against four last year. The course in German conversation and foreign correspondence numbers forty-four. The course in French conversation has thirteen members, and the call for Italian has found the department ready to give a course in the elements of this language to eleven men. Interest in Spanish has grown since last year so that it was necessary to form two classes in elementary Spanish, containing sixty-eight students, as against forty-eight last year. Spanish II. has risen from three students last year to eighteen this year. The classes in French and German literature are still small (seven and five respectively), but they promise well for the future.

The courses in French II. and German II. required of all students who are candidates for a degree aim to give the greatest facility attainable for reading intelligently scientific works in French and German. The efficiency in this work will be greatly increased by a modification of the arrangement entered into with the Department of English, whereby all students in French II. and German II. will once a month write a translation of a passage selected from some scientific work written in French or German, aiming to reproduce the meaning of the original in the best English at the student's command. This translation will then be criticised by the members of the Department of English with special attention to the English expression, and returned to the student marked for further study, or to be re-written as the case may require.

A plan has been evolved whereby the Library of the Department of Modern Languages will become more useful for the student body The Library will be opened every

school day for study, consultation of reference books, and loaning books for home use.

The Library will probably receive a considerable increase through an agreement of the most important publishers of foreign language text-books to donate copies of their publications for reference and use by students, as well as by the members of the department. These donations are to the Library of the Department of Modern Languages at the Institute of Technology. Ginn & Co., Boston; Silver, Burdett & Co., Boston; and Heath & Co., Boston, have already sent a considerable number, and their example will probably be followed by all the leading publishers. This will put a valuable educational library of modern language books within the reach of all our students and instructors.

The number of hours of instruction given by each member of the department averages seventeen per week, and a considerable amount of time is consumed in correcting written work. While the members of the department have not published anything of great moment beyond what was reported in preparation at the time of the last report, it may be mentioned that Professor Vogel, Mr. Dike, and Dr. Kurrelmeyer, each has in preparation something which will go to press during the ensuing year.

FRANK VOGEL.

THE LIBRARIES.

The gross accessions to the libraries of the Institute during the year 1903–4 amount to 4,829, as follows: —

TABLE OF GROSS ACCESSIONS CLASSIFIED BY SOURCES.

By Purchase, volumes	1,251
By Purchase, maps	960
By Binding	930
By Gifts	1,688
Total	4,829

After deducting losses and books counted twice, the net increase of the library amounts to 3,089 volumes, 760 pam-

phlets, and 960 maps,— making the total number of volumes in the libraries of the Institute 67,361, and the number of pamphlets and maps, 19,558. The following table gives the particulars of the growth of the several libraries in volumes, pamphlets, and maps, with the amount expended for the accessions to each library, and its present total contents: —

TABLE OF THE NET INCREASE, WITH THE COST OF THE SAME, DURING THE YEAR 1903-04, AND THE TOTAL CONTENTS OF THE LIBRARIES OF THE INSTITUTE, SEPT. 30, 1904.

LIBRARIES.	Net Increase.				Total Contents.	
	Volumes.	Pamphlets.	Maps.	Cost.	Volumes.	Pamphlets and Maps.
General Library:						
General	146	252	—	$172.71*	5,595	4,727
English	117	—	—	183.82	3,228	44
Military Science	—	—	—	3.26†	332	7
Walker Memorial	146	—	—	—	371	—
Drawing	22	—	—	—‡	22	—
Totals General Library	431	252	—	$359.79	9,538	4,778
Architecture	208	3	—	220.48	3,536	236
Biology	245	55	—	334.45	3,026	617
Chemistry	323	43	—	754.53	9,382	1,751
Electrical Engineering	176	12	—	390.02	821	33
Engineering	545	184	—	$33.41	11,415§	4,299§
Geology	133	40	960	92.62	2,542	2,404
History and Economics	473	70	—	432.72	12,110	3,517
Margaret Cheney Room	2	—	—	—	670	13
Mathematics	75	—	—	162.56	1,390	208
Mining	196	62	—	360.20	3,664	629
Modern Languages	24	2	—	74.73	1,103	29
Naval Architecture	—‖	—‖	—	—‖	709	65
Physics	258	37	—	409.37	7,445¶	979
Totals	3,089	760	960	$4,424.88	67,361	19,558

* Includes cost of books purchased for Secretary's Office and for Drawing Department.
† Subscription to a periodical not bound.
‡ Included in General.
§ After 709 volumes and 65 pamphlets had been transferred to Naval Architecture.
‖ Included in Engineering.
¶ Apparent error in this item in Report for 1902-03 was due to the transfer of 396 volumes from Physics to Electrical Engineering.

The advance of science and technology along new lines is marked by the frequent appearance of new periodicals established to record the progress of research and endeavor in these new directions. The Institute, in order to keep up with the times, must have these journals. The number of periodicals and other serial publications received during the year 1903–04 was 944, an increase of 14 over the previous year. The following table shows the number and cost of the serial publications charged to each account and for each department.

TABLE OF PERIODICALS AND OTHER SERIAL PUBLICATIONS RECEIVED DURING THE YEAR 1903–04, 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	43	19	14	25	101	$53.92	$28.00	$73.03	$154.95
Architecture	9	9	3	31	52	38.32	6.00	148.58	192 90
Biology	6	9	19	34	68	31.94	38.00	224.61	294.55
Geology	11	2	4	7	24	18.50	8.00	37.77	64.27
Chemistry	15*	38	14	29	96*	131.17	28.00	162.96	322.13
Engineering	34	50	65	60	209	125.15	132.00	244.45	499.60
Electrical Engineering	3	16	9	6	34	70.58	18.00	31.10	119.68
History and Economics,	56	38	2	40	136	74.98	4.00	130.14	209.12
Mathematics	—	2	—	17	19	4.10	—	66.54	70.64
Mining	7	12	35	24	78	33.07	70.00	106.64	209.71
Modern Languages	—	2	—	17	19	4.91	—	75 12	80.03
Naval Architecture	2	12	4	5	23	45.32	8.00	16.95	70.27
Physics	15	15	23	22	75	50.66	46.00	103.57	200.23
Walker Memorial	9	—	—	—	9				
Margaret Cheney Room,	1	—	—	—	1				
Totals.	211	244	192	317	944	$682.62	$384.00	$1,421.46	$2,488.08

There were added to the general catalogue during the year 4,927 cards, making the total number of entries in the catalogue 65,534. There were issued 1,034 orders for new books and periodicals and 1,124 orders for binding. In five of the Libraries records were kept of the number of books borrowed, with the following results: —

* Not including Experiment Station reports.

General Library	1,428
Biological	210
Chemical	1,844
Engineering	1,346
Mining	1,804

Soon after the General Library was transferred, several years ago, to its present quarters, the experiment of keeping the room open in the evening was tried. There was no response on the part of the students, however, and after a month it was closed. Last February, at the suggestion of Dean Burton, the experiment was tried again, and this time with much better results. Two students were appointed to act as Attendants from five to seven o'clock and from seven to ten, respectively; and they have kept records of the number of readers, which may be summarized as follows: —

NUMBER OF READERS IN THE GENERAL LIBRARY DURING THE EVENINGS OF 72 DAYS FROM FEBRUARY 17 TO JUNE 3, 1904.

Hours	5-7	7-10
Average attendance	20	9
Minimum	4	0
Maximum	69	33

Owing to the generosity of Dr. Charles G. Weld, we were able during the summer to enclose an alcove off the drawing-room for naval architecture, and into the new room have been moved 709 volumes and 65 pamphlets from the Engineering Library, thus establishing a new departmental Library of Naval Architecture. To these Dr. Weld has added a collection of books consisting of 173 volumes and 7 pamphlets, many of them old and rare works of great value, which formerly belonged to the late Henry Bryant, Esq. This collection has not yet been regularly incorporated in the library, and therefore does not appear in the statistics of this report. Dr. Weld has also given a number of new books to the Institute for this department, including Holmes, "Practical Shipbuilding," and two copies of Walton, "Steel Ships."

The donor of the Library for the Walker Memorial has enlarged his gift this year by 146 volumes, and he has continued the subscription to 9 periodicals. Among other gifts, we

have received from Harry F. Noyes — 38 volumes of U.S. Consular Reports; from Mrs. Cheney for the Margaret Cheney Room — Poems of Wordsworth; Van Dyke, "Little Rivers"; *The Outlook; Scribner's Magazine*, and the *Literary Digest;* from M. Guggenheim, of Venice — a work entitled "Papadopoli Palace"; from the Swedenborg Publishing Co.— the Works of Swedenborg, 25 volumes; from the authors — Wells, "Advanced Course in Algebra"; Peabody, "Naval Architecture"; Bridge, "Inside History of the Carnegie Steel Company"; Carhart, "Physics for University Students."

R. P. BIGELOW.

THE SOCIETY OF ARTS: REPORT OF THE SECRETARY.

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 May 22, 1903, to May 26, 1904.

Fifteen meetings have been held, usually on the second and fourth Thursdays of each month from October to May, inclusive. The average attendance has been about one hundred and seventy-five, the largest being about four hundred, and the smallest forty-five. The general interest in the Society which has been manifested during the past few years has been maintained.

The following papers have been presented before the Society: —

American Rapid Transit in the Light of European Experience, by Mr. John P. Fox.

Solar Evaporations: Their Development and Use in Water Engineering, by Captain William H. Jaques.

Mosquitoes, and Suggestions for their Extermination, by Mr. William Lyman Underwood.

One Field of Twentieth Century Science, by Professor Simon Newcomb.

The Influence of Food Preservations on Digestion, by Dr. Harvey W. Wiley of the U.S. Department of Agriculture.

Steam Turbines, by Mr. Charles Garrison.

The Use of Electricity in Metallurgy, by Professor Joseph W. Richards of Lehigh University.

The Chemical Work of the U.S. Geological Survey, by Dr. F. W. Clarke, Chief Chemist of the U.S. Geological Survey.

The Action of Radium and Ultra Violet Light on Minerals and Precious Stones, by Mr. George F. Kunz.

The Preservative Treatment of Wood, by Dr. Samuel P. Sadtler.

The Measurement of the Heat of the Stars, by Professor E. F. Nichols of Columbia University.

The History and Work of the Smithsonian Institution, by Dr. Cyrus Adler, Librarian of the Smithsonian Institution.

The Recent Conflagration in Baltimore, by Professor Charles L. Norton of the Institute.

Coinage and the Precious Metals, by Mr. George E. Roberts, Director of the U.S. Mint.

Mechanical Flight, by Mr. J. Emery Harriman, Jr.

During the year one life member and fourteen associate members have been elected to the Society. The total membership at the end of the year is three hundred and sixty-two.

The *Technology Quarterly* has appeared regularly during the year under the editorship of Dr. R. P. Bigelow. In addition to the Proceedings of the Society twenty-two articles and several book reviews have been published.

At the forty-second annual meeting held on May 19, 1904, the following-named gentlemen were elected officers of the Society for the year 1904–05:—

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, Henry Fay, and R. P. Bigelow.

Respectfully submitted,

SAMUEL C. PRESCOTT, *Secretary*.

Publications.

CHEMISTRY AND CHEMICAL ENGINEERING.

HENRY P. TALBOT.— Study Questions in Inorganic Chemistry and Qualitative Chemical Analysis. Boston, 1904. Thomas Todd.

WILLIAM H. WALKER.— A Laboratory Course in Industrial Chemistry. *Technology Review*, Vol. VI., No. 2, 1904.

WILLIAM H. WALKER and L. M. BOURNE.— The Hydrolytic Enzyme Contained in Castor-oil Seeds. *Technology Quarterly*, Vol. XVII., p. 284.

AUGUSTUS H. GILL and S. A. FOSTER.— Contribution to our Knowledge of White Lead and of its Protecting Properties. *Technology Quarterly*, Vol. XVII., p. 145.

AUGUSTUS H. GILL and S. N. MASON.— The Detection of Mineral Oil in Distilled Grease Oleines. *Journal of the American Chemical Society*, Vol. XXVI., pp. 665–672.

ELLEN H. RICHARDS.— First Lessons in Food and Diet. Whitcomb & Barrows, Boston, 1904.

ELLEN H. RICHARDS and ISABEL F. HYAMS.— Notes on Oscillaria Prolifica. Third Paper: Coloring Matters. *Technology Quarterly*, Vol. XVII., p. 270.

ELLEN H. RICHARDS and LILY M. KENDALL.— Permanent Standards in Water Analysis. *Technology Quarterly*, Vol. XVII., p. 277.

ELLEN H. RICHARDS and A. G. WOODMAN.— Air, Water, and Food from a Sanitary Standpoint. Second Edition. John Wiley & Sons, New York, 1904.

ALPHEUS G. WOODMAN.— The Exact Estimation of Atmospheric Carbon Dioxide: A Brief Survey. *Technology Quarterly*, Vol. XVII., p. 258.

S. P. MULLIKEN.— A Method for the Identification of Pure Organic Compounds by a Systematic Analytical Procedure Based on Physical Properties and Chemical Reactions. Vol. I. Compounds of Order I. John Wiley & Sons, New York, 1904.

GEORGE W. ROLFE and CHARLES FIELD, 3d.— Some Notes on Laurent Polariscope Readings. *Journal of the American Chemical Society*, Vol. XXVI., p. 986.

GEORGE W. ROLFE and F. H. STORER.— Observations on a Malt Glucose, known as "Midzu-ame," made in Japan from Rice and Millet. *Bulletin of the Bussey Institution of Harvard University*, December, 1904.

WILLIAM T. HALL.— Analytical Chemistry. Vol. II. Quantitative Analysis. Translated from the German of F. P. Treadwell.

A. A. BLANCHARD.— The Viscosity of Solutions in Relation to the Constitution of the Dissolved Substance. *Journal of the American Chemical Society*, Vol. XXVI., p. 1315.

A. A. BLANCHARD.— Ueber die Zersetzung des Ammoniumnitrits. *Zeitschrift für physikalische Chemie.*

MILES S. SHERRILL and STANISLAUS SKOWRONSKI.— A Study of the Mercury Sulphocyanate Complexes. *Journal of the American Chemical Society.*

ROY W. MOORE and W. LOEB.— Die Bedeutung des Kathodenmaterials für die elektrolytische Reduktion des Nitrobenzols. *Zeitschrift für physikalische Chemie*, Vol. XLVII., p. 418.

NELSON E. TOUSLEY and M. GOMBERG.— Some Tri-p-tolylmethane Derivatives. *American Chemical Journal*, 1904.

RESEARCH LABORATORY OF PHYSICAL CHEMISTRY.

Serial Contributions of the Laboratory.

No. 1.— A. A. NOYES and W. D. COOLIDGE.— The Conductivity of Aqueous Solutions at High Temperatures. 1. Description of the Apparatus. Results with Potassium and

Sodium Chloride up to 306°. *Proceedings of the American Academy of Arts and Sciences*, Vol. XXXIX., pp. 163–219, 1903. *Zeitschrift für physikalische Chemie*, Vol. XLVI., pp. 323–378, 1903.

No. 2.— H. M. GOODWIN and R. HASKELL.— The Electrical Conductivity of Very Dilute Hydrochloric and Nitric Acid Solutions. *Proceedings of the American Academy of Arts and Sciences*, Vol. XL., pp. 399–415, 1904. *Physical Review*, Vol. XIX., pp. 369–386, 1904.

No. 3.— C. S. HUDSON.— The Hydration of Milk-sugar in Solution. *Journal of the American Chemical Society*, Vol. XXVI., pp. 1065–1082, 1904.

No. 4.— W. R. WHITNEY and J. C. BLAKE.— The Migration of Colloids. *Journal of the American Chemical Society*, Vol. XXVI., pp. 1339–1387, 1904.

No. 5.— A. A. NOYES.— A System of Qualitative Analysis, including nearly all the Metallic Elements. Part II. Analysis of the Tungsten Group. *Technology Quarterly*, Vol. XVII., pp. 214–257, 1904.

No. 6.— A. A. NOYES.— The Properties of Salt Solutions in Relation to the Ionic Theory. *Science*, Vol. XX., pp. 577–587, 1904. *Technology Quarterly*, Vol. XVII., p. 293, 1904.

Other Publications of the Research Staff.

W. BÖTTGER.— Löslichkeitsstudien an schwerlöslichen Stoffen. *Zeitschrift für physikalische Chemie*, Vol. XLVI., pp. 521–619, 1903.

C. A. KRAUS.— The Electrical Conductivity of Solutions in Methyl Alcohol in the Neighborhood of their Critical Points. *Physical Review*, Vol. XVIII., pp. 40–56 and 89–103, 1904.

BIOLOGY.

W. T. SEDGWICK.— Why Dirt is Dangerous. *Journal of the Massachusetts Association of Boards of Health*, Boston, May, 1904.

W. T. SEDGWICK.— Why Dirty Milk is Dangerous. *Journal of the Massachusetts Association of Boards of Health*, Boston, August, 1904.

W. T. SEDGWICK.— Chicago Drainage Canal Case. *Record of Evidence, Supreme Court of the United States, State of Missouri* vs. *The State of Illinois and the Sanitary District of Chicago*. Vol. III., pp. 2184–2417; 2758–2789. Vol. VIII., pp. 7955–7974. Jefferson City, Mo., Tribune Publishing Company, 1904.

W. T. SEDGWICK.— Article on "Sanitary Science and Public Health." *Encyclopædia Americana*, Vol. XIV. New York, 1904.

S. C. PRESCOTT (with C.-E. A. WINSLOW).— Elements of Water Bacteriology, with Special Reference to Sanitary Water Analysis. New York, John Wiley & Sons, 1904. pp. 162 + x. 8vo.

S. C. PRESCOTT.— A Note on Methods of Isolating Colon Bacilli. *Science*, N.S., Vol. XVI., No. 408, pp. 671–672.

S. C. PRESCOTT (with S. K. BAKER).— On Some Cultural Relations and Antagonisms of Bacillus Coli and Houston's Sewage Streptococci, with a Method for the Detection and Separation of these Micro-organisms in Polluted Waters. *Journal of Infectious Diseases*, Vol. I., No. 1, pp. 193–210. *Report of the American Public Health Association*, Vol. XXIX., pp. 369–384.

S. C. PRESCOTT.— Report of Committee on Significance of Bacillus Coli in Water Supplies. *Report of the American Public Health Association*, Vol. XXIX., pp. 356–358.

S. C. PRESCOTT.— The Effect of Radium Rays on the Colon Bacillus, the Diphtheria Bacillus and Yeast. *Science*; N.S., Vol. XX., No. 503, pp. 246–248.

S. C. PRESCOTT.— Ptomaines and Ptomaine Poisoning. *Good Housekeeping*, Vol. XXXIX., No. 4, October, 1904, pp. 444–447.

R. P. BIGELOW.— Articles on "Segmentation of the Body," "Segmentation of the Ovum," "Senility," "Sex," "Sperma-

tozoa," and "Variation" in the *Reference Handbook of the Medical Sciences* (revised edition), Vols. VII. and VIII. New York, William Wood & Co., 1904.

A. W. WEYSSE.— A Text-book of Synoptic Zoölogy. New York, Macmillan & Co., 1904. pp. 514 + xxv. 8vo.

A. W. WEYSSE.— Notes on Animal Behavior. *Science*, N.S., XIX., 955, June, 1904.

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Statistics.

THE CORPS OF INSTRUCTORS.

The Catalogue of this year shows the number of instructors of all grades to be 188, inclusive of those concerned with the mechanic arts, but exclusive of those who are announced as lecturers for the year only. The addition of these raises the total to 221. This year's Catalogue will show a decrease of eight in the number of lecturers and some changes in the grades of professors and instructors. Without counting lecturers, the number of instructors to that of students bears the proportion of one to eight and three-tenths. The following table shows the distribution among the several classes of instructors, in comparison with last year: —

	1903–04.		1904–05	
Professors	30		28	
Associate Professors	14		18	
Assistant Professors	25		19	
		69		65
Instructors	66		67	
Assistants	51		56	
		117		123
Lecturers	41	41	33	33
Total		227		221

STUDENTS AND GRADUATES.

The registration of this year, as shown by the Catalogue, amounts to 1,561. 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	1885–86	609
1866–67	137	1886–87	637
1867–68	167	1887–88	720
1868–69	172	1888–89	827
1869–70	206	1889–90	909
1870–71	224	1890–91	937
1871–72	261	1891–92	1,011
1872–73	348	1892–93	1,060
1873–74	276	1893–94	1,157
1874–75	248	1894–95	1,183
1875–76	255	1895–96	1,187
1876–77	215	1896–97	1,198
1877–78	194	1897–98	1,198
1878–79	188	1898–99	1,171
1879–80	203	1899–1900	1,178
1880–81	253	1900–1901	1,277
1881–82	302	1901–1902	1,415
1882–83	368	1902–1903	1,608
1883–84	443	1903–1904	1,528
1884–85	579	1904–1905	1,561

STUDENTS BY CLASSES.

The aggregate number of students for 1904–05 is divided among the several classes, as follows: —

Fellows	11
Graduate students, candidates for advanced degrees	21
Regular students, Fourth Year	228
" " Third "	261
" " Second "	192
" " First "	298
Special students	550
Total	1,561

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.	32	—	32
Fourth Year	228	115	343
Third Year	261	164	425
Second Year	192	169	361
First Year	298	102	400
Total	1,011	550	1,561

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 Course.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Total.
4th Year Class .	52	51	24	10	19	29	3	2	–	11	7	–	20	228
3d " "	39	72	36	16	15	38	–	4	–	11	6	1	23	261
2d " "	49	35	17	15	12	31	1	7	–	10	9	–	6	192
Total	140	158	77	41	46	98	4	13	–	32	22	1	49	681

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

Year.	Civil Engineering.	Mechanical Engineering.	Mining Engineering and Metallurgy.	Architecture.	Chemistry.	Electrical Engineering.	Biology.	Physics.	General Course.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Total.
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

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: —

* Deducting those counted twice.

Year.	Total.	Course.												
		I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.
1st . . .	4	–	–	–	–	–	–	–	–	–	–	–	–	–
2d . . .	5	2	3	–	–	–	–	–	–	–	–	–	–	–
3d . . .	12	2	5	–	–	–	2	–	–	–	2	–	1	–
4th . . .	8	3	3	–	1	–	1	–	–	–	–	–	–	–
5th . . .	5	1	3	–	–	–	–	–	–	–	–	1	–	–
	34	8	14	–	1	–	3	–	–	–	2	1	1	–

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

	First Year.	Second Year.	Third Year.	Fourth Year.	Total.
Mathematics	410	341	236	3	990
Chemistry	407	94	111	104	716
English	374	282	9	7	672
French	256	–	86	–	342
Physics	–	356	407	117	880
German	174	103	113	2	392
Mechanic Arts . . .	–	145	81	115	341

The total registration in the Sumner School was 233 students as compared with 258 in 1903: the registration in the various subjects is shown in the following table: —

	1904.
Mathematics.	
Analytic Geometry	28
Integral Calculus	12
Applied Mechanics	22
Mechanical Drawing and Descriptive Geometry . . .	23
Mechanic Arts (Shopwork).	
Forging	16
Chipping and Filing	12
Machine-Tool Work	31
Wood Work (120, 122, 123)	8

NOTE.— Numbers immediately following certain subjects refer to the subject numbers used in the current Catalogue.

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
California	1	1	3	4	1	10	8	18
Colorado	–	1	6	2	–	9	7	16
Connecticut	1	7	6	5	13	32	16	48
Delaware	–	2	–	–	–	2	–	2
Dist. of Columbia	3	1	4	2	2	12	5	17
Florida	–	–	–	1	1	2	2	4
Georgia	–	–	1	–	–	1	5	6
Hawaii	–	–	–	–	–	–	1	1
Illinois	2	5	5	5	3	20	23	43
Indiana	1	2	2	–	2	7	3	10
Iowa	–	1	1	–	3	5	4	9
Kansas	–	1	1	–	1	3	1	4
Kentucky	–	4	–	–	1	5	3	8
Louisiana	1	–	–	–	–	1	4	5
Maine	–	6	7	3	4	20	6	26
Maryland	–	3	2	3	4	12	6	18
Massachusetts	13	132	149	122	215	631	258	889
Michigan	1	2	–	–	1	4	5	9
Minnesota	–	–	1	1	–	2	9	11
Mississippi	–	–	–	3	–	3	1	4
Missouri	–	2	5	1	3	11	14	25
Montana	–	–	–	–	2	2	3	5
Nebraska	–	1	–	1	1	3	2	5
New Hampshire	1	6	7	3	6	23	13	36
New Jersey	–	1	4	1	2	8	8	16
New Mexico	–	1	1	–	–	2	–	2
New York	2	20	15	11	8	56	38	94
North Carolina	–	1	–	–	–	1	–	1
North Dakota	–	–	–	–	1	1	–	1
Ohio	3	6	8	4	–	21	14	35
Oregon	–	2	3	–	–	5	3	8
Pennsylvania	1	5	7	12	6	31	25	56
Philippine Islands	–	–	–	–	–	–	4	4
Porto Rico	–	–	1	–	1	2	2	4
Rhode Island	–	2	5	1	5	13	6	19
South Dakota	–	1	–	–	–	1	1	2
Tennessee	1	–	–	–	–	1	1	2
Texas	–	1	1	3	–	5	8	13
Utah	–	1	–	–	–	1	2	3
Vermont	–	–	3	–	–	3	2	5
Virginia	–	–	3	–	1	4	–	4
Washington	–	–	1	–	–	1	1	2
Wisconsin	1	2	6	1	2	12	2	14
Foreign Countries.								
Armenia	–	–	–	–	–	–	1	1
Australia	–	–	–	–	–	–	1	1
Brazil	–	–	1	–	–	1	2	3
Central America	–	–	–	–	1	1	–	1
Chili	–	–	–	–	–	–	1	1
China	–	1	–	–	–	1	7	8
Cuba	–	–	1	–	–	1	3	4
Denmark	–	–	–	–	1	1	–	1
Ecuador	–	–	–	–	–	–	1	1
England	–	2	–	–	1	3	1	4
France	–	–	–	1	–	1	–	1
India	–	–	–	–	–	–	1	1
Jamaica	–	–	–	–	–	–	1	1
Japan	–	–	–	–	–	–	1	1
Korea	–	–	–	–	2	2	–	2
Malta, Island of	–	–	–	1	–	1	–	1
Mexico	–	1	–	–	1	2	2	4
New Brunswick	–	–	–	–	–	–	2	2
Nova Scotia	–	2	1	–	–	3	1	4
Ontario	–	1	–	–	2	3	2	5
Quebec	–	–	–	–	–	–	2	2
Scotland	–	–	–	–	1	1	1	2
Sweden	–	–	–	–	–	–	1	1
Syria	–	1	–	–	–	1	–	1
Transvaal	–	–	–	–	–	–	1	1
Turkey	–	–	–	1	–	1	1	2
Total	32	228	261	192	298	1,011	550	1,561

Forty states of the Union and two territories, besides the District of Columbia, Porto Rico and the Philippine Islands, are represented on our list of students. Of the total number of 1,561, 889 are from Massachusetts, or 58 per cent. of the whole; 134 are from other New England states; 478 are from outside New England. Of these 60 are from foreign countries.

A table showing the number of students in each year, from 1898, coming from each state or territory, and from

each foreign country, may be not without interest and instruction: —

States.	1898.	1899.	1900.	1901.	1902.	1903.	1904.
Alabama	1	–	1	2	1	1	1
Arkansas	–	–	1	1	1	1	–
California	11	9	10	9	15	19	18
Colorado	8	7	8	6	10	11	16
Connecticut	26	29	35	42	43	44	48
Delaware	3	4	4	3	4	3	2
Dist. of Columbia	8	7	13	14	17	15	17
Florida	–	1	1	1	2	2	4
Georgia	4	3	3	4	6	4	6
Hawaiian Islands	1	–	1	–	–	1	1
Idaho	–	–	–	1	–	–	–
Illinois	51	36	39	44	49	44	43
Indiana	3	5	7	11	14	6	10
Iowa	7	6	10	8	8	6	9
Kansas	–	–	–	1	1	1	4
Kentucky	10	4	5	9	11	9	8
Louisiana	1	1	2	1	2	2	5
Maine	19	25	22	30	35	34	26
Maryland	8	8	13	16	27	25	18
Massachusetts	719	731	779	837	935	869	889
Michigan	9	10	8	12	10	9	9
Minnesota	11	10	7	10	10	9	11
Mississippi	–	–	–	–	–	4	4
Missouri	10	11	13	19	20	22	25
Montana	2	3	5	4	3	2	5
Nebraska	1	3	4	3	5	4	5
Nevada	–	1	1	–	–	–	–
New Hampshire	25	29	26	31	34	23	36
New Jersey	13	12	8	6	8	13	16
New Mexico	–	–	–	–	1	1	2
New York	68	61	68	79	96	104	94
North Carolina	2	2	2	6	6	7	1
North Dakota	–	–	–	–	1	1	1
Ohio	23	27	27	27	43	37	35
Oregon	3	2	1	2	4	7	8
Pennsylvania	34	33	37	36	44	52	56
Philippine Islands	–	–	–	–	–	–	4
Porto Rico	–	–	–	1	2	2	4
Rhode Island	23	32	35	38	40	28	19
South Carolina	1	1	1	2	4	–	–
South Dakota	–	1	1	2	1	3	2
Tennessee	3	4	6	4	3	5	2
Texas	1	2	4	7	9	11	13
Utah	5	6	7	7	2	3	3
Vermont	12	12	15	15	12	11	5
Virginia	3	2	3	5	7	7	4
Washington	7	4	2	4	3	3	2
West Virginia	–	1	1	1	–	–	–
Wisconsin	8	7	8	11	11	13	14
Wyoming	–	–	–	–	1	–	–
Foreign Countries.							
Armenia	–	–	–	–	–	1	1
Australia	–	–	–	–	2	3	1
Austria	–	–	–	1	–	–	–
Bermuda	–	–	1	2	1	1	–
Brazil	–	–	–	4	5	3	3
Cape Breton	1	–	–	–	–	–	–
Central America	–	–	–	–	–	–	1
Chili	–	–	–	1	1	1	1
China	–	–	–	1	1	2	8
Cuba	1	–	–	1	2	3	4
Denmark	1	1	1	1	1	1	1
Dutch Guiana	1	1	–	–	–	–	–
Ecuador	–	–	–	–	–	–	1
England	4	1	3	3	3	4	4
France	1	2	4	1	–	–	1
Germany	1	1	2	3	1	2	–
India	–	–	–	–	–	1	1
Ireland	–	–	–	–	1	1	–
Jamaica	–	1	1	1	–	–	1
Japan	1	2	2	2	1	2	1
Korea	–	–	–	–	–	–	2
Malta, Island of	–	–	–	–	–	1	1
Manitoba	–	–	–	–	1	1	–
Mexico	7	7	7	7	10	8	4
New Brunswick	3	3	2	2	2	1	2
Nova Scotia	2	–	2	6	8	9	4
Ontario	–	–	–	3	2	2	5
Quebec	1	3	4	2	–	1	2
Russia	–	1	1	1	–	–	–
Scotland	–	–	–	–	1	1	2
Sweden	–	–	–	–	–	–	1
Syria	–	–	–	–	–	1	1
Transvaal	–	–	–	–	–	–	1
Turkey	3	3	3	1	4	–	2
Total	1,171	1,178	1,277	1,415	1,608	1,528	1,561

RESIDENCE OF MASSACHUSETTS STUDENTS.

It has been said that 58 per cent. of our students are from Massachusetts. All the counties of the State except Nantucket send students to the Institute. One hundred and forty-six 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 and seventy-four and Suffolk two hundred and fifty-five pupils; Essex comes third, with one hundred and twenty-six; Norfolk, fourth, with eighty-one.

County.	No. of Towns.	No. of Students.	County.	No. of Towns.	No. of Students.
Barnstable	4	6	Hampshire	2	5
Berkshire	5	13	Middlesex	34	274
Bristol	12	38	Norfolk	18	81
Dukes	1	2	Plymouth	16	27
Essex	26	128	Suffolk	4	255
Franklin	4	6	Worcester	15	35
Hampden	5	19			
			Total	146	889

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

Boston	239	New Bedford	12	Peabody	7
Newton	45	Taunton	12	Winchester	7
Cambridge	29	Hyde Park	11	Andover	6
Malden	26	Haverhill	10	Arlington	6
Somerville	25	Wakefield	10	Milton	6
Brookline	19	Beverly	9	Woburn	6
Lowell	19	Medford	9	Brockton	5
Waltham	19	Springfield	9	Canton	5
Lawrence	17	Chelsea	8	Holyoke	5
Newburyport	16	Quincy	8	Marlboro	5
Framingham	13	Belmont	7	Pittsfield	5
Lynn	13	Fitchburg	7	Revere	5
Salem	13	Gloucester	7	Weymouth	5
Melrose	12	Milford	7	Worcester	5

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.
1893–94	1,157	701	456	301	155
1894–95	1,183	768	415	271	144
1895–96	1,187	778	409	266	143
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

AGES OF STUDENTS.

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

Period of Life.	1903–1904		1904–1905.	
	Half-year Groups.	Yearly Groups.	Half-year Groups.	Yearly Groups.
16 to 16½ years	1	—	1	—
16½ to 17 "	9	10	8	9
17 to 17½ "	13	—	22	—
17½ to 18 "	38	51	40	62
18 to 18½ "	50	—	47	—
18½ to 19 "	38	88	51	98
19 to 19½ "	31	—	41	—
19½ to 20 "	34	65	40	81
20 to 20½ "	14	—	15	—
20½ to 21 "	8	22	10	25
21 to 22 "	9	9	9	9
	245	245	284	284

The results appear in the table above in comparison with the corresponding results of 1903–04.

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

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

Under 20½	1
Between 20½ and 21	8
" 21 " 21½	10
" 21½ " 22	28
" 22 " 23	75
" 23 " 24	45
" 24 and over	65
Total	232

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

GRADUATE STUDENTS.

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

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

Universities.

Boston	1	Missouri	1
Brown	1	Ohio State	1
California	1	Pennsylvania	4
Chicago	2	Porto Rico	1
Columbia	1	Princeton	9
Cornell	1	Rochester	4
Denison	1	Saint Louis	2
De Pauw	1	Southwestern	1
Georgetown	2	Syracuse	1
Hamline	1	Texas	1
Harvard	19	Tulane	1
Indiana	1	Vermont	1
Johns Hopkins	2	Washington and Lee	3
Kansas State	2	Washington State	1
Lehigh	1	Wesleyan	1
Louisiana	1	Western Reserve	1
Maine	1	Wooster	1
Mercer	1	Yale	10
Minnesota	1		86

Colleges.

Amherst	4	New Hampshire	1
Anatolia	1	New Mexico	1
Bates	1	Oberlin	1
Beloit	4	Rock Hill	1
Bethany	1	Sacred Heart	1
Boston	1	Saint Ignatius	1
Bowdoin	1	Saint Stanislaus	1
Butler	1	Saint Vincent	1
Canisius	1	Saint Francis Xavier	1
Case School of Applied Science	2	Smith	1
Centenary	1	Syrian Protestant	1
Central	1	Texas Agricultural	1
Coe	1	Trinity	2
Colby	3	U. S. Naval Academy	20
Connecticut Agricultural	1	Wabash	1
Dartmouth	4	Washington and Jefferson	1
Davidson	1	Wellesley	1
Delaware	1	Westminster	1
Hamilton	1	Williams	2
Holy Cross	1	Wittenburg	1
Iowa State	1	Worcester Polytechnic	1
Kansas State	1	Yankton	1
Kentucky State	1		100
Massachusetts Institute of Technology	18		
Middlebury	1		
Milton	1	Total	186
Mount Allison	1	Deduct names counted twice	4
Mount Holyoke	1		182

WOMEN STUDENTS.

The number of women pursuing courses with us is twenty-nine. Of these six are graduates of colleges. Of the total number five are regular students of the third year, three of the second, and one of the first year. Twenty are special students. Of the eight regular students of the upper classes one takes Course II., Mechanical Engineering; three take Course IV., Architecture; three, Course V., Chemistry; and one, Course XII., Geology. Of the special students, four devote themselves to architecture, nine to biology, one to chemistry, and one to physics, while three are first-year students.

STATISTICS OF ADMISSION.

Of the 1,561 students of the present year, 575 were not connected with the school in 1903-04. Of these 277 were admitted as regular students of the first year upon the basis of their entrance examinations. The 298 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 277 who were thus admitted to the first year on examination, and have taken their place in the school, 71 were admitted on examination, but have not entered the school.

In the case of the 277 persons who were admitted on examination, and have joined the school, the results of the examinations, embracing both those of June and those of September, were as follows: —

Admitted clear	185
" on one condition	66
" on two conditions	22
" on three conditions	4
	277

Of the 761 persons who presented themselves in June for examination, 37 Complete, 10 Final, 88 Preliminary, and 24 Partial candidates, a total of 159, were rejected. In September 15 Complete, 5 Final, and 13 Preliminary candidates were rejected. 271 attended the September examinations.

GRADUATES BY COURSES.

The following table exhibits the number of persons who have received the Bachelor's Degree in each of the several courses since the foundation of the school: —

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	–	–	–	–	–	–	–	–	–	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
Totals	549	688	280	275	325	1	540	49	56	93*	131	46	11	102	3,148*
Deduct names counted twice															16
Net total															3,132*

* Deducting names counted twice.

GENERAL STATEMENT

OF THE

RECEIPTS AND DISBURSEMENTS BY THE TREASURER

FOR THE YEAR ENDING SEPT. 30, 1904

STATEMENT OF THE TREASURER.

The Treasurer submits the annual statement of the financial affairs of the Institute for the year ending September 30, 1904.

The increase in the tuition fees went into effect at the beginning of the year, so far as regarded the first-year students, and the result is shown in increased receipts from that source, such increase amounting to nearly $11,000.

Throughout the year strict economy has been practised in the expenditures, and in certain items considerable savings have been made. The cost of repairs has been less than the year before by about $4,000. General expenses have been reduced about $12,000, and there has been a saving of more than $6,000 in the cost of fuel.

These savings were more than offset by an increase of expenses in other matters. The expenditure for Department Supplies has increased about $16,000. Catalogues and reports have cost about $2,300 more than the previous year, and fire insurance has increased by about $600. The Society of Arts has cost about $1,600 more than the year before, and the St. Louis Exposition has added to our expenses about $3,300. The deficit has been increased by the fact that the receipts for laboratory supplies and breakages have been about $4,000 less. There have been, moreover, the following special expenditures: for equipment for the Electrical Engineering Building, about $20,000; and for the building known as Engineering Building C, about $9,500. Payments for salaries and labor have been much larger than during the previous year. The expenditures for the Electrical Engineering Building and for Engineering Building C are not included in our current expenses, but, even so, there is a deficit in the current expense account for the year of more than $55,000. This, however, is accounted for in part by the payment of about $9,000 for the equipment and maintenance of the Physico-Chemical Research Laboratory, this sum being in addition to about $5,000 paid from gifts for that special purpose, and also by the expenditure of $3,000 for a dynamo plant in the Department of Physics and $4,200 for Electro-Chemical equipment. The increased charge for printing catalogues and reports is due in part to the fact that many of these were printed for distribution at the St. Louis Exposition.

During the year the following legacies and gifts have been received: —

From the Arioch Wentworth Estate, $100,000.

From the Charles C. Nichols estate, $5,000 to constitute the Charles C. Nichols Fund.

From the same friend who has heretofore paid the expenses of the Sanitary Research Laboratory an additional $5,000 for the same purpose.

From Theodore E. Russel, Esq., $2,000 to form the Richard Lee Russel Fellowship.

From the Estate of Susan E. Dorr, $1,476.94, to be added to the Susan E. Dorr Fund.

Other gifts have amounted to between five and six thousand dollars, of which Professor A. A. Noyes gave $3,000 to aid the Physico-Chemical

Research Laboratory. One friend of the Institute contributed $1,000 for general purposes, and another $500 for salaries. General Charles J. Paine gave $421.73 for the department of Naval Architecture, Mrs. William B. Rogers $200 for the purchase of periodicals, and Mr. Samuel Cabot $200 for the Physico-Chemical Research Laboratory. Gifts have also been received from Charles G. Weld, Esq., and another friend.

Additional subscriptions to the Walker Memorial Fund have been paid, amounting to $7,500; and the whole fund, including accrued income, is now $94,890.45.

After deducting the deficit in the current expense account, there remains a net increase in the property of the Institute amounting nominally to $68,014.69, about $15,000 of which is made up of students' fees paid in advance.

Securities Sold or Paid, General Fund.

$35,000	Fitchburg R.R. 5s	1903	$35,000.00
26,000	New York & New England R.R. 6s	1905	26,390.00
2,000	New York & New England R.R. 7s	1905	2,050.00
1,000	Bur. & Mo. River R.R. non-ex. 6s	1918	1,000.00
1,000	Ozark Equipment Co. 5s	1910	1,000.00
			$65,440.00

Securities Sold or Paid, Rogers Memorial Fund.

30,000	Bur. & Mo. River R.R. 4s	1910	30,000.00
6,000	New York & New England R.R. 6s	1905	6,090.00
			$36,090.00

Securities Bought or Received as Legacies, General Fund.

34,000	Baltimore & Ohio R.R. 3½s	1925	30,090.00
30,000	Chi., Mil. & St. Paul R.R. 7s.	1910	35,100.00
52,000	N.Y. Cent. & H. R. R.R. (L. S.) 3½s	1998	46,046.65
5,000	American Tel. & Tel. Co. 5s	1907	5,012.50
			$116,249.15

Rogers Memorial Fund.

6,000	Baltimore & Ohio R.R. 3½s	1925	5,310.00
31,000	N.Y. Cent. & H. R. R.R. Deb. 4s	1934	30,225.00
			$35,535.00

Richard Lee Russel Fund.

2,000	Conv. Title Ins. Co. Mortgage 4s	1908	$2,000.00

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

Dr.

Cash balance, Sept. 30, 1903		5,545.71
RECEIPTS FOR CURRENT EXPENSES.		
Income of funds for salaries	4,324.00	
" " " " Savage Fellowship	400.00	
" " " " scholarships (students' fees),	10,675.00	
" " " " Joy "	200.00	
" " " " W. B. Rogers Scholarships,	500.00	
" " " " Library	480.00	
" " " " general purposes	26,235.12	
" " Rogers Memorial Fund	10,610.11	
" " Charlotte B. Richardson Fund	1,495.15	
" " Rotch Prize Funds	400.00	
" " Rotch Architectural Fund	1,000.00	
" " Edward Austin Fund, Scholarships	6,737.50	
" " " " " Awards	3,387.50	
" " Teachers' Fund	3,400.00	
Letter Box Fund	50.00	
Students' fees	297,344.25	
State Scholarships	4,000.00	
United States Act of 1862	6,293.06	
United States Act of 1890	8,333.34	
Gift of State of Massachusetts	25,000.00	
Laboratory supplies and breakages	11,925.99	
Rents, per Table (page 12)	10,348.81	
Gifts	2,394.15	
Interest	3,410.38	
Boston University	2,650.00	
Sale Printed Lecture Notes	4,461.15	446,055.51
GIFTS AND BEQUESTS FOR SPECIAL PURPOSES.		
Increase Scholarship Funds	728.11	
" Teachers' Fund	600.00	
" Edward Austin Fund	4,275.00	
" Susan E. Dorr Fund, additional	1,476.94	
" Joy Scholarship Fund	1,222.61	
Richard Lee Russel Fellowship Fund	2,000.00	
Charles C. Nichols Fund	5,000.00	15,302.66
GIFTS AND BEQUESTS FOR GENERAL PURPOSES.		
Arioch Wentworth Legacy		100,000.00
SECURITIES SOLD OR PAID.		
General Fund, page 3		65,440.00
Rogers Memorial Fund, page 3		36,090.00
SUNDRIES.		
Income credited to Bond Premium Acc't	3,737.50	
" " " Rogers Bond Premium Acc't,	788.00	
Copley Society of Boston, on acc't	666.68	
Walker Memorial Fund	14,841.85	
Sanitary Research Laboratory Fund, additional	5,000.00	
Physico-Chem. Research Fund	3,000.00	
Notes Receivable	25,000.00	
Students' Notes	7.25	
Acc'ts Payable and Fees paid in advance	17,206.06	70,247.34
		$738,681.22

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

FOR THE YEAR ENDING SEPT. 30, 1904.

Cr.

EXPENSES.

Salaries, per Table (page 12)	340,649.43	
Fellowship paid from Savage Fund	400.00	
" " " Dalton Grad. Chem. Fund,	500.00	
Edward Austin Fund, Awards	3,387.50	
Teachers' Fund "	3,400.00	
Prizes, Rotch Funds	400.00	
Repairs, per Table (page 13)	11,911.07	
General Expenses, per Table (page 13)	17,822.45	
Fire Insurance	4,786.43	
Fuel	18,943.12	
Water	3,470.10	
Gas	2,652.10	
Electricity	2,020.93	
Printing and Advertising	7,552.61	
" Lecture Notes	3,139.24	
" Annual Catalogues and Reports	6,107.64	
Physico-Chemical Research Fund	3,000.00	
Department Supplies, per Table (p. 12),	66,269.94	
Society of Arts	1,775.62	
St. Louis Exposition	3,272.99	501,461.17

(Expenses more than Income, $55,405.66)

SECURITIES BOUGHT OR RECEIVED AS LEGACIES.

General Fund, page 3	116,249.15
Rogers Mem. Fund, page 3	35,535.00
Richard Lee Russel Fund, page 3	2,000.00
Joy Fund, interest deposited	1,222.61

SUNDRIES.

Aug. Lowell Lab. Electrical Eng. Bldg., 1902	48.98	
Equipment Electrical Engineering Building	19,854.55	
Engineering Building C	9,501.95	
Sanitary Research Laboratory Fund, expended	5,526.97	
Physico-Chem. Research Fund, expended	4,895.75	
Student Fund, expended	763.50	
Roentgen-Ray Fund, expended	18.50	
Students' Deposits	250.00	
Notes Payable	25,000.00	65,860.20
Cash balance Sept. 30, 1904		16,353.09
		$738,681.22

E. and O. E.

GEORGE WIGGLESWORTH,
Treasurer.

The following account exhibits the property held by the Institute, as per Treasurer's books, Sept. 30, 1904: —

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 .		7,411.00
			249,541.00

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
5,000.00	Dominion Coal Co. 1st 6s	1913	5,000.00
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
50,000.00	Chi. Terminal & Transfer Co. 1st 4s,	1947	47,507.50
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	49,180.00
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
100,000.00	American Tel. & Tel. Co. 4s . . .	1929	99,875.00
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
17,000.00	Ozark Equipment Co. 5s	1910	17,000.00
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
5,000.00	American Tel. & Tel. Co. 5s . . .	1907	5,000.00
	Advances to Bond Premium acc't		37,775.00
			1,420,499.61
	Amount carried up		$1,670,040.61

	Amount brought up				$1,670,040.61

STOCKS.

Shares.					
172	Boston & Albany R.R.	par	100	34,456.50	
80	Chi., Milwaukee & St. Paul R.R. Pf.	"	100	9,908.00	
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	68,909.64	
1	Boston Ground Rent Trust	"	1000	900.00	137,205.64

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		$1,829,592.56

Amount brought up			$1,829,592.56

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		7,967.85	
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	1,704,956.03
Equipment, Engineering Building		16,555.24	
" Mechanical Laboratories		20,628.56	
" Elec. Eng. Building		86,550.15	123,733.95

SUNDRIES.

Notes Receivable		12,000.00	
Loans to Copley Society of Boston		7,666.65	
Students' Notes		763.25	
Cash Balance, Sept. 30, 1904		16,353.09	36,782.99
			$3,695,065.53

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 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, "	500.00	108,100.00
SCHOLARSHIP TRUSTS.		
Richard Perkins Fund	53,330.39	
James Savage "	14,475.51	
Susan H. Swett "	10,332.95	
William Barton Rogers Fund	10,737.98	
Joy Fund	10,271.31	
Elisha Thatcher Loring Fund	5,385.34	
Charles Lewis Flint "	5,297.05	
Thomas Sherwin "	5,000.00	
Farnsworth "	5,000.00	
James H. Mirrlees "	2,855.09	
William F. Huntington "	5,243.70	
T. Sterry Hunt "	3,237.84	
Elisha Atkins "	5,000.00	
Nichols "	5,000.00	
Ann White Vose "	60,841.65	
Ann White Dickinson "	40,695.39	
Dalton Grad. Chemical "	6,239.51	
Willard B. Perkins "	6,653.15	
Billings Student "	50,000.00	
Henry Saltonstall "	10,000.00	
Isaac W. Danforth "	5,200.00	
Charles C. Nichols "	5,000.00	
Richard Lee Russel "	2,000.22	327,797.08
OTHER TRUSTS.		
Charlotte Billings Richardson Ind. Chem. Fund,		37,378.78
Susan Upham Fund		1,303.58
Susan E. Dorr "		16,373.95
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 "		375,399.37
Teachers' "		108,100.00
Saltonstall "		41,416.06
Letter Box "		71.50
MISCELLANEOUS.		
Henry L. Pierce Legacy, 1898	848,000.00	
Joseph B. Glover Legacy	5,000.00	
Arioch Wentworth Legacy, 1904	100,000.00	
Aug. Lowell Lab. Electrical Eng. Fund	68,000.00	
Walker Memorial Fund	15,545.22	
Roentgen-Ray Experiment Fund	981.50	
Sanitary Research Laboratory Fund	3,980.43	
Student Fund	3,569.20	
Physico-Chem. Research Fund	2,995.25	
M. I. T. Stock Account	879,597.34	
Students' Fees received in advance	12,990.00	
Supplies " " "	2,058.45	
Acc'ts Payable	2,157.61	1,944,875.00
		$3,695,065.53

Comparative Statement of Funds, etc.

	Sept. 30, 1903.	Sept. 30, 1904.
Trusts for general purposes	686,850.21	686,850.21
" " Salaries	108,100.00	108,100.00
" " Scholarships	319,275.98	327,797.08
" " Library	7,000.00	7,000.00
Charlotte B. Richardson Ind. Chem. Fund	37,378.78	37,378.78
Susan Upham Fund	1,301.52	1,303.58
Susan E. Dorr "	14,897.01	16,373.95
Rotch Architectural Library Fund	5,000.00	5,000.00
Rotch Architectural Fund	25,000.00	25,000.00
Rotch Prize Fund	5,200.00	5,200.00
Rotch "Special" Prize Fund	5,200.00	5,200.00
Henry L. Pierce Legacy	848,000.00	848,000.00
Saltonstall Fund	41,006.00	41,416.06
Aug. Lowell Lab. Electrical Eng. Fund	68,000.00	68,000.00
Arioch Wentworth Legacy		100,000.00
Edward Austin Fund	371,124.37	375,399.37
Teachers' Fund	107,500.00	108,100.00
Letter Box Fund	54.00	71.50
Students' Deposits	250.00	
Roentgen-Ray Experiment Fund	1,000.00	981.50
Sanitary Research Laboratory Fund	4,507.40	3,980.43
Walker Memorial Fund	703.37	15,545.22
Joseph B. Glover Legacy	5,000.00	5,000.00
Dormitory Fund	4,332.70	3,569.20
Physico-Chem. Research Fund	4,891.00	2,995.25
Notes Payable	25,000.00	
Students' Fees paid in Advance		12,990.00
Supplies " " "		2,058.45
Accounts Payable		2,157.61
M. I. T. Stock Account	930,478.50	879,597.34
	$3,627,050.84	$3,695,065.53

Increase, Consisting of:		
Bequests for Special Purposes, etc. (See page 4),	15,302.66	
Gifts and Bequests for General Purposes. (See page 4)	100,000.00	
Net Gain on Bonds sold	4,524.50	
Walker Memorial Fund	14,841.85	
Fees, etc., paid in advance	15,048.45	
Acct's Payable	2,157.61	
	55,405.66	151,875.07
Less Expenses more than Income	250.00	
" Students' Deposits	526.97	
" Sanitary Rese'rch Lab. Fund, expended, net,	18.50	
" Roentgen-Ray Fund, expended	1,895.75	
" Physico-Chem. Res'rch Fund, expended, net,	763.50	
" Dormitory Fund, expended	25,000.00	
" Notes Payable paid		83,860.38
		$68,014.69

INCOME FROM GENERAL INVESTMENTS, AND APPLICATION THEREOF.

Applied to Salaries	4,324.00	From Dividends, Bank Stocks	90.00
" " Scholarships	11,175.00	" Bonds	63,863.66
" " " James Savage Fund	400.00	" Dividends, Railroad Stocks	1,855.00
" " Charlotte B. Richardson Fund	1,495.15	" " Manufacturing Stocks	796.00
" " Teachers' Fund	4,000.00	" Real Estate Stocks	2,915.00
" " Edward Austin Fund	14,400.00		
" " Rotch Prize Funds	400.00		
" " Rotch Architectural Fund	1,000.00		
" " Library	480.00		
" " General Purposes	26,235.12		
" " Samuel Dorr Annuity	1,000.00		
" " Increase of Funds	872.89		
" " Advances to Bond Premiums	3,737.50		
	$69,519.66		$69,519.66

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

Paid Massachusetts Institute of Technology	10,610.11	Received Income from Railroad Bonds	11,398.11
Credited to Advances Bond Premiums	788.00		
	$11,398.11		$11,398.11

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	4,000.00	
Use of Rooms and Gymnasium	2,667.17	
Cambridge Real Estate	181.64	$10,348.81

Department Supplies.

Applied Mechanics	1,998.27	
Architecture	1,885.52	
Biology	1,714.90	
Brookline Athletic Field	1,245.00	
Chemistry	14,393.67	
Civil Engineering	2,184.64	
Drawing	918.34	
Economics	348.70	
Electrical Engineering	4,322.84	
English	284.14	
Equipment Electro-Chemistry	4,196.93	
Equipment Phys. Chem. Lab.	5,980.78	
General Library	1,799.39	
Geology	1,573.61	
History	791.76	
Mathematics	237.82	
Mechanic Arts	5,578.56	
Mechanical Engineering	2,825.24	
Military	135.87	
Mining	3,795.87	
Modern Languages	93.09	
Naval Architecture	1,437.41	
Physical Culture	142.74	
Physics	5,386.95	
Special Dynamo Plant	2,997.90	$66,269.94

Salaries.

Instruction	261,458.83	
Administration	37,587.98	
Labor	41,602.62	$340,649.43

General Expense.

Window Shades		53.33	
Furniture		2,709.55	
Stationery and Office Supplies		1,479.77	
Postage		2,456.78	
Electrical Wiring, Lamps, etc.		1,816.99	
Sundries		1,354.75	
Express		408.73	
Janitor's Supplies		1,103.10	
Examinations		357.30	
Diplomas and Commissions		491.00	
Washing		735.88	
Telephone Service, Installing Stations, Rentals, Repairs, etc.		1,330.68	
Engine Room Supplies:			
Oil	331.39		
Waste	209.17		
Sundries	39.69	580.25	
Ice		460.68	
Examination Books		420.61	
Graduation Exercises		243.96	
Removing Ashes		161.50	
Glass		136.25	
Union Safe Deposit Vaults (one year)		75.00	
Tech. Reunion		587.55	
Medical Services		53.00	
Plans		805.79	$17,822.45

Repairs.

Department Improvements:		
Architecture	62.60	
Biology	393.90	
Chemistry	730.37	
Civil Engineering	36.86	
Drawing	420.58	
Electrical Engineering	358.19	
Geology	367.26	
Mechanic Arts	627.06	
Mechanical Engineering	187.54	
Mining	258.09	
Naval Architecture	436.55	
Physics	213.36	4,092.36
Rogers Building		1,198.51
Walker "		1,649.46
Engineering Buildings, A and B		921.41
Pierce Building		282.72
Engineering Building, C		285.64
Lowell Building		219.32
Gymnasium Building		141.00
Mechanical Laboratories		516.00
Boiler and Power House		208.66
Tech. Union		17.09
Lunch Room		37.79
Sundries		2,341.11
		$11,911.07

BOSTON, December 2, 1904.

Mr. E. L. Parker, an accountant employed by this committee, has examined the accounts of the Treasurer of the MASSACHUSETTS INSTITUTE OF TECHNOLOGY for the year ending September 30, 1904, and his report is hereto annexed.

We have verified the list of personal property held by the Institute.

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

BOSTON, December 2, 1904.

To the Auditing Committee of the
Massachusetts Institute of Technology:

GENTLEMEN,— I have audited the accounts of Mr. George Wigglesworth, Treasurer, for the year ending September 30, 1904.

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. The account of property held by the Institute and the funds and balances, as shown in the Treasurer's report of September 30, 1904, is in accordance with the books.

Respectfully submitted,

EDWARD L. PARKER,
Public Accountant.