1921

Trinity College Bulletin, 1921 (Catalogue supplement)

Trinity College

VOLUME XVIII NEW SERIES NUMBER 1

Trinity College Bulletin

INSTRUCTION IN SCIENCE

MATHEMATICS
PHYSICS
CHEMISTRY
BIOLOGY
GEOLOGY
PRE-MEDICINE
PRE-ENGINEERING

Supplement to the Catalogue of Trinity College for 1920-1921.

HARTFORD, CONNECTICUT

1921

TRINITY COLLEGE BULLETIN

Issued quarterly by the College. Entered January 12, 1904, at Hartford, Conn., as second class matter, under the Act of Congress of July 16, 1894. The Bulletin includes in its issues: the College Catalogue; Reports of the President, Treasurer, and Librarian; Announcements and Circulars of Information.

Accepted for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized March 3, 1919.

Instruction in Science

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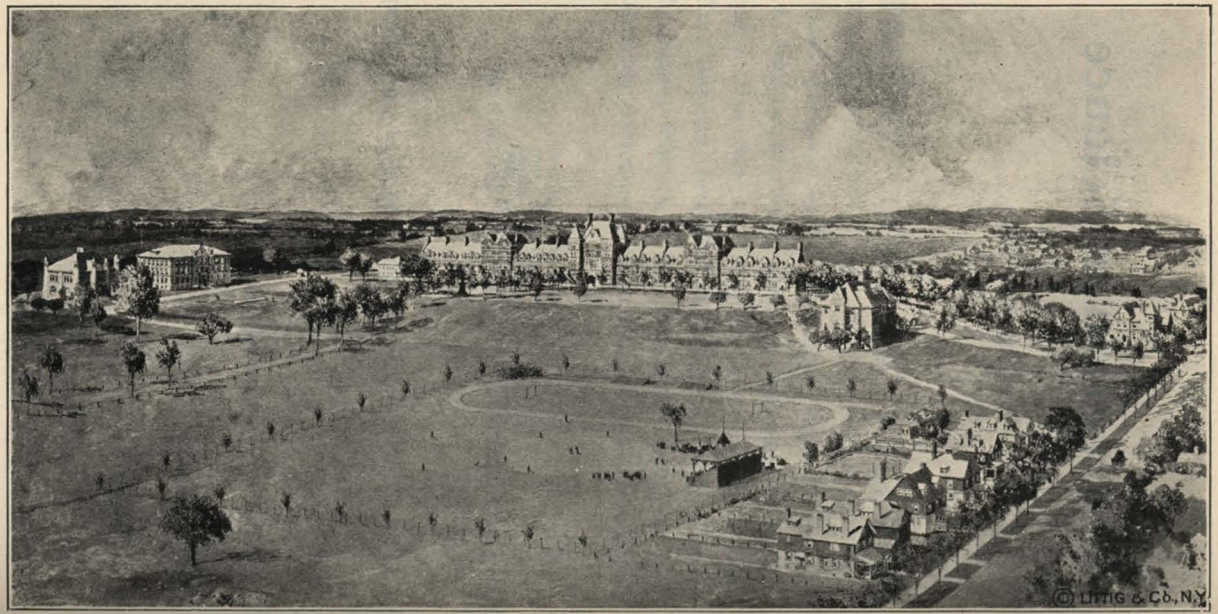


Trinity College

The College.

Trinity College, Hartford, Conn., is a college offering courses of instruction in the arts and sciences. Its departments comprise: Greek, Latin, English, Modern Languages (French, German, Spanish, Italian), Biblical Literature, Philosophy and Psychology, History and Political Science, Economics and Social Science including Insurance, Mathematics and Astronomy, Physics, Chemistry, Biology, Physiology and Hygiene, Geology, Civil Engineering and Drawing, and Physical Training. The College confers the degrees of B. A., B. S., M. A. and M. S. The Library contains over 125,000 books and pamphlets, among which are included the more important reference books in science, together with bound and current volumes of many scientific periodicals. The number of students enrolled in the college in 1920-1921 was 215.

The tuition fee at Trinity College is $150 per annum. Room rent in the College dormitories varies from $40 to $200 for each person. Annual charges for heat, incidentals and membership in the Athletic Association amount to about $75. For detailed information regarding the College, its requirements for admission, curriculum, scholarships, rooms, etc. reference should be made to the Annual Catalogue, copies of which may be obtained by addressing the Registrar, Trinity College, Hartford, Conn.

The Group System.

The courses of instruction in Trinity College have been arranged in a number of groups, each of which centers about some distinctive subject or field of learning. Certain of these groups lie in the domain of the sciences, and detailed information concerning them will be found in this Bulletin.

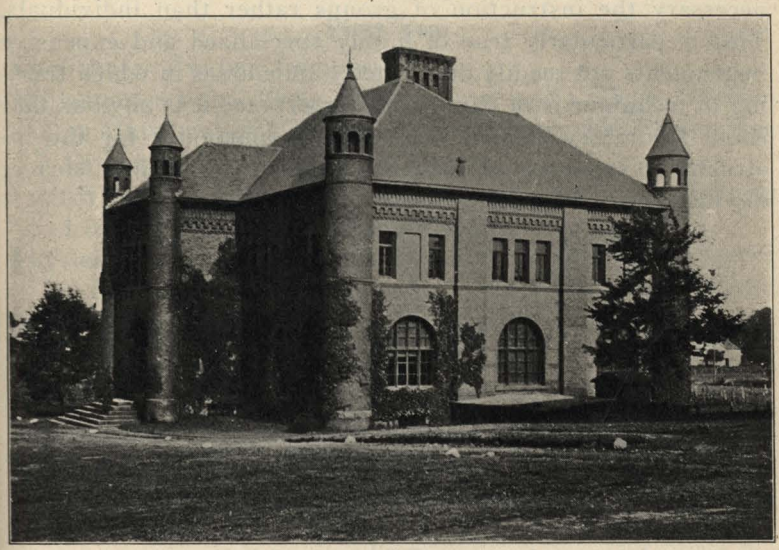
It is the purpose of Trinity College to offer its students a broad and liberal education. Each group affords the opportunity for concentration on a major study, but undue specialization is guarded against by the requirement of certain courses not directly related to the major subject, and by the privilege of choosing a variable number of free electives. In selecting these the student is aided by a faculty adviser. The

Library

number of elective studies is usually greater than that indicated in the formal outline of the group, since most students receive credit at entrance for one or more of the subjects prescribed for the first year in college. Courses in science are open to students enrolled in non-science groups, and courses in arts, languages, philosophy and social sciences may be elected by those in science groups.

While a desirable liberality is thus provided for in the undergraduate course of study, each of the groups in science has been designed to give thorough preparation for graduate

or professional study in the field in which the major subject of the group lies. Trinity College does not offer complete training for the professions, but it does prepare its undergraduates as adequately as possible for the schools that provide the final training for professional careers. The better institutions giving instruction in medicine, public health, the various branches of engineering, industrial chemistry and the like—as well as graduate schools for the training of science teachers and research workers—are all making increasing demands on the colleges for preparatory instruction in the fundamental sciences and related subjects. It is with these demands in view that the courses constituting the science groups outlined in the following pages have been selected.



The Jarvis Laboratories.

Science in the Small College.

The small college, if provided with adequate laboratories, ample apparatus, and properly equipped lecture rooms, offers at least two fairly obvious advantages to the student seeking instruction in the sciences:

1. Personal contact with experienced instructors in the laboratories as well as in the lecture and recitation rooms. Small classes and small laboratory sections make this possible. Even in the elementary courses the student receives individual instruction from professors who are experienced in teaching, and whose lives are being devoted to the fields of science which they represent.

2. Opportunity for becoming thoroughly familiar with scientific instruments, demonstration apparatus and the details of laboratory technique. This also is the direct result of small numbers in laboratory classes. The student has access to apparatus, the close study and individual use of which is often not possible where large classes and limited time make necessary the instruction of groups rather than individuals. This is particularly true of highly specialized and expensive instruments not readily duplicated. In courses in which training in technique is of paramount importance it is obvious that small laboratory classes give better opportunity for the instructor to supervise in detail the work of the student, correct his mistakes, and guide his manipulations.

The Mathematical-Physical Group.

Mathematical Sub-Group

An arrangement of courses, with Mathematics as the major study, leading to the degree of bachelor of science. This group is especially recommended to students who wish to become teachers of mathematics, to enter the actuarial profession, or to obtain a broad collegiate preparation for graduate work in Mathematics or Astronomy.

First Year.

English 1: English Composition.
Mathematics 1 ab: Plane Trigonometry and College Algebra; or Mathematics 2 ab: Analytic Geometry and Elementary Differential and Integral Calculus.
French 1 or 2: Elementary or Advanced French; or German 1 or 2: Elementary or Advanced German.
Physics 1: General Physics; or, for those who offer Physics 1 for admission, Drawing 1: Mechanical and Freehand Drawing and Elementary Descriptive Geometry.
Chemistry 1: General Chemistry.

Second Year.

Mathematics 2 ab; or Mathematics 3 ab: Calculus and Elementary Differential Equations.
Physics 2: Mechanics and General Properties of Matter, Heat and Sound.
Drawing 1; or an elective, if Drawing 1 was taken in the first year.
Philosophy 1 ab: Logic and Psychology.
One additional course.

Third Year.

Mathematics 3 ab; or Mathematics 6: Advanced Algebra.
Mathematics 5: General Astronomy.

Physics 4: Advanced Laboratory Physics.
Two additional courses.

Fourth Year.

Mathematics 4: Advanced Calculus and Differential Equations; or Mathematics 6.
Physics 5: Analytical Mechanics.
Three additional courses.

To satisfy the requirements for the degree in this group the student must take five courses in Mathematics, four courses in Physics, one in Chemistry, one in Drawing, one in Philosophy, two in French and two in German. He must also elect two courses in the departments of Economics, History or English (exclusive of English 1), but both of these courses may not be taken in the same department.

Courses of Instruction in Mathematics and Astronomy.

1 ab: Plane Trigonometry and College Algebra.

1 c: Solid Geometry.

2 a: Analytic Geometry. Elements of plane analytic geometry including conic sections, trigonometric, logarithmic and exponential curves, polar coordinates. An introduction to solid analytic geometry.

2 b: Elementary Differential and Integral Calculus. The fundamental principles, methods and formulas of differential and integral calculus; application to simple problems in geometry and the physical sciences.

3 ab: Calculus and Elementary Differential Equations. A continuation of course 2 b, including applications to mechanics, the determination of lengths, areas, and volumes; the expansion of functions into series; the solution of simple differential equations.

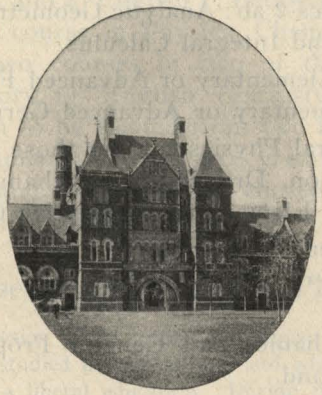
4: Advanced Calculus and Differential Equations. A more critical examination of the fundamental methods of the calculus; definite integrals, elliptic integrals; theory of ordinary and partial differential equations. The contents of this course will be varied from year to year to meet the particular needs of the students.

5: General Astronomy. An elementary course dealing with the fundamental facts, principles and methods of astronomy; observatory work; spherical trigonometry; navigation.

6: Advanced Algebra, including the elementary principles of determinants, theory of equations, theory of numbers, convergent series, calculus of finite differences and probability. Particular attention is paid to the needs of students who are preparing to take the examinations of the Actuarial Society of America.

The Astronomical Observatory.

The observatory contains a six and one-half inch refracting telescope, an alt-azimuth instrument, a two and one-half inch transit, a portable refracting telescope and numerous other smaller instruments.



The Mathematical-Physical Group.

Physical Sub-Group.

An arrangement of courses, having Physics as a major and Mathematics as a minor study, leading to the degree of bachelor of science. This group is especially desirable for those who plan to become electrical or mechanical engineers, as well as for those who wish to fit themselves for expert work in applied physics or for teaching and research.

First Year.

English 1: English Composition.

Mathematics 1 ab: Plane Trigonometry and College Algebra; or Mathematics 2 ab: Analytic Geometry and Elementary Differential and Integral Calculus.

French 1 or 2: Elementary or Advanced French; or German 1 or 2: Elementary or Advanced German.

Physics 1: General Physics; or, for those who offer Physics 1 for admission, Drawing 1: Mechanical and Freehand Drawing and Elementary Descriptive Geometry.

Chemistry 1: General Chemistry.

Second Year.

Physics 2: Mechanics and General Properties of Matter, Heat and Sound.

Mathematics 2 ab; or Mathematics 3 ab: Calculus and Elementary Differential Equations.

Drawing 1; or an elective, if Drawing 1 was taken in the first year.

Philosophy 1 ab: Logic and Psychology.

One additional course.

Third Year.

Physics 3 ab: Light and Electricity and Elementary Thermodynamics.

Physics 4: Advanced Laboratory Physics.

Mathematics 3 ab; or an elective, if Mathematics 3 was taken in the second year.

Chemistry 2: Qualitative Analysis.

One additional course.

Fourth Year.

Physics 5: Analytical Mechanics.

One elective from the courses in Physics, Mathematics or Civil Engineering.

Three additional courses.

To satisfy the requirements for the degree in this group, the student must receive credit for Physics 1, 2, 3 ab, 4 and 5; Mathematics 1 ab, 2 ab and 3 ab; Chemistry 1 and 2; French 1 and 2; German 1 and 2; English 1; Philosophy 1 ab; Drawing 1; one additional course in Physics, Chemistry or Civil Engineering; and two courses in two of the departments of Economics, History or English (exclusive of English 1). There will remain to be elected from two to five courses, according to the amount of entrance credits received in required subjects, and these may be chosen from any of the various departments of the college.

Courses of Instruction in Physics.

1: General Physics. This course is designed to meet the needs of those who have not studied physics before, and who wish it primarily as an essential part of a liberal education. During the year the five main divisions, mechanics, heat, sound, light, and electricity, are treated in lectures with experimental demonstrations, recitations and laboratory work. The text book used is somewhat more advanced that the usual school text, but only a very elementary knowledge of mathematics is required of the student.

2: Mechanics and General Properties of Matter, Heat and Sound. This is open to all who have had the elements of the subject, and is

necessarily more difficult than Physics 1. Although many of the same topics are discussed, they are attacked in the more thorough quantitative manner that is characteristic of an "exact science." Moreover, many new subjects too difficult for the beginner are described and illustrated.

3 a: Light and Electricity. This is a continuation of Physics 2 and should be taken by all who have completed the latter course. The subject matter is treated in a similar spirit. The laboratory is particularly well equipped for demonstration experiments in these two important branches.

3 b: Elementary Thermodynamics. This course is intended to fit the student for physical chemistry, steam engineering or for advanced work in heat. The fundamental principles and equations are derived, and the simpler applications fully discussed. While not essentially a technical course, the student should have no difficulty in grasping the more difficult text books on the steam engine after such an introduction.

4: Advanced Laboratory Physics. A course, partly accompanying and partly following Physics 2, in exact measurements and observations of physical quantities. It includes one lecture a week on the theory of measurements, and two periods of two hours each in the laboratory. The department is well equipped for this work, and as the classes in such a course are necessarily small, it is possible to provide them with the highest grade of instruments, thus giving opportunities for refined observations and exact results which would be impossible with larger classes.

5: Analytical Mechanics. This is a general course in statics and dynamics intended to provide a sound foundation for the study of physical sciences and of engineering. The subject is based upon a single fundamental principle, all other mechanical laws and principles being derived from it. The conditions for the equilibrium of a particle and of rigid bodies; the equations of motion of a particle and of a rigid body; the principles of the conservation of energy, of linear momentum and of angular momentum; and the principle of virtual work, are all derived from the action principle. These principles are applied to the solution of many problems of physics and engineering, such as problems on friction, stresses in cranes and trusses, flexible cables, center of mass and moment of inertia, work, energy and power, linear and tortional elasticity, collision and impact, orbital motion, and periodic motion. Knowledge of elementary differential and integral calculus is taken for granted.

6: Introductory Electrical Engineering. A course in the theory of the dynamo, motor and various transformers, combined with laboratory work, is offered to those who are preparing to be engineers, either civil, mechanical or electrical. This is a decidedly technical course, and gives the student a fairly wide survey of the whole field of electrical

engineering. In the laboratory actual commercial tests are made on commercial apparatus, and all the most important types of electrical machinery and measuring apparatus are represented in the equipment.

8 a: Radio-Communication. A half course in wireless telegraphy and telephony is offered for the benefit of those who wish to gain more information about this important method of communication than can be obtained in merely operating an amateur station. The theory of ether waves, the production of high frequency oscillations, and their reception and detection by the pliotron and other detectors are studied, and tests and measurements are carried out in the laboratory, together with practice in receiving and sending messages.

The Jarvis Physical Laboratories.

The Jarvis Physical Laboratories, as has been intimated above, are well equipped with modern and well designed apparatus.

In the field of electricity might be mentioned a very adequate outfit of standard meters, potentiometers, bridges, resistances, condensers, inductances; also galvanometers and electrometers of several types and extreme delicacy. In addition there is demonstration apparatus for exhibiting all kinds of discharges, X ray and high frequency phenomena, beside the usual instruments for illustrating the more fundamental facts and laws.

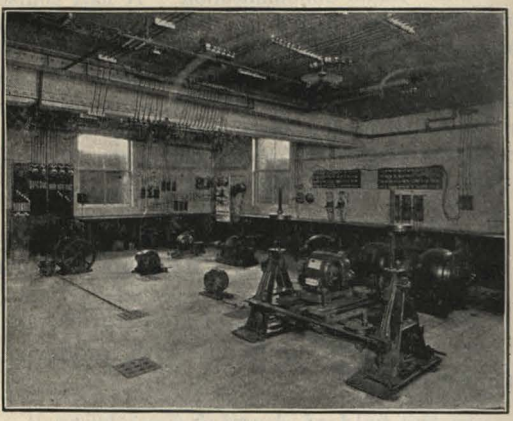
In the field of light are a Lummer-Brodhun photometer, several good spectrometers, an interferometer, polariscope, an optical bench for performing Fresnel's classic experiments on diffraction, and all the usual equipment for demonstrating the familiar laws of optics.

Sound is represented by a small model pipe organ, a pair of electrically driven Lissajou's forks, a very modern Kundt's tube apparatus, and all the usual demonstration apparatus.

In the domain of mechanics and heat may be mentioned a cathetometer, two excellent micrometer microscopes, apparatus for measuring heat conductivity, expansion, specific and latent heats with precision. Regnault's apparatus for obtaining the saturated steam curve, an outfit for determining

Joule's equivalent, and Joly's steam calorimeter also deserve mention.

The electrical engineering laboratory contains two induction motors, two D. C. generators, a D. C. motor, an A. C. generator, several ordinary transformers, a mercury arc rectifier, a rotary converter, a storage battery of 120 volts and 40 ampere-hour capacity, and a complete line of A. C. and D. C. ammeters, voltmeters, and wattmeters, also a wave meter, and all the usual accessories for making tests and obtaining characteristic curves.



Dynamo Room of Department of Physics

The Chemical Group.

This group is arranged for students who expect to teach chemistry in the high schools, to enter industrial work as analytical chemists, or to continue the subject in a graduate school or a school of chemical engineering. Many students prefer a general training before they enter a technical school. It is to these students that this group is especially recommended, as it includes the fundamentals in mathematics, physics and chemistry, and yet leaves half of the time for other subjects. The completion of this group with the degree of bachelor of science will permit students to finish a course of chemical engineering in one to two years depending upon the technical school chosen. The classes in all courses except general chemistry are small and therefore allow close personal supervision.

First Year.

English 1: English Composition.

Mathematics 1 ab: Plane Trigonometry and College Algebra; or Mathematics 2 ab: Analytic Geometry and Elementary Differential and Integral Calculus.

French 1 or 2: Elementary or Advanced French; or German 1 or 2: Elementary or Advanced German.

Physics 1: General Physics; or Physics 2: Mechanics and General Properties of Matter, Heat and Sound.

Chemistry 1: General Chemistry; or Chemistry 2: Qualitative Analysis.

Second Year.

Chemistry 2; or Chemistry 3: Elementary Quantitative Analysis.

Mathematics 2 ab; or Mathematics 3 ab: Calculus and Elementary Differential Equations.

Physics 3 a: Light and Electricity.

Philosophy 1 ab: Logic and Psychology.

One and one-half additional courses.

Third Year.

Chemistry 3; or Chemistry 4: Advanced Quantitative Anaylsis; or Chemistry 5: Quantitative Organic and Food Analysis.

Chemistry 6: Elementary Organic Chemistry; or Chemistry 8: Elementary Physical Chemistry.

Mathematics 3 ab; or an elective, if Mathematics 3 was taken in the second year.

Two additional courses.

Fourth Year.

Chemistry 4 or 5: Courses in Quantitative Analysis.

Chemistry 7 ab: Advanced Organic and Biological Organic Chemistry; or Chemistry 8.

Physics 4: Advanced Laboratory Physics.

Two additional courses.

To satisfy the requirements for the degree in this group the student must take two courses in French and two in German, two courses in English (exclusive of English 1), Economics or History, the two courses not to be in the same department; and in addition at least six courses in Chemistry, three in Mathematics, and two in Physics.

Courses of Instruction in Chemistry.

General Chemistry.

1: General Chemistry. A course of lectures (with experiments) and laboratory work in general chemistry.

Analysis.

2: Qualitative Analysis. A short course of lectures on the theory

of solutions with laboratory work on the qualitative estimation of the metals and acid radicals.

3: Elementary Quantitative Analysis. A laboratory course in the simpler gravometric and volumetric methods. It also includes weekly exercises in stoichiometry.

4: Advanced Quantitative Analysis. This course takes up special fields of quantitative analysis of iron and steel, non-ferrous alloys, water, gas, etc. The students are allowed to choose the subjects in which they are particularly interested.

5: Quantitative Organic and Food Analysis. A laboratory course devoted to the estimation of carbon, hydrogen, nitrogen, sulfur, the halogens and phosphorus in organic compounds; the quantitative estimation of common organic substances, such as alcohol, formaldehyde, glucose and cane sugar; the determination of saponification, iodine, Reichert-Meissl and Polenske values of fats and oils, the analysis of milk and feeds.

Organic Chemistry.

6: Elementary Organic Chemistry. This is an introductory course to the chemistry of the compounds of carbon. The lectures cover the preparation and the physical and chemical properties of the principal types of organic compounds of both the aliphatic and aromatic series, their inter-relations and simple proofs for their structures. The laboratory work follows closely the ground covered in the lectures.

7 a: Advanced Organic Chemistry. This is an extension of course 6 covering special topics such as organic reactions, valency of carbon, sterioisomerism of carbon and nitrogen compounds, and color and structure.

7 b: Biological Organic Chemistry. A course comprising an elementary study of the carbohydrates, fats, proteins and enzymes. The laboratory work takes up typical preparations and tests of the above named substances.

Physical Chemistry.

8. Elementary Physical Chemistry. A study of the laws governing chemical phenomena. The lectures cover gases, liquids, solids, solutions, the phase rule, thermo-chemistry, chemical change, etc. The laboratory work includes molecular weight determinations, conductivity measurements, determination of heats of neutralization, and other topics.

The Chemical Laboratories.

The department of Chemistry with the department of Physics occupies the Jarvis Laboratories. The Chemical department is provided with a lecture room seating forty students, and with a class or recitation room seating twenty. The laboratory for general chemistry and qualitative analysis will be remodeled during the summer of 1921, and will have accommodation for one hundred and twenty students working in two sections. The laboratory for elementary quantitative analysis has ample room for twelve students. A new laboratory for organic chemistry is being fitted up at the present time, and will be ready for 1921-1922. There is also a special laboratory for physical chemistry.

One of the Chemical Laboratories

The store room is well supplied with the chemicals, glassware, porcelain, etc., which are needed in a college laboratory. It contains in addition the following special apparatus: electric vacuum oven, rotary vacuum pump, automatic Toepler vacuum pump, electric combustion furnace, polariscope reading to 1/100 degree, Zeiss butyrorefractometer, microscope, motor generator and storage battery, and all the apparatus for physical-chemical experiments, such as molecular weights by the Dumas, freezing point and boiling point methods, conductivity measurements, heats of neutralization, etc.

The Biological (Pre-Medical) Group.

This group of studies, leading to the degree of bachelor of science, affords instruction in the natural sciences for students whose interests lie in the field of biology. The biological courses have been correlated with other subjects, especially chemistry, so as to provide adequate training for graduate work in the biological sciences. The group is also designed to prepare students for the study of medicine and public health, and includes all the subjects required for admission to the leading medical schools.

First Year.

English 1: English Composition.
Mathematics 1 ab: Plane Trigonometry and College Algebra; or Mathematics 2 ab: Analytic Geometry and Elementary Differential and Integral Calculus.
French 1 or 2: Elementary or Advanced French; or German 1 or 2: Elementary or Advanced German.
Physics 1: General Physics.
Chemistry 1: General Chemistry.

Second Year.

Biology 1: General Biology.
Chemistry 2: Qualitative Analysis.
Mathematics 2 ab; or an elective, if Mathematics 2 was taken in the first year.
Philosophy 1 ab: Logic and Psychology.
One additional course.

Third Year.

Biology 2 ab: Vertebrate and Invertebrate Zoology.
Biology 4: Microbiology; or Chemistry 8: Physical Chemistry.

Chemistry 6: Organic Chemistry.

Physiology and Hygiene 1: Elementary Physiology and Hygiene.

One additional course.

Fourth Year.

Biology 3 ab: Microscopical Technique and Vertebrate Embryology.

Chemistry 8; or Biology 4.

Three additional courses.

To satisfy the requirements for the degree in this group, the student must be credited with both Mathematics 1 and 2, and with two courses in French and two in German. He must elect two courses in the departments of Economics, History or English (exclusive of English 1), but both of these courses may not be taken in the same department. The additional elective courses necessary to complete his schedule of studies in the second, third or fourth years may be chosen in any of the various departments of the college. Preparatory medical students should bear in mind that a laboratory course in college physics required for admission to class A medical schools cannot be anticipated by presenting a high school course in physics as a college entrance subject.

Courses of Instruction in Biology.

1: General Biology. An introductory course dealing with the gross and microscopical structure of animals and plants, the functions of their organs, their development, and their relations to one another and to man. The lectures include a brief systematic survey of the animal and plant kingdoms, illustrated by museum material, and an introduction to the theory of organic evolution and to other generalizations of biological science. The laboratory work comprehends dissections, microscopical examination of animal and plant structures, studies of various activities or organisms, and exercises in the scientific method.

2 a: Vertebrate Zoology, with special reference to comparative anatomy. Laboratory dissections of a fish, an amphibian and a mammal.

Lectures on the classification of the vertebrates and on the comparative anatomy of their organs.

2 b: Invertebrate Zoology. A study of the classification, morphology, physiology, and life histories of selected types of invertebrate animals, including forms of interest from the point of view of premedical education. Lectures, laboratory and museum work.

3 a: Microscopical Technique and Elementary Embryology. The theory and practice of microscopical technique. Standard methods of fixation, embedding, section cutting, staining and mounting. Exercises in micrometry, determination of magnification, etc. Preparation of embryological material, and study of the early stages of the development of animals.

3 b: Vertebrate Embryology. A continuation of course 3 a. The development of the organs of the vertebrate body. Laboratory studies of vertebrate embryos, with text book assignments and lectures.

4: Microbiology. An elementary study of microorganisms. The general technique of laboratory methods is taken up, including care and sterilization of glassware; making, sterilization and care of culture media; preparation and use of stains. The forms, the physiology and the culture of microorganisms are studied, after which a systematic study of several types of organisms is made. In the second term examination of air, milk, water and sewage is taught, and some of the common organisms producing diseases in animals and man are studied.

A voluntary seminar is held from time to time for the presentation of papers by students in the advanced courses, and for the discussion of current topics of biological interest.

Courses of Instruction in Physiology and Hygiene.

1: Elementary Physiology and Hygiene. In this course the tissues, organs and systems of the human body are studied by means of lectures and text books and with the aid of charts, models and demonstrations. After the physiology of an organ or system has been covered the hygiene pertaining to that subject is taught. Both personal and public hygiene are considered.

2: Human Physiology. A more advanced and detailed study of physiology with lectures and assignments in text book and scientific journals.

The Biological Laboratories.

The courses in biology and physiology are given in the laboratories and class rooms of the Boardman Hall of Natural History. The general biological laboratory is spacious and well lighted for dissection and microscopical work. Each student is provided with a modern compound microscope and a dissecting microscope, and the equipment for instruction includes a comprehensive collection of prepared microscopical slides, anatomical models and demonstration material.

The laboratory for advanced courses is furnished with all the necessary apparatus for adequate training in the approved laboratory methods of microscopical technique, embryology and bacteriology. The equipment comprises high grade compound microscopes with oil immersion lenses, microtomes, paraffin bath, incubators for high and low temperature growth, dry, flowing steam and high pressure sterilizers, constant temperature water bath, refrigerator, special glassware, and all the necessary chemicals, reagents, and microscopical accessories. Models illustrating the development of vertebrate embryos and the structure of microorganisms are available for the use of students. A basement laboratory provides facilities for gross dissections and injections, and in this part of the building aquaria and a vivarium are maintained.

The biological lecture room is furnished with a balopticon and projection lantern, an ample series of lantern slides and a collection of zoological and botanical charts covering a wide range of subjects.

The Museum of Natural History.

The Museum of Natural History occupies portions of three floors of Boardman Hall, and affords a variety of illustrative material for the classes in biology and geology. In the biological section there are on exhibition: a series of Ward models of extinct vertebrates; skeletons and mounted specimens of recent vertebrates, chiefly mammals; collec-

Museum

tions of local birds, eggs and nests; an extensive collection of invertebrates including representative groups of insects and marine animals from the shores of New England, the West Indies and the Pacific coast; an herbarium of local flowering plants prepared by the Horticultural Society of Connecticut; the Lorenz herbaria of New England ferns, mosses and liverworts; and a comprehensive collection of mounted diatoms.

The geological section of the Museum contains a large variety of rocks and minerals including the Caswell collection of four thousand mineral specimens, and a collection of invertebrate fossils.

The Pre-Engineering Group.

The group is intended to furnish a broad foundation and a non-technical background for those students who expect to prepare later for a career which is essentially engineering, whether in manufacturing, in public life or as professional engineers. By carefully selecting their free electives, graduates of the college who have finished this group should be able to obtain a technical degree in a year and a half or two years of additional study. There may thus be combined, in approximately six years the advantages of a general college education with the bachelor's degree and the technical training in a highly specialized school. The group is planned also to meet the needs of the student who has not fully decided upon his life work, but who has a preference for applied science.

First Year.

English 1: English Composition.

Mathematics 1 ab: Plane Trigonometry and College Algebra; or Mathematics 2 ab: Analytic Geometry and Elementary Differential and Integral Calculus.

French 1 or 2: Elementary or Advanced French; or German 1 or 2: Elementary or Advanced German.

Physics 1: General Physics; or, for those who offer Physics 1 for admission, Chemistry 1: General Chemistry.

Drawing 1: Mechanical and Freehand Drawing and Elementary Descriptive Geometry.

Second Year.

Mathematics 2 ab; or Mathematics 3 ab: Calculus and Elementary Differential Equations.

Civil Engineering 1 ab: Plane Surveying.

Chemistry 1; or Philosophy 1 ab: Logic and Psychology.

A course in Physics.

One additional course.

Third Year.

Mathematics 3 ab; or a course in Geology.
Philosophy 1 ab; or an elective, if Philosophy 1 has been taken.
Drawing 2: Descriptive Geometry and Elementary Mechanism.
A course in Physics.
One additional course.

Fourth Year.

A course in Chemistry or Geology.
Civil Engineering 2 ab: Applied Mechanics.
Three additional courses.

To satisfy the requirements for the degree in this group, the student must take two courses in Civil Engineering, two in Drawing, three in Mathematics, three in Physics, two in Chemistry, one in Philosophy, two in French and two in German. He must also elect two courses in the departments of Economics, English (exclusive of English 1) or History, but both of these courses may not be taken in the same department. As part of these requirements may be satisfied at admission, a careful selection of entrance subjects will enable the student to increase the number of electives that may be taken.

Courses of Instruction in Engineering and Drawing.

In addition to the group preparatory to engineering outlined above, more advanced courses in civil engineering may be elected. A description of the courses offered in the Department of Civil Engineering and Drawing follows:

Civil Engineering.

1 ab: Plane Surveying. Theory of plane surveying through location of curves. Actual practice in the use of the tape, level and transit, dealing with the ordinary surveying and location problems. Map work and earthwork computations, largely from original notes, occupy the winter months. The course is conducted so that the underlying theory is at all times emphasized.

The equipment for this work is adequate and modern, consisting of an excellent variety of tapes, leveling rods, levels and transits, with the necessary accessories.

2 ab: Applied Mechanics. This course, while divided into two parts, each taken for one term, is in reality a complete course in applied mechanics. The first part includes the theory and practice of the design of beams, columns, etc., and a discussion of their behavior as integral parts of a structure. The second part includes hydraulics: pressures on submerged surfaces, flow in pipes and conduits, weirs, hydraulic motors, design of pipe lines, etc.

This course is a most important part of the theory underlying the study of engineering, civil, electrical and mechanical. It is also part of the work that should be taken by all who have to do with construction problems.

3: Theory of Structures. A course for the student who wishes to continue course 2. Theoretical investigations of roof and bridge trusses and plate girders, retaining walls, etc., following modern analytical methods.

4 a: Street and Highway Engineering. A non-technical discussion of the various types of roads and pavements. The course is made as broad as the time allowed to the subject (one term) will permit. The great importance of highway transportation places this subject in the list of semi-professional courses.

5: Sanitary Engineering. Rainfall; run-off; stream flow. Investigation, design and construction of public water supplies. Methods of distribution and filtration. Sewerage; construction of systems of sewers, both domestic and storm water; sewage treatment and destruction; house plumbing so far as it affects the larger problem of the disposal of human wastes.

This course is intended primarily for those who expect to become civil or sanitary engineers or health officers, but it may be pursued with profit by any properly prepared student interested in the public health problem.

6 b: Masonry and Reinforced Concrete. A continuation of the subject matter of course 2. Theory and design of steel-concrete structures. A course recommended to the more advanced student only.

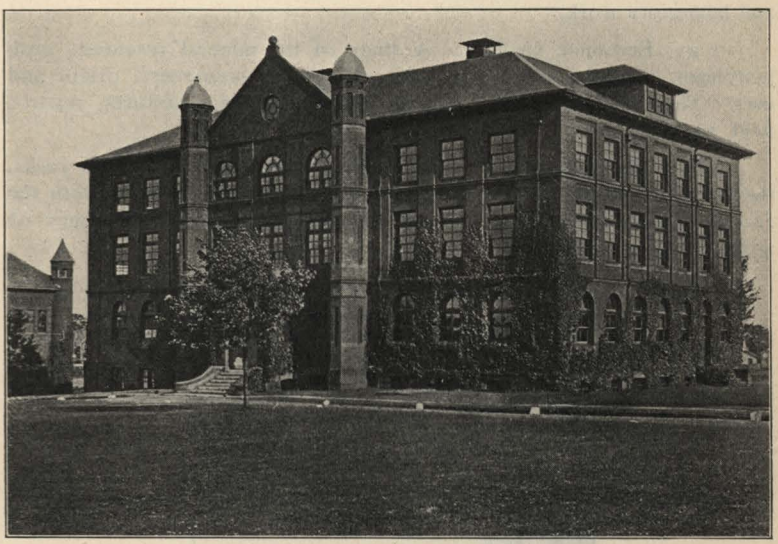
Drawing.

1: Elementary Drawing, designed for those who have not previously taken drawing. Use of the instruments; geometrical constructions; orthographic projections; pictorial drawing; elementary mechanical drawing; elementary descriptive geometry.

2: Descriptive Geometry. This is essentially a recitation course

with black-board work. The point, line, plane and surface are studied, and combined into more or less complicated problems. Besides its value as a means of attacking many of the questions which arise in applied mathematics, descriptive geometry furnishes a mental training unique and valuable.

3: For the more advanced or special student a third course in drawing or design may be arranged.



Boardman Hall of Natural History.

Courses of Instruction in Geology.

1: Elementary Geology. First term: Physical Geology. Lectures dealing in general with the architecture, minerals, rocks and origin of the earth. Dynamical processes. Second term: Historical Geology. Lectures on the rock formations, their age, distribution and fossils. Origin of the earth and development of plant and animal life. Field trips and museum studies.

2 a: Meteorology and Oceanography. Climate in its relation to human activities past and present. The atmosphere, the oceans and their geological significance. A study of weather maps and weather observation.

2 b: Systematic Physiography and Glacial Geology. Earth features: mountains, plateaus, plains, drainage; causes and results of volcanoes and earthquakes; glaciation in North America and other parts of the world. Lectures, map studies, excursions.

3 a: Geography. Physiographic regions of North America. A detailed study of the sections of our own continent, with special reference to the influences of topography and resources on human activities.

3 b: Crystallography and Mineralogy. Optical, physical and chemical properties of minerals, their origin and association. Lectures and laboratory work.

4 a: Economic Geology. A study of the mineral resources, coal, petroleum, natural gas, ore deposits, etc., as to occurrence, origin and uses. The effect of ground waters; metamorphism. Lectures, reports, field trips.

4 b: Paleontology. A study of fossils, their preservation in rocks, their uses in geology and their evolutional significance, together with the factors governing the development of extinct and modern groups of animals. Museum studies.