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DEPARTMENT OF PHARMACY

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# DIRECTORY OF THE UNIVERSITY

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The Faculty—Address:

THE UNIVERSITY OF NOTRE DAME

NOTRE DAME, INDIANA.

The STUDENTS—Address:

As for the Faculty, except that the name of the  
HALL in which the student lives should be added.

A Postoffice, a Telegraph Office, a Long Distance  
Telephone, and an Express Office are at the University.

The University is two miles from the city of South  
Bend, Indiana, and about eighty miles east of Chicago.  
The Lake Shore and Michigan Southern, the Grand  
Trunk, the Vandalia, the Indiana, Illinois & Iowa, the  
Chicago and Indiana Southern, and the Michigan Central  
railways run directly into South Bend.

# EXECUTIVE OFFICERS OF THE UNIVERSITY

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# FACULTY OF THE DEPARTMENT OF PHARMACY

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ROBERT L. GREEN, PH. G.,  
Pharmacy and Materia Medica.

REV. ALEXANDER KIRSCH, C. S. C.,  
Microscopy and Bacteriology.

REV. JOSEPH A. MAGUIRE, C. S. C.,  
Analytical Chemistry.

REV. JULIUS A. NIEUWLAND, C. S. C.,  
Organic Chemistry and Botany.

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Physics.

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English.

KNOWLES B. SMITH, E. M.,  
Geology.

FRANCIS POWERS, M. D.,  
Physiology and Histology.

JOHN S. WORDEN, B. S.  
General Chemistry.

## UNIVERSITY OF NOTRE DAME

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The University of Notre Dame was founded in the year 1842, by the Very Reverend Edward Sorin, the late Superior General of the Congregation of Holy Cross. In an act approved January 15, 1844, the Legislature of Indiana gave the University power to grant degrees. The beginning of this act is:

*"Be it enacted by the General Assembly of the State of Indiana, that Edward Frederick Sorin, Francis Lewis Cointet, Theophilus Jerome Marivault, Francis Gouesse and their associates and successors in office, be, and are hereby constituted and declared to be, a body, corporate and politic, by the name and style of the 'University of Notre Dame du Lac,' and by that name shall have perpetual succession, with full power and authority to confer and grant, or cause to be conferred and granted such degrees and diplomas in the liberal arts and sciences, and in law and medicine, as are usually conferred and granted in other universities in the United States, provided, however, that no degree shall be conferred or diplomas granted, except to students who have acquired the same proficiency in the liberal arts and sciences, and in law and medicine, as is customary in other universities in the United States."*

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# THE DEPARTMENT OF PHARMACY

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The Department of Pharmacy of the University of Notre Dame was established in 1898. From the very beginning the department has enjoyed a healthy and satisfactory growth, a growth which gives every promise of continuance. The equipment and scope of the work have been enlarged from time to time in order to keep abreast of progress in pharmaceutical lines. This progressive policy will continue to be maintained. The aim kept constantly in view is to furnish a broad, thorough, practical training in pharmacy, which will enable the student to take his place creditably in any of the varied branches of his calling. That this aim has been fully realized is attested by the fact that many of our graduates in pharmacy are occupying positions of responsibility in large drug houses,—wholesale, retail and manufacturing.

The location of the University is ideal. It is situated on the banks of two charming lakes, near the St. Joseph river, a river famous for its beauty as well as its history. The climate is agreeable and health-promoting, tempered in winter as well as in summer by Lake Michigan, which is not far distant. The location of the University away from the immediate neighborhood of a large city is another great advantage. Removed from the distractions of city life the student can devote his whole attention undisturbed to his work and in consequence can make better progress than he could if he were subject to those distractions. The instructors, too, devote their whole time to teaching and this of course insures thoroughness.

That the advantage of a scientific training is being

recognized more and more every day is proved by the increasing number of students choosing this line of work. The hand is trained as well as the mind, and thus is furnished an evenly balanced education. The thorough, systematic, painstaking work required by this study in the formative period of life exercises a wholesome effect on the character and establishes the clear and accurate method of thought and action which are so essential to success in this age of high pressure work. Besides its practical value, the pharmacy course offers exceptional opportunities for a training of this character owing to the large amount of laboratory work required.

#### METHODS AND SCOPE OF THE WORK

The subject is presented in such a manner as to impart a thorough theoretical as well as a practical knowledge of pharmacy. The work commences with the simplest and gradually leads up to the most complicated processes. Lectures, demonstrations and discussions precede and accompany the practical work in the laboratory. The application of the theory to the manufacture of preparations firmly grounds the student in the principles of the study and gives him a comprehensive understanding of the subject.

Special attention is given to the little details which are so essential to success in any professional work, particularly in pharmacy. The student is carefully drilled in store etiquette, business hints, prescription work and dispensing. Neatness and order in all the operations and extreme care in the manufacture of all preparations are required throughout the courses. A frequent and rigid inspection of apparatus and desks by the instructor does much to establish habits of order and neatness. To inculcate habits of caution and accuracy, which are of paramount importance in



pharmacy, the student is required to fill out an order blank for his laboratory supplies for each preparation. The druggist in charge fills the order, countersigns it and hands it to the instructor for verification. Mistakes are thereby easily located and trouble in the work too is often cleared up. This check exercises a wholesome restraining influence on the student and renders careless, slipshod work almost impossible.

Each student works independently in the laboratory under the supervision of the instructor. The work is done in three or more consecutive hours on consecutive days. Continuity of effort is of unquestioned value, as it insures more rapid progress and better work than brief periods with long intermissions. Many pharmaceutical processes require considerable time for their completion, and success in such cases can be attained only by uninterrupted attention. Besides the loss of time incident to the preparation both after and before work is reduced to a minimum.

The second year students take weekly turns in the drug store where they dispense supplies for the laboratory, order goods, invoice stock, write business letters, etc. This work familiarizes the student with the general arrangement of stock and furnishes a training practically the same as that obtained in a retail store.

The following is a partial list of the pharmaceutical and chemical processes and preparations with which the student becomes familiar in his work in the laboratory: Assaying, clarification, crystallization, colation, carbonization, comminution, calcination, dilution, decantation, decoloration, deflagration, desiccation, dialysis, distillation, elutriation, expression, extraction, emulsification, filtration, fusion, granulation, ignition, incineration, levigation, maceration, percolation, precipitation, scaling, standardizing, sublimation, solution, separation,

- \* testing, turbidation, volumetric and gravimetric estimations, polariscopic and spectroscopic estimations, manufacture of pills, troches, lozenges, tablets, suppositories, plasters, ointments, cerates, powders and the various official preparations.

The following text-books and reference works are used in the study of Pharmacy and Materia Medica: U. S. Pharmacopœia, U. S. Dispensatory, National Formulary, National Dispensatory, *Casparis' Pharmacy*, *Remington's Pharmacy*, *Scoville's Art of Compounding*, *Ruddimæn's Incompatibilities*, *Oldberg's Chemistry*, *Sayre's Materia Medica and Pharmacognosy*, *Potter's Materia Medica and Therapeutics*, *White & Wilcox Materia Medica and Therapeutics*, *Sturmer's Pharmaceutical Arithmetic*.

The requirements of the Pharmaceutical Syllabus are fully carried out.

### ADMISSION

The department offers three programs of courses leading to degrees, one of two years leading to the degree of Graduate in Pharmacy (Ph. G.), one of three years leading to the degree of Pharmaceutical Chemist (Ph. C.), and a third of four years leading to the degree of Bachelor of Science in Pharmacy.

Applicants for admission to the two year program which leads to the degree of Graduate in Pharmacy (Ph. G.) must be eighteen years (18) of age and must pass an examination in the subjects taught in the first year of a reputable high school. A certificate from the principal of such a school will be accepted in place of examination.

For admission to the three year program, which leads to the degree of Pharmaceutical Chemist (Ph. C.), applicants must be eighteen years (18) of age and must

present satisfactory evidence by examination or certificate of having spent two years in a high school of the best grade. A certificate admitting to the third year of high school will be accepted instead of an examination.

For admission to the four year program without examination, applicants must be graduates of fully accredited High Schools or Preparatory Schools of equal standing; otherwise an examination will be necessary. A candidate failing to pass satisfactory examinations in one or more of the subjects required for admission may, at the discretion of the Faculty, be admitted to the Freshman year conditioned, to make up his deficiency *within one school year*.

Advanced standing is given on presentation of acceptable certificate or by examination.

A candidate must present a certificate or pass examinations in the following branches to receive Freshman standing.

PHYSICAL GEOGRAPHY. As given in *Tarr's* text-book or an equivalent treatise.

PHYSIOLOGY. *Martin's Human Body*, or an equivalent treatise.

ZOOLOGY. Elementary.

BOTANY. Elementary.

CIVIL GOVERNMENT. The American Constitution; Federal and State Governments.

HISTORY. General outlines of Ancient, Medieval and Modern History.

ALGEBRA. The whole subject as far as logarithms, as given in *Wentworth's College Algebra*, or an equivalent in the larger treatises of other authors.

GEOMETRY. Plane and Solid, including the solution of simple original problems and numerical examples, as given in the works of *Wentworth*, *Chauvenet*, *Newcomb*, or equivalent treatises by other authors.

TRIGONOMETRY. Plane and Spherical.

CHEMISTRY. Elements of inorganic chemistry. The preparation in this subject must include a course of lectures and recitations. A course of at least fifty experiments in elementary chemistry actually performed by the pupil.

PHYSICS. Elementary. The preparation on this subject should include a course of lectures, illustrated by experiments, and recitations from a text-book similar to *Carhart and Chute's* or *Gage's*. In both chemistry and physics the laboratory note-book must be presented.

ENGLISH. Part of the examination is given for answering questions upon the text-books and readings required in the preparatory courses in English in the Preparatory School of the University; the remainder for writing an essay.

GERMAN. A two-year course in German is required. Ability to translate at sight easy German into English and easy English into German, or

FRENCH. A two-year course in French may be presented instead of German under the same conditions. Ability to translate readily, rather than an accurate grammatical knowledge, is expected.

LATIN. Grammar, complete; *Cæsar*, four books of the Gallic War; translation of English into Latin based on the text of *Cæsar*.

## EQUIPMENT

The Equipment of the department is complete and modern. The laboratories for pharmaceutical work and for chemistry especially are large, roomy and well ventilated. Each of these laboratories, and there are five devoted to pharmacy and chemistry alone, measures 42x35 feet. They are twenty feet high and are lighted on three sides, insuring plenty of light and abundance

of air. The laboratories are furnished with hoods of good draught, drying ovens, chambers and water stills; the desks are provided with hot and cold water, suction, pressure, acetylene, electricity, gas and the necessary reagents. There are separate laboratories for microscopy, botany, bacteriology, mineralogy and assaying, and physics. The apparatus is of the most approved type. Instruments of the latest design and appliances of modern manufacture are provided for the students. Each desk is supplied with all the apparatus necessary for ordinary work. Special apparatus such as spectrometers, polarimeters, tablet machines, specific gravity apparatus, etc., are furnished as required.

The department contains a fully equipped Drug Store in which the student obtains practically the same experience that he would get in actual business. A second year student is placed in full charge. He is required to furnish supplies for the department, order material, write business letters, invoice stock, etc. Then at the end of a specified time he delivers the store in good order to his successor.

About 2,000 recent prescriptions written by physicians, and taken from the files of a drug store, constitute a very important part of the equipment. Under supervision of the instructor each student is required to read them and compound those requiring special manipulation. The reading room is supplied with all the leading pharmaceutical and chemical journals and books of reference. The pharmacognosy room contains specimens of all the official and a great many unofficial drugs for study and identification.

### THESIS.

During the third year the students taking the three year program are required to spend at least two hours

a week in original research on a subject within the domain of Pharmacy. The results of this work are carefully recorded and must be typewritten and presented to the Faculty as a requirement for graduation. This applies likewise to students of the four year program in the last year of their work.

### LABORATORY FEES

Pharmaceutical Laboratory II., IV., each.....	\$20.00
Pharmaceutical Laboratory VI., VII., each.....	20.00
Chemistry V.....	20.00
Chemistry II., III., IV., VI., and IX. each.....	10.00
Bacteriology.....	10.00
Chemistry I.....	5.00
Physics I.....	5.00
Physics III.....	5.00
Geology III.....	5.00
Botany II.....	5.00
Microscopy.....	1.00

## STUDIES PRESCRIBED FOR THE DEGREE OF GRADUATE IN PHARMACY

## FIRST YEAR

SUBJECTS: FIRST TERM.	Hrs. a week	Course	SUBJECTS: SECOND TERM.	Hrs. a week	Course
Pharmacy	8	I, II	Pharmacy	8	I, II
Chemistry	5	I	Chemistry	5	I
Microscopy	2	I	Chemistry	2	X
Bacteriology	5	I	Physiology	5	I
Arithmetic	3	IX	Chemistry	4	III
Physics	5	I	Physics	5	I

## SECOND YEAR

Pharmacy	8	III, IV	Pharmacy	11	IV, V, VI a
Chemistry	4	IV	Pharmacy	2	XI
Chemistry	7	VI	Mat'ra Medica	3	VIII
Mat'ra Medica	3	VIII	Botany	5	I, II
Botany	5	I, II	Pharmacog'y	1	I
Pharmacog'y	1	X			

## DEGREE: PHARMACEUTICAL CHEMIST

## FIRST YEAR.

Pharmacy	8	I, II	Pharmacy	8	I, II
Chemistry	5	I	Chemistry	5	I
Microscopy	2	I	Chemistry	2	X
Bacteriology	5	I	Physiology	5	I
Arithmetic	3	IX	Chemistry	4	III
Physics	5	I	Physics	5	I

## SECOND YEAR

Pharmacy	8	III, IV	Pharmacy	11	IV, V, VI a
Chemistry	4	IV	Pharmacy	2	XI
Chemistry	7	VI	Mat'ra Medica	3	VIII
Mat'ra Medica	3	VIII	Botany	5	I, II
Botany	5	I, II	Pharmacog'y	1	X
Pharmacog'y	1	X			

## THIRD YEAR

Pharmacy	6	VI b	Pharmacy	6	VII
Chemistry	5	IX c	Chemistry	5	XIV
Geology	2	III	Urine Anal.	3	VII a
Elective	5		Toxicology	3	VII b
Thesis	2		Elective	5	
			Thesis	2	

# STUDIES PRESCRIBED FOR THE DEGREE OF BACHELOR OF SCIENCE IN PHARMACY

## FRESHMAN YEAR

SUBJECTS: FIRST TERM.	Hrs. a week	Course	SUBJECTS: SECOND TERM.	Hrs. a week	Course
Chemistry	4	II	Chemistry	4	II
English	3	I	English	3	I
Botany	5	I, II	Botany	5	I, II
German	5	I	German	5	I
Microscopy	2	I	Physiology	5	I

## SOPHOMORE YEAR

Pharmacy	8	I., II.	Pharmacy	8	I., II
Chemistry	4	V	Chemistry	4	V
Physics	5	II, III	Physics	5	II, III
English	3	II	English	3	II

## JUNIOR YEAR

Pharmacy	8	III., IV	Pharmacy	11	IV. V. VIa.
Chemistry	5	VI	Chemistry	2	VI (c)
Bacteriology	5	I	Geology	5	I
Zoology	5	I	Pharmacy	2	XI
			Zoology	5	I

## SENIOR YEAR

Pharmacy	8	VI b	Pharmacy	5	VII
Pharmacog'y	2	X	Pharmacog'y	2	X
Geology	2	III	Urine Anal	2	VII a
Elective	5		Toxicology	3	VII b
Mat'ra Medica	3	VIII	Elective	5	
Thesis			Mat'ra Medica	3	VIII
			Thesis	5	



## COURSES IN PHARMACY

## I.

ELEMENTS OF PHARMACY—Lectures and recitations on the art and science of pharmacy, and demonstrations of the various pharmaceutical processes.

[Three hours a week for two terms.]

## II.

GALENICAL PHARMACY—A laboratory course to accompany Course I. This course consists of the practical application of the pharmaceutical processes to the manufacture of official preparations of the United States Pharmacopœia and of unofficial and N. F. preparations.

[Five hours a week for twenty-six weeks.]

## III.

INORGANIC PHARMACY—Laboratory, demonstrations and recitations. A thorough course in the preparation and testing of pharmaceutical and technical chemicals.

[Six hours a week for one term.]

## IV.

GENERAL PHARMACY—A systematic classification of organic and inorganic drugs and preparations from a pharmaceutical standpoint followed by a close study of each of the classes.

[Two hours a week for two terms.]

## V.

MAGISTRAL PHARMACY—Includes the manifold methods of extemporaneous pharmacy with consideration of incompatibility, posology, and the principles of elegant pharmacy. Dispensing and prescription practice.

[Three hours a week for one term.]

## VI.

(a) PHARMACEUTICAL CHEMISTRY—Chiefly assaying, testing and manufacturing. Determination of melting

and boiling points, and solubilities. Some attention is given also, to toilet and commercial preparations with a view to the invention and development of original formulas.

[Six hours a week for one term.]

(b) PHARMACEUTICAL PHARMACY—Pssaying and manufacturing.

[Six hours a week for one term.]

#### VII.

GENERAL PHARMACY—Pharmaceutical analysis and assaying, micro-chemical, polariscopic and spectroscopic estimations. Incompatibilities and methods of manufacture.

[Five hours a week for one term.]

#### VIII.

MATERIA MEDICA—This work embraces a detailed consideration of botanical drugs, their pharmaceutical definition and description, constituents, habitat, therapeutic action, use, dose and antidote. Attention is given also to mineral drugs and those of animal origin. They are studied individually at first then in classes or groups. The grouping is so arranged as to make the subject comparatively easy for the student.

[Two hours a week for three terms.]

#### IX.

PHARMACEUTICAL ARITHMETIC—This work includes a study of weights and measures, percentage, relationship of systems, reducing and enlarging formulas, alligation and chemical problems.

[Three hours a week for one term.]

#### X.

PHARMACOGNOSY—The identification of preparations and crude drugs by their physical properties with special reference to quality and detection of adulteration. Attention is also given to the methods of prevent-

ing loss by improper storage or by the ravages of insects. Important drugs are studied under the microscope in cross section and in powder form.

[Three hours a week for one term.]

## XI.

COMMERCIAL PHARMACY—A brief course in business methods, store-management, banking, accounting, and everything connected with the commercial side of pharmacy. Likewise a number of lectures on Pharmaceutical Jurisprudence.

[Two hours a week for one term.]

## BACTERIOLOGY.

LECTURES AND LABORATORY WORK. Lectures on the form, structure, reproduction and classification of bacteria. The relations of bacteria to disease, etc. The principles of sterilization, thermal and chemical, are pointed out. The early part of the laboratory work is occupied in the preparation of the various culture media and in studying pure cultures of certain non-pathogenic bacteria in these media. Observations on the microscopic characteristics of bacteria and special attention to the microscopic technique in bacteriological work. Later on in the course some time is devoted to practice in isolation and identification of pathogenic germs by the various staining processes. Inoculation of animals. Bacteriological investigation of water, air and soil. Text-book, *Abbott's Principles of Bacteriology*.

[Five hours a week for fourteen weeks.]

## I.

BOTANY. Lectures and recitations on the morphology of the root, stem, leaf, flower, fruit and seed; the development of the embryo and the processes of pollination and fertilization; the study of the vegetable cell, of its products, of cell formation, of plant tissues and

the various physiological phenomena; the structure, growth, reproduction and general classification of the Text-book, *Bastin's College Botany*, Barnes & Coulter. algae, fungi, lichens, mosses, ferns, and the higher plants.

[Four hours a week for two terms.]

## II.

BOTANICAL LABORATORY. Supplementary to Course I. Special microscopical study of thallophyta, bryophyta, pteridophyta and spermatophyta referred to in Course I. Drawings must be made of all plants examined. Plants under these headings are collected and put before the student that he may become familiar with their morphology, structure and classification. The course is to accompany or to be preceded by Course I. Provision is also made in this course for students in pharmacy to take a special laboratory course in pharmaceutical botany. Study of the determination and classification of the simpler plants. The analysis of the phanerogams occupies the time during the spring months and the student is made familiar with the habitat and characteristics of the local flora. Text-book for classification of plants, *Kellerman's Spring Flora*.

[One laboratory hour a week for two terms.]

## III.

ADVANCED BOTANY. Lectures, recitations, demonstrations. The work of this course is essentially the same as that laid out in *Strasburger's* or *Vine's* text-book of Botany. Special study is made of the physiology, ontogeny, phylogeny, ecology and classification of plants. Text-book, *Strasburger*.

[Three hours a week for two terms.]

## IV.

LABORATORY FOR ADVANCED BOTANY. Supplementary to Course III., and either following or accompanying it:

(a) PLANT HISTOLOGY AND PHYSIOLOGY. Half of the

time allotted for laboratory work is devoted to plant histology and physiology. The student is required to study practically the method of killing, fixing, embedding, sectioning, staining, mounting and drawing of plant tissues. Text-book, *Chamberlain*.

(b) PLANT CLASSIFICATION ADVANCED. The other half of the laboratory work is devoted to the determination and classification of the more difficult plants, the compositae, grasses, mosses, myxomycetes, etc. Herbarium study is required, as well as preparing and collecting plants for preservation. During spring and autumn frequent excursions into the neighboring fields and woods are made for the purpose of studying and collecting for preservation the local aquatic and land flora. Text-book, *Britton's or Gray's Manual*.

[One and one-half hours a week for two terms.]

## V.

SYSTEMATIC BOTANY. Principally laboratory and herbarium work in special groups of phanerograms and cryptograms. Study of nomenclature and classification of plants. This course is designed to meet the needs or inclinations of students specializing in botany. Library, reference books and seminar work.

## CHEMISTRY.

### I.

(a) GENERAL CHEMISTRY. A minor course dealing with the general principles of chemistry and embracing a study of only the commoner elements and their typical compounds. Text-book, *Remsen's Elements of Chemistry*.

[Three hours a week for two terms.]

(b) A LABORATORY COURSE covering in the laboratory the work of the Course (I. a.) and designed to accompany it. *Laboratory Manual, Maguire*.

[Two hours a week for two terms.]

## II.

(a) ADVANCED INORGANIC CHEMISTRY. Lectures and recitations. A complete study of the elements and their most important compounds, following the classification based on Mendeleeff's Law, and including a discussion of the theories of the science. Text-book, *Alexander Smith's College Chemistry*.

[Two hours a week for two terms.]

(b) EXPERIMENTAL CHEMISTRY. A Laboratory course to accompany Course II., the work consisting of the preparation by the student of the elements and their more typical compounds, determination of molecular weights, verification of the fundamental laws of chemistry, etc. During the latter part of the course, there is taken up the study of the reactions involved in the separation and detection of the more common inorganic bases and acids, the analysis of salts, mixtures of salts, and the complex substances, such as earths, ores, ashes, etc. Text-books, *Perkin* and *Thorpe*, supplemented with lectures.

[Two to three hours a week for two terms.]

## III.\*

QUALITATIVE ANALYSIS. A course arranged for the students in Pharmacy, comprising a study of the commoner metals and acids, their reactions and separation. Text-book, *Perkin*.

[Four hours a week for one term.]

## IV.\*

QUANTITATIVE ANALYSIS. Course suited to the needs of the students in Pharmacy, comprising the determination of substances, both gravimetrically and volumetrically. Text-books, *Appleton* and *Schimpf*.

[Fours hours a week for one term.]

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\* Courses III. and IV. are intended for students of two and three year programs.

## V.

QUANTITATIVE ANALYSIS. A laboratory study of the principles involved in the quantitative separation and estimation of substances, both gravimetrically and volumetrically. Complete analysis of a number of simple salts, like barium chloride, with partial analysis of many complex substances. Text-book, *Olsen*.

[Four hours a week for two terms.]

## VI.

(a) ELEMENTARY ORGANIC CHEMISTRY. Lectures and recitations. A systematic study of the hydrocarbons and their derivatives, and the investigation of their properties. Special attention is given to the aliphatic and aromatic series. Text-book, *Remsen*.

[Five hours a week for one term.]

(b) EXPERIMENTAL ORGANIC CHEMISTRY. A course fitted to accompany the preceding, involving the preparation by the student in the laboratory of the most important and typical organic compounds and the investigation of their properties. Text-book, *Gatterman's Manual*.

[Two hours a week for one term.]

## VII.

(a) URINE ANALYSIS. A course of laboratory exercises in the methods employed in the detection and estimation of the constituents of urine, pathologic as well as normal. Text-book, *Holland*.

[Three hours a week for one term.]

(b) TOXICOLOGY. Symptoms and treatment of poisoning. A chemical and physical examination of the common poisons to familiarize the student with their properties. Attention is also given to their separation from food and animal tissue. Text-book, *Holland*.

[Three hours a week for one term.]

## VIII.

TECHNICAL CHEMICAL ANALYSIS. Advanced courses intended for students specializing in chemistry. Special courses, at the option of the student, in

- I. GAS ANALYSIS.
- II. WATER ANALYSIS.
- IV. COMMERCIAL ORGANIC ANALYSIS.
- V. OILS AND FATS.
- VI. IRON ANALYSIS.

[Five to fifteen hours a week for two terms.]

## IX.

(a) ADVANCED ORGANIC CHEMISTRY. An advanced course, intended for students specializing in chemistry. Lectures, recitations and discussions of special subjects of organic chemistry, synthetic chemistry, isomerism, and stereochemistry. Text-books, *Cohen* and special reference works.

[Two hours a week for one term.]

(b) ADVANCED ORGANIC LABORATORY. The term is spent principally in the making of organic preparations by methods demanding special case, skill and accuracy in the student.

[Six to eight hours a week for two terms.]

(c) ADVANCED ORGANIC LABORATORY. This term is devoted to ultimate organic analysis, qualitative and quantitative; analysis of carbon, hydrogen, the halo-gens, sulphur and nitrogen in organic compounds by the various methods; also in the determination of molecular weights of organic compounds. Text-books, special notes and reference work.

[Eight hours a week for one term.]

## X.

GENERAL PHARMACEUTICAL CHEMISTRY. In this course the chemical basis and their compounds are



considered, with special reference to their importance in pharmacy and materia medica. Text-books, *Sadtler's and Trimble's Pharmaceutical Chemistry*.

### XI.

(a) ELECTROCHEMISTRY. Lectures, experiments and recitations on the principles of electrochemistry and their application in the chemical industries, separation of metals, the preparation of chemical elements and electrosyn thesis of compounds. Text-books, *Classen and Lüpke*.

[Two hours a week for one term.]

(b) ELECTROCHEMICAL LABORATORY. A laboratory course accompanying Course XI. (a). Experiments demonstrating the laws and principles of electrochemistry, electrolysis, electrosynthesis and electro-metallurgy. Quantitative determination of metals electrolytically. Text-books, *Lüpke and Classen*.

[Two hours a week for one term.]

### XII.

HISTORY OF CHEMISTRY. The subject is divided into topics and epochs of special interest in the development of chemistry as a science. These are discussed at length, together with the biographies of the men who aided in their development. Lectures and recitations. Seminar and journal work for advanced students. Text-book. *Meyer*. Reference to chemical periodicals.

[Three hours a week for one term.]

### XIII.

(a) PHYSICAL CHEMISTRY. Lectures, recitations and demonstrations, experiments on the subjects of gas density, solutions, chemical dynamics, the phase rule, thermochemistry, photochemistry, etc. Text-book, *Van Deventer*.

[Two hours a week for one term.]

(b) EXPERIMENTAL PHYSICAL CHEMISTRY. Laboratory work to accompany Course XIII. (a). Vapor density methods, calorimetric demonstrations, molecular weight demonstrations by the freezing and boiling point methods, etc.

[One hour a week for one term.]

#### XIV.

INDUSTRIAL CHEMISTRY. Lectures, recitations and laboratory work. The consideration of chemical manufacture, fuels, etc., and the preparation in the laboratory of chemically pure substances, organic and inorganic. Special reference books and journals.

[Five hours a week for two terms.]

#### XV.

ADVANCED QUANTITATIVE. Mostly laboratory work in special methods for gravimetric and volumetric determinations of inorganic substances. Special reference work. [Five hours a week for one term.]

### ENGLISH.

#### I.\*

GENUNG'S PRINCIPLES OF RHETORIC. A study of the complete text. Frequent practice in simple theme work, versification, writing in all literary forms and assigned readings.

[Three hours a week for two terms.]

#### II.

(a) ESSAY AND ORATION. Intensive study.

[Three hours a week for fourteen weeks.]

(b) POETRY AND THE POETS. Texts, theory and critical study. Practice in writing in all literary forms and assigned readings.

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\* The student may elect his work in English after completing English I.

## III.

FICTION. (a) The Short Story, technically, historically and critically considered.

[Three hours a week for fourteen weeks.]

(b) The Novel, technically, historically and critically considered.

[Three hours a week for twenty-two weeks.]

Practice in writing in all literary forms and assigned readings.

## IV.

THE DRAMA. (a) Hennequin's The Art of Playwriting.

[Three hours a week for fourteen weeks.]

(b) Elizabethan Dramatists. Intensive study of Shakespeare.

[Three hours a week for sixteen weeks.]

(c) Modern Drama, from Sheridan to the present time.

[Three hours a week for six weeks.]

Under all the subjects special attention will be given to current productions with a view of properly acquainting the student with the writers of the day.

## GEOLOGY.

## I.

PRINCIPLES OF GEOLOGY. Lectures, recitations, demonstrations. The study of the general features of the earth; the material composing the accessible parts of the earth; the arrangements of the material in rocks; the causes of geological changes; the history of the earth and the various forms of life that existed in the different periods of successive geological ages. Text-book, *Brigham*.

[Four hours a week for one term.]

## II.

MINERALOGY. Lectures, recitations, and laboratory

work. A study of crystallography and the classification of minerals, accompanied by practice in the laboratory and museum in the determination of minerals, especially the ores. Blow-pipe analysis. Text-book, *Crosby*.

[Two hours a week for one term.]

## METALLURGY.\*

### I.

ASSAYING. Chiefly laboratory work. Furnace assaying of the ores of gold, silver and lead. Text-book, *Ricketts*.

[Two laboratory hours a week for one term.]

## MICROSCOPY

### I.

MICROSCOPY. Lectures and laboratory work. Refraction and dispersion of light and illumination. The index of refraction in different media. Different shapes of lenses. Spherical and chromatic aberration. The selection and care of a good microscope. The use of accessories for advanced work; immersion and adjustable objectives, camera lucida, sub-stage condenser, polarizer, micrometers, etc. Special work in photomicrography. Text-book, *Gage*.

[Two hours a week for two terms.]

### II.

MICRO-CHEMISTRY. Laboratory work. The preparation of micro-chemical reagents and their application in testing, fixing, hardening, staining, cleaning and mounting tissues and organs.

[One laboratory hour a week for one term.]

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\* For other courses in Metallurgy, see General Catalogue.

## PHYSICS

## I.

(a) PHYSICS. Instruction in Physics is given by lectures and recitations in which the general laws of mechanics, heat, acoustics, optics, electricity and magnetism are presented. The course is intended to meet the needs of those who desire a general knowledge of the subject, as well as to lay the foundations for advanced work. Particular attention is paid to the correct statement of principles, so that in his advanced work the student will have nothing to unlearn or relearn. Text-book, *Carhart and Chute*.

[Three hours a week for two terms.]

(b) THE LABORATORY WORK of this course consists of a series of experiments which verify and apply practically the fundamental principles of physics. The student also receives instruction in the use and careful handling of apparatus, accurate observation, and correct deduction of results. Neat and concise reports of all experiments are kept by each student and form the basis for the grades in his work.

[Two hours a week for two terms.]

## II.

GENERAL PHYSICS. In this course there is a more extended treatment of the same subjects than is given in Course I. Mathematical principles are applied to physical phenomena. Special attention is paid to accuracy in the mathematical work and in the statements of the principles involved. Lectures and recitations. Text-book, *Crewe*.

[Three hours a week for two terms.]

## III.

PHYSICS. The application of mathematics in physical

work. Measurements of length, mass and time. Work in mechanics, heat, light, sound, electricity and magnetism. The work is done in the laboratory and the student is taught to depend on his own resources and to check his results.

[Two laboratory hours a week for two terms.]

#### IV.

PHYSICAL LABORATORY. Special advanced work in heat, light, mechanics, sound, electricity and magnetism. Accuracy in observations and in the calculation and recording of the results is required. Students may specialize here according to the program which they are following. This course must be preceded by Courses II. and III.

[Three hours a week for one term.]

#### V.

ELECTRICAL MEASUREMENTS. Laboratory practice with galvanometers, voltmeters, ammeters and wattmeters, resistance work, the relation or equivalence between electric energy and heat, capacity and inductance, insulation tests.

[Three hours a week for one term.]

#### VI.

CALORIMETRY. Accurate work in laboratory, using methods of mixtures, bomb and other calorimeters in measuring the calorific value of gaseous and solid fuels, quantitative measurements of radiation and conduction of heat as applied to pipe coverings, etc.

[Three hours a week for ten weeks.]

### PHYSIOLOGY

#### I.

(a) This course comprises lectures, recitations and

demonstrations based upon *Thornton's Text-book of Human Physiology*. A liberal supply of models, charts and manikins are at hand to facilitate all demonstrations required.

(b) Laboratory work consisting of a selected number of experiments so arranged as to give the student a fair insight into modern experimental physiology.

(c) A limited number of microscopical preparations are required to be made by each student, and he must examine a set of typical preparations in order to acquire a fair knowledge of the microscopical structure of the tissues and organs of the human body.

(d) During the course special lectures will be given upon personal, domestic and municipal hygiene.

[Three recitations and one laboratory period for two terms.]

N. B.—Students of Pharmacy must take sections (a) and (d) and may select either (b) or (c).

## II.

(a) This course comprises a complete study of human physiology such as is required of students of medicine. The lectures, recitations and demonstrations are based upon *Kirk's Handbook of Physiology* and *Hall's Text-book of Physiology*. The student will have free access to a copy of the *The American Text-book of Physiology* for special reference.

(b) Laboratory work in experimental physiology. The manual used is *Hall's Experimental Physiology*, but the student will have free access to a number of other similar works,

[Four recitation hours and two laboratory periods for two terms.]

## ZOOLOGY

## I.

This course comprises:

(a) Lectures, recitations and demonstrations based upon *Nicholson's Text-book of Zoology*.

(b) Lectures, readings and recitations based upon *Parker's Elementary Course in Biology*.

(c) Laboratory work on Invertebrata as outlined in *Pratt's Invertebrate Zoology*, and *Parker's Biology*.

(d) Mammalian Osteology including the study of one or two types of skeletons belonging to each order of mammalia. The work is outlined in *Kirsch's Elementary Course in Mammalian Osteology*.

[Two recitation hours and three laboratory periods for first term; three recitation hours and three laboratory periods for second term.]

## II.

This course comprises:

(a) Recitations, lectures and demonstrations based upon *Hertwig's Manual of Zoology*.

(b) Laboratory work upon some Invertebrata in order to complete and supplement the work under (c) in Course I.

(c) Dissection and laboratory work upon one of two types in each of the classes of Vertebrata, viz.: fish, frog, newt, turtle, snake, mammal; the text-book used is *Pratt's Vertebrate Zoology*.

(d) A more extended study of mammalia with reference to the cat as outlined in *Davison's Mammalian Anatomy*.

(e) An outline of comparative Embryology of animals. Text-book, *Packard and Foster and Balfour*.