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INDEX

PAGE		PAGE		PAGE	
Agricultural Chemistry . . .	10	Greek	27	Philosophy	39
Analytical Chemistry	3	Greek Art	28	Physical Chemistry	7
Anatomy	1	Histology	29	Physical Education	42
Bibliography	1	History	30	Physical Geography	21
Biochemistry	47	Hygiene	57	Physical Training	57
Biology	1	Inorganic Chemistry	3, 6	Physics	43
Botany	1	Insect Morphology	19	Physiology	47
Chemical Microscopy	8	Italian	52	Preventive Medicine	57
Chemistry	3	Latin	33	Psychology	48
Economic Geology	23	Limnology	18, 20	Public Law	25
Economics	10	Mathematics	35	Public Speaking	49
Education	12	Military Science	57	Romance Languages	50
Embryology	29	Mineralogy	22	Romance Philology	52
English	14	Musical	22	Sanitary Chemistry	9
Entomology	18	Nature Study	18, 20	Scandinavian Languages	54
French	50	Organic Chemistry	5	Semitic Languages	54
Geology	21	Paleontology	23	Spanish	52
German	24	Parasitology	20	Stratigraphic Geology	23
Government	25	Petrography	22	Systematic Entomology	19
				Zoology	55

CALENDAR

First Term 1920-1921

Sept. 17,	Friday,	Entrance examinations begin.
Sept. 22,	Wednesday,	Entrance examinations end.
Sept. 27-28,	Monday, Tuesday,	Registration of new students.
Sept. 29,	Wednesday,	Registration of matriculated students.
Sept. 30,	Thursday,	Instruction begins.
Oct. 19,	Tuesday,	Last day for payment of tuition.
Nov. —,	Thursday,	Thanksgiving recess of one day.
Dec. 22,	Wednesday,	Instruction ends at 1 p. m.
Jan. 6,	Thursday,	Instruction resumed at 1 p. m. } Christmas Recess.
Jan. 11,	Tuesday,	Founder's Day.
Jan. 20,	Saturday,	Instruction ends at 6 p. m.
Jan. 31,	Monday,	Final examinations begin.
Feb. 9,	Wednesday,	Final examinations end.

Second Term 1920-1921

Feb. 12,	Saturday,	Registration of all students.
Feb. 14,	Monday,	Instruction resumed at 8 a. m.
Mar. 4,	Friday,	Last day for payment of tuition.
Apr. 6,	Wednesday,	Instruction ends at 1 p. m.
Apr. 14,	Thursday,	Instruction resumed at 1 p. m. } Spring Recess.
May 28,	Saturday,	Navy Day.
June 8,	Wednesday,	Final examinations begin.
June 16,	Thursday,	Final examinations end.
June 22,	Wednesday,	Commencement.

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 David Clinton Gillespie, A.B., M.A., Ph.D., Assistant Professor of Mathematics.
 James Chester Bradley, A.B., M.S., Ph.D., Assistant Professor of Entomology.
 Oscar Diedrich von Engeln, A.B., Ph.D., Assistant Professor of Physical Geography.
 Benton Sullivan Monroe, A.B., A.M., Ph.D., Assistant Professor of English.
 Rasmus S. Saby, Ph.D., Assistant Professor of Political Science.

- Guy Brooks Muchmore, A.B., Assistant Professor of Public Speaking.
Laurence Pumpelly, A.B., Ph.D., Assistant Professor of the Romance Languages and Literatures.
Abbott Payson Usher, A.B., A.M., Ph.D., Assistant Professor of Economics.
Wallie Abraham Hurwitz, Ph.D., Assistant Professor of Mathematics.
James Batcheller Sumner, Ph.D., Assistant Professor of Biochemistry in the Department of Physiology.
Thomas Roland Briggs, Ph.D., Assistant Professor of Physical Chemistry and Electro-Chemistry.
Albert Hazen Wright, A.B., A.M., Ph.D., Assistant Professor of Zoology.
Arthur Augustus Allen, A.B., A.M., Ph.D., Assistant Professor of Ornithology.
Leslie Nathan Broughton, A.B., A.M., Ph.D., Assistant Professor of English.
Alexander M. Drummond, A.B., A.M., Assistant Professor of Public Speaking.
James T. Quarles, Assistant Professor of Music.
Clyde Firman Craig, A.B., Ph.D., Assistant Professor of Mathematics.
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Harley Earl Howe, B.S., M.A., Ph.D., Assistant Professor of Physics.
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Ralph Chapman Rodgers, M.E., A.M., Instructor in Physics.
Ellsworth David Elston, A.B., A.M., Instructor in Physical Geography.
Frederick Raymond Georgia, B.Chem., Instructor in Chemistry.
Ernest Trowbridge Paine, A.M., Instructor in Philosophy.
Arthur John Rider, B.S., M.S., Instructor in Chemistry.
Aaron Bodansky, B.S., Instructor in Biochemistry.
Dean LaFever Gamble, B.S., Instructor in Zoology.
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Yuen Ren Chao, A.B., Ph.D., Instructor in Physics.
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ASSISTANTS

Andrew Curtis White, A.B., Ph.D., Reader in Greek.
 Pearl Gertrude Sheldon, A.B., Ph.D., Assistant in Geology.
 Harvey Elmer Stork, A.B., Assistant in Botany.
 Vining Campbell Dunlap, A.B., Assistant in Botany.
 Ralph Thomas Kline Cornwell, B.Chem., Assistant in Chemistry.
 Frank Alexander Griffin, Assistant in Chemistry.
 James Arthur Kennedy, A.B., Assistant in Chemistry.
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 Arthur Walker Bull, B.Chem., Assistant in Chemistry.
 Willard Riehlman Barrett, Assistant in Chemistry.

Harold Arthur Bedient, A.B., Assistant in Chemistry.
Louis Gottchalk, B.A., Assistant in Ancient History.
Agnes Cecilia Hogan, B.S., Assistant in Zoology.
William Marion Pierce, A.B., Assistant in Physics.
Mary Evalena Wright, B.S., Assistant in Chemistry.
John D. Blanchard, Reading Assistant in Economics.
Joseph Howard Flint, Assistant in Chemistry.
Henry S. Berkoff, Assistant in Zoology.
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Eleanor C. McMullen, Assistant in Zoology.
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Frederick Charles Schmutz, B.Chem., Assistant in Chemistry.
Merit Scott, Assistant in Physics.
Benjamin Pepper, A.B., Assistant in English History.
Robert James Fletcher, B.Chem., Assistant in Chemistry.
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Roy James Kennedy, Assistant in Physics.
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George Henry Brandes, B.Chem., Assistant in Chemistry.
Arthur John Sherburne, B.Chem., Assistant in Chemistry.
Alden Howard Moody, B.S., Assistant in Chemistry.
Robert Brainard Corey, B.Chem., Assistant in Chemistry.
Ethel L. Anderson, A.B., Assistant in Histology and Embryology.
Howard Bernhard Adelmann, Assistant in Histology and Embryology.
Edwin John Carpenter, jr., A.B., Assistant in Economics.
Paul Vincent Blackburn, Assistant in Chemistry.
Colston Estey Warne, Reading Assistant in Economics.
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Malcolm Fuller Orton, Reading Assistant in Economics.
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COLLEGE OF ARTS AND SCIENCES

Regarding admission to the College of Arts and Sciences the General Circular of Information should be consulted.

Two courses are offered in the College of Arts and Sciences, one leading to the degree of Bachelor of Arts, the other leading to the degree of Bachelor of Chemistry.

THE DEGREE OF BACHELOR OF ARTS

1. Requirements for Graduation.

- a. Residence for eight terms as defined and provided for in paragraphs 2-6.
- b. Credit for one hundred and twenty hours, of which at least ninety hours must be for courses given in the College of Arts and Sciences.
- c. A grade of C or better in at least sixty of the required one hundred and twenty hours. A, B, C, D are passing grades; E represents a condition; F a failure.
- d. Election of courses in accordance with the provisions of paragraphs 8-15 (Choice of Studies).
- e. Completion of the work in Hygiene and Preventive Medicine and in Military Drill or in Physical Training prescribed by the University Faculty. (See page 57.)

2. Credit for Terms of Residence.

- a. **During the Academic Year.** To secure credit for a term of residence a student must complete during that term at least twelve hours of the work for which he has registered.
 - i If, as a result of ill health or other causes beyond his control, a student fails to pass twelve hours in a term, the term's residence may be completed either by attendance at a summer session or by examination or by both as the Faculty may determine, but no credit for courses elected in any other term may be used to complete the necessary twelve hours.
 - ii When failure to pass twelve hours is due to other causes than those just specified, all credit for the term in residence and in hours is cancelled and the student may resume his work in the College only under such conditions and at such times as the Faculty may designate. A freshman, however, who, at the end of his first term, has failed to pass twelve hours of work, but who nevertheless is permitted to continue in the College, may be allowed until the beginning of his fourth term to make up deficiencies in courses for which he was registered during the first term whenever such deficiencies may, under the rules of the College, be made up.
 - iii A student's general record may be so unsatisfactory that the Faculty will refuse him permission to continue in the College even though residence credit for the preceding term may have been established.

- b. **By Examination at Admission.** In case a student has gained twelve hours of college credit by passing admission examinations set for that purpose, he will be considered as having completed one term of residence. If the college credit gained at entrance amounts to six hours, he may complete a term of residence by securing credit for at least six hours in a summer session of the University.
- c. **In Summer Sessions.** To obtain credit by means of work done in summer sessions, a student must have previously satisfied the entrance requirements of the College, and must obtain in advance the Dean's approval of his selection of courses. He may then obtain in any Cornell summer session credit for the number of hours he passes, between the limits of five and eight hours inclusive. To obtain credit for a term of residence, he must pass a total of at least twelve hours in two or more summer sessions, at least five in each without condition. Credit for two terms of residence, but no more, may be secured in this way.

No credit in hours or residence will be allowed a student not passing at least five hours, except that for a course in a foreign language meeting ten periods a week a student may obtain credit for four hours, which he may combine with eight hours secured in another summer session to obtain credit for a term of residence.

Credit will be allowed under the same restrictions for work done in summer sessions of other universities belonging to the Association of American Universities by a student regularly registered in this College, but permission to offer such credit must be obtained in advance from the Dean of this College.

For the combination of credit obtained in summer sessions with college credit gained at entrance, see paragraph b above.

- 3. **Residence During the Last Two Terms.** The degree will not be conferred upon any student unless he has been in residence at Cornell University during the last two of the required eight terms.

4. **Admission to Advanced Standing.** A student admitted to the College of Arts and Sciences from another college of Cornell University or from any other institution of collegiate rank will receive credit toward the degree of Bachelor of Arts for the number of terms and of hours to which his records may, in the judgment of the Faculty, entitle him. In order, however, to obtain the degree of Bachelor of Arts he must, as a candidate for that degree, have been in residence at least two terms in the College of Arts and Sciences and in that college only.

5. **Registration in Two Colleges of the University.** A student who has completed in the College of Arts and Sciences at least six terms of residence (no one of them under the provisions of paragraph 2b) may, with the permission of the Faculties concerned, be registered both in the College of Arts and Sciences and also in any other college of Cornell University.

6. **Registration in the College and in the Graduate School.** A student who has satisfied all the requirements for graduation except in respect of residence, may, with the permission of the Graduate School, register both in the College of Arts and Sciences and in the Graduate School.

7. **Removal of Marks of Conditioned, Incomplete, and Absent.** A student who in any course has received a term mark of E (a condition) or a mark of incomplete or of absent may, with the consent of the Dean and upon payment of the fee required by the University, be permitted to remove the mark by examination or otherwise as the Department concerned may direct. A mark of conditioned or of incomplete or of absent may not be removed later than registration day of the third term of attendance in the University after the course was taken in class and not more than one attempt at removal will be allowed.

A student who has received a mark of F (a failure) in any course must register again for the course if he desires to secure credit therefor.

Choice of Studies

8. **At least Twelve Hours of Work.** A student must register in each term for at least twelve hours of work. No student may register for more than twenty hours in any term except by permission of the Dean. For registration in a course not in the College of Arts and Sciences the permission of the college or of the professor concerned must be secured. (See also paragraph 11b.)

9. **Under-class Advisers.** Freshmen and Sophomores are under the jurisdiction of the Advisory Board for Underclassmen. Each freshman will be assigned to a member of the faculty who will act as his adviser during his freshman and sophomore years. The function of the adviser is to assist the student in his choice of studies, to advise him during the term regarding his work, and generally to give him friendly counsel. The approval of the study card and the signature of the adviser must be obtained before the study card is filed at the office of the Dean.

10. **Under-class Requirements.** During the freshman and the sophomore year, each student is required to include in the courses for which he registers the following: in English and history, six hours; in one or more languages other than English, six hours; in philosophy, psychology, and mathematics, six hours; and in physics, chemistry, geology, physical geography, and the biological sciences, six hours. Of these hours the student is required to take at least twelve, and advised to take more, in his freshman year. Each six hours may be entirely in one division (for example, English six hours), or partly in one and partly in another (for example, English three hours and history three hours). The following courses in foreign languages may not be applied in satisfaction of the foreign language requirement: Greek 1; Latin A, B; German 1, 1a, 3, 3a; French 1, 1a, 2, 3, 3a; Spanish 1, 1a, 2, 3; Italian 1, 2. College credit gained under paragraph 2b may not be applied in satisfaction of any of these under-class requirements. {

These requirements must be completed before a student may begin counting hours in an upper-class group. (See paragraph 12.)

11. Courses Open to Freshmen.

a. The following are the courses in the College of Arts and Sciences open to freshmen, except that,

1. a student may not register for any of these courses for which he has not satisfied the prerequisites if any are specified (see announcement under each course),
2. a student may not register for any of these courses for which he has presented an acceptable equivalent at entrance.

COLLEGE OF ARTS AND SCIENCES

- | | |
|---------------------------------------|--|
| Bibliography 1, 2 | History 1, 2, 31, 32 |
| Biology 1 | Italian 1, 2 |
| Botany 1, 2, 3 | Latin A, B, 1, 1a, 3 |
| Chemistry 1, 6, 7, 85 | Mathematics 1, 2, 2E, 3, 6 (2), 7 (1), 7 (2), 15 |
| English 1 | Music 1, by examination, (see page 38) |
| Entomology 4, 5 | Natural History 60 |
| French 1, 2, 3, 3a, 4a, 4b, 5a, 5b, 6 | Physics 2, 3, 4a, 4b, 7, 10 |
| Geology 1, 1a, 2, 11, 21 | Physiology 3, 6 |
| German 1, 1a, 3, 3a, 4, 5, 8 | Spanish 1, 2, 3, 4a, 4b, 5a, 5b |
| Greek 1, 2 | Zoology 1, 5, 6, 12 |
- b. Subject to the permission mentioned in paragraph 8, required courses in other colleges in the regular freshman schedule of those colleges may be elected by a freshman in the College of Arts and Sciences but only with the approval of his adviser.
- c. Under exceptional circumstances, a freshman may by petition secure permission from the Advisory Board for Underclassmen to take courses (including freshman electives in other colleges) in addition to those allowed under a and b.

12. **Upper-class Groups and Advisers.** Each student shall choose at the beginning of his junior year one of the following groups:

- | | |
|-----------------------------------|--|
| 1. Ancient Languages | 11. Philosophy and Education |
| 2. Botany | 12. Philosophy and Psychology |
| 3. Chemistry | 13. Physics |
| 4. Economics | 14. Physiology and Biochemistry, Anatomy, and Histology and Embryology |
| 5. English and Public Speaking | 15. Psychology and Education (including Physical Education) |
| 6. French and Italian | 16. Spanish and Italian |
| 7. Geology and Physical Geography | 17. Zoology and Entomology |
| 8. German | |
| 9. History and Government | |
| 10. Mathematics | |

In the group selected he must complete during his junior and his senior year at least twenty hours of work, but courses marked with an asterisk (*) may not be counted toward this requirement. In choosing these twenty hours the student must obtain the advice and approval of some professor or assistant professor within the group who will sign the study card. With the sanction of his adviser and of the Dean, a student may choose, instead of one of the upper-class groups listed above, a combination of two related groups. A senior in this College who is registered also in some other college of Cornell University is excused from ten of these twenty hours. (See paragraph 5.)

13. **Theses.** Any senior candidate for the degree of Bachelor of Arts may, with the permission of the Dean, arrange with the Department in which he is taking his principal work to write a thesis which, if accepted, shall entitle him to not more than three hours of credit a term.

14. **Study Cards.** Students will file their study cards at the office of the Dean in accordance with instructions issued at the time of registration.

15. **Changes in List of Courses.** With the consent of the Dean and the approval of the adviser, a student may alter his list of courses in the first term during the first six days of instruction, and in the second term during the first day of instruction.

Thereafter no student will be permitted to cancel his registration for any course in which he is registered, unless he shall previously have obtained from the Dean authorization to do so on the ground of ill health or for other reasons beyond the student's control.

BACHELOR OF ARTS WITH HONORS

1. Any department, or group of departments, in the College of Arts and Sciences may recommend that the degree of Bachelor of Arts with Honors in a particular subject or group of subjects shall be awarded to a student who, in addition to complying with the ordinary requirements for the degree, has satisfied such additional requirements as the department or group of departments concerned may set.

2. Any department or group of departments may admit to candidacy for Honors a student who has completed four terms of residence, at least half of whose work is above C, and who has received no more than one term mark below C during his second year of residence. Further prerequisites may be set by the departments or groups of departments concerned. A student who has maintained an exceptionally high standard of work during his third year of residence may be added to the list of candidates for Honors not later than the beginning of his seventh term of residence. A student may be dropped from the list of candidates for Honors for failure to maintain a satisfactory standard of work.

3. Candidates for Honors may receive credit (in hours) for additional work of a high order, which may or may not be in connection with regular courses of instruction.

4. Each department or group of departments that desires to enroll students as candidates for Honors shall submit its proposed requirements to the approval of the Committee on Educational Policy. These requirements may include such items as a minimum amount of work of specified grade in the special subject, general reading in the field of that subject, knowledge of auxiliary subjects, ability to make use of one or more foreign languages, a thesis, and a special examination.

THE DEGREE OF BACHELOR OF CHEMISTRY

The requirements for the degree of Bachelor of Chemistry are residence for eight terms and the completion of the following curriculum. In addition to these requirements the work prescribed by the University in Hygiene and Preventive Medicine and in Military Drill or in Physical Training must be completed.

Students who have not presented three units of German and two units of French upon entering the course in chemistry, will be required to make up the shortages in these languages before the beginning of the senior year.

First Year		No. of Course	First Term	Second Term
Introductory Inorganic Chemistry.....	Chemistry	1	6	—
Qualitative Analysis.....	Chemistry	7	6 or 0	0 or 6
Analytical Geometry, Differential Calculus, Integral Calculus.....	Mathematics	7	5	5
Introductory Experimental Physics.....	Physics	2	—	5
Drawing.....	Sibley College	D3	3	—
English.....	English	1	3	3

Second Year

Quantitative Analysis.....	Chemistry	12	0 or 6	6 or 0
Organic Chemistry.....	Chemistry	30	6	6
Gas Analysis.....	Chemistry	19 & 20	4 or 0	0 or 4
Heat and Light.....	Physics	8c	2	—
Physical Experiments.....	Physics	14	—	2
Crystallography.....	Geology	12	0 or 3	3 or 0
Elementary Chemical Spectroscopy.....	Chemistry	24	3 or 0	0 or 3
Elective.....			—	3

Third Year

Introductory Physical Chemistry.....	Chemistry	50	3	3
Physical Chemistry Laboratory.....	Chemistry	51	3	3
Chemical Microscopy.....	Chemistry	65	0 or 2	2 or 0
Quantitative Analysis, Lectures.....	Chemistry	15	—	2
Advanced Quantitative Analysis.....	Chemistry	14	2	2
General Physics.....	Physics	9c	2	—
Physical Experiments.....	Physics	14	2	—
Mechanics.....	Sibley College	M5	5	—
Mechanical Laboratory.....	Sibley College	X12	—	4
Elective.....				3

Students that wish to register in the junior year for a greater number of elective hours than the schedule demands may, with the approval of the Department, be permitted to defer taking some of the required courses of the junior year.

Fourth Year

Electrical Engineering Laboratory.....	Sibley College	E12	4	—
Seminary.....	Chemistry	95	—	1
Research.....	Chemistry	96 (at least)	4	4
Electives.....	at least		5	5

In choosing his elective subjects in the senior year the student is advised to select as his special field some one of the following seven divisions of chemistry: inorganic chemistry, analytical chemistry, organic chemistry, physical chemistry, chemical microscopy, sanitary chemistry, agricultural chemistry. While the greater part of the elective work should lie in the field thus chosen, the remainder may comprise courses in any division of chemistry, or such other courses as may be approved by the Department of Chemistry.

The provisions of paragraphs 2aiii, 2b, 2c, 3, 4, 12, 13, 14, and 15 relating to the degree of Bachelor of Arts apply in general to candidates for the degree of Bachelor of Chemistry. A candidate for the latter degree may register for twenty hours a term. To register for more than twenty hours in any term he must secure the approval of the Department of Chemistry.

COURSES OF INSTRUCTION

ANATOMY

*21. **Elementary Human Anatomy.** First term, credit three hours. Professor KERR and ———. Lecture demonstrations, M W F, 11, Stimson.

An introductory course for students in the biologic sciences. Normal structure of the body together with its variations and evolution based on development in the individual and the race. Previous courses in zoology and physiology are recommended. Not intended for premedical students.

22. **Anatomical Methods.** First term, credit three hours. Prerequisite, Zoology 1. Previous work in comparative anatomy is also recommended. Professor KERR and instructors. Laboratory, any morning except Saturday.

BIBLIOGRAPHY

1. **Bibliography.** First term, credit two hours. Librarian AUSTEN. T Th, 12, Library, Political Science Seminary Room.

A study of classification, cataloguing, indexing, illustrating, binding, preparation of manuscripts, etc.

2. **Bibliography.** Second term, credit two hours. Librarian AUSTEN. T Th, 12, Library, Political Science Seminary Room.

Writing and bookmaking in ancient times. Printing and bookmaking in the Middle Ages. Lectures and reference reading. Open to freshmen who have had course 1.

BIOLOGY

*1. **General Biology.** Throughout the year, credit three hours a term. Professor NEEDHAM, Assistant Professor CLAASSEN, Dr. HAUSMAN and assistants. Lectures, M W, 9 or 11, Roberts 131. One practice period a week. T F, 8-10:30, or daily except S, 2-4:30, Roberts 302. Additional sections will be provided if necessary. All students must get their laboratory assignments in the Biology office, Roberts Hall 322, before instruction begins.

An elementary course designed to acquaint the general student with the main ideas of biology through selected practical studies of the phenomena on which biological principles are based. Both lectures and laboratory work will deal with such topics as the interdependence of organisms, the simpler organisms, organization and phylogeny, heredity and variation, natural selection and adaptation, segregation and mutation, the life cycle, metamorphosis and regeneration, and the responsive life of organisms. Laboratory fee, \$2.50 a term.

BOTANY

For a complete course in elementary botany students are advised to take courses 1, 2, and 3. These courses are intended as cultural exercises to lay the foundation for advanced work in botany and to prepare students for teaching the elementary principles of the science. Those who wish to begin botany in the second term may begin with course 2, or 3, or both.

1. **Evolution of Plants.** First term, credit three hours. Professor ROWLEE and Mr. STORK. Lectures, M, 11. Laboratory, T Th, 2-4:30, Sage College, Botanical Laboratory. If necessary, another section for laboratory will be arranged.

*May not be counted for upperclass group.

A study of the structure, development, and relationships of representative plants among the algae, fungi, liverworts, mosses, ferns, gymnosperms, and angiosperms, with discussions of the general lines of evolution. In the lectures attention will be given to life histories of representative plants in the different groups; also to the form and structure of the reproductive organs, the phenomena of fertilization, the general features of plant anatomy, and the distribution and importance of plant life.

2. **Elementary Plant Physiology and Ecology.** Second term, credit three hours. Professor ROWLEE and Mr. STORK. Lectures, Monday, 11. Laboratory hours by appointment. Sage College, Botanical Laboratory.

A study of the fundamental principles of plant activities in relation to the cell, protoplasm, plant nutrition, respiration, irritability, response, reproduction, and environment. Field studies for the observation of these principles.

3. **Local Flora.** Second term, credit three hours. Professor ROWLEE and Mr. DUNLAP. Lectures and recitations, Fri, 9, and five laboratory hours a week. Laboratory Friday afternoon and by appointment. Sage College, Botanical Laboratory.

Studies of typical plants representing the groups of angiosperms; field excursions for the purpose of studying the local flora.

[4. **Systematic Botany.** Throughout the year, credit three hours a term. Prerequisite, course 1 or 3. Professor ROWLEE. Lectures, W, 11. Laboratory and field work, F afternoon and S morning. Sage College, Botanical Laboratory.

A study of the kinds of plants with special reference to the morphology, identification, habitat, and range of species. Extra field work will be substituted for some of the lectures.] Not given in 1920-21.

8a. **Plant Cytology.** First term, credit three hours. Prerequisite, courses 1 and 2. Professor ROWLEE and Mr. DUNLAP. Lectures, F, 11. Laboratory work, F afternoon and S morning, and by appointment. Sage College, Botanical Laboratory.

Introduction to methods of investigation. Studies of the vegetable cell, in multiplication and contents. Practical application of modern methods in a study of nuclear and cell-division.

8b. **Comparative Histology of Plants.** Second term, credit three hours. Prerequisite, course 8a. Professor ROWLEE and Mr. DUNLAP. Lectures, F, 11. Laboratory, F afternoon and S morning, and by appointment. Sage College, Botanical Laboratory.

Structure and development of the tissues of higher plants.

9a. **Dendrology.** First term, credit four hours. Professor ROWLEE. Lectures, T, 10. Laboratory and field work, M afternoon and T morning. Botanical Laboratory, Sage College.

A biological and taxonomic study of trees and shrubs including laboratory study and field observations upon native species.

9b. **Xylogy.** Second term, credit four hours. Courses 8b and 9a may advantageously precede this course. Professor ROWLEE. Lectures, T, 10. Laboratory and field work, M afternoon and T morning. Sage College, Botanical Laboratory.

Study of the development of woody structures, structure and properties of different kinds of wood, identification of woods, laboratory technique.

10. **Comparative Morphology and Embryology.** Second term, credit three hours. Prerequisite, courses 1 and 2 or 3. Mr. STORK. Lectures, one or two a week by appointment. Laboratory work, one or two periods by appointment. Additional laboratory work, if desired, may be taken under course 13. Sage College, Botanical Laboratory.

A study of representative groups which illustrate the line of evolution of green plants, including the development and homologies of sporogenous, reproductive, and embryological organs, with discussions of the principal plant phyla in the algae, liverworts, mosses, ferns, gymnosperms, and angiosperms.

11. **Mycology.** First term, credit four hours. Prerequisite, courses 1 and either 2 or 3. Mr. DUNLAP. Lectures, T Th, 11. Laboratory work, M W afternoons or by appointment. Sage College, Botanical Laboratory.

Intended as a basis for research in mycology and plant pathology. General classification, development, and plant pathology. Basidiomycetes, with especial attention to edible and poisonous mushrooms, and wood-destroying and parasitic species; the parasitic fungi, their history and development. Practice in the recognition of species, or research may in some cases be taken along with this course.

17. **Research Problems.** Professor ROWLEE, Mr. STORK, and Mr. DUNLAP. Not less than four hours a week. May form the basis of major or minor work for an advanced degree. Problems for investigation will be assigned preferably the preceding spring.

18. **Seminary.** Credit one hour. Professor ROWLEE, Mr. STORK, and Mr. DUNLAP.

Discussions of current literature and problems under investigation. Required of all graduates and open to undergraduates who are interested in research.

CHEMISTRY

INTRODUCTORY INORGANIC CHEMISTRY

*1. **Introductory Inorganic Chemistry.** Lectures, recitations, and laboratory. Repeated in second term, credit six hours.

1a. Lectures, M W F, 9, or M W F, 11. Professor BROWNE and Mr. GRIFFIN. Rockefeller A.

1b. Recitations (one hour a week to be arranged). Laboratory: first term, M F, 2-4.30; T Th, 2-4.30; W, 2-4.30 and S, 8-10.30; second term, M F, 2-4.30; T Th, 2-4.30; W, 2-4.30 and S, 8-10.30; M W, 8-10.30. Mr. MCKINNEY and Messrs. LINDSLEY, COREY, MARTIN, FLINT, LANG, LAUBENGAYER, and HELPS.

Entrance credit in chemistry does not carry with it university credit in course 1. If a student entering the University from a preparatory school desires credit in course 1 he must pass an examination set by the Department of Chemistry. This examination is held both in New York City and in Ithaca on the same day in September as the entrance examination. University credit in course 1 that is obtained by passing this examination does not carry with it entrance credit in chemistry.

Examinations for those who were unavoidably absent from the final examination in course 1 will be held at 2 p. m. on the day before instruction begins in the fall.

ANALYTICAL CHEMISTRY

6. **Qualitative and Quantitative Analysis.** Repeated in second term, credit five hours. Prerequisite course 1. Mr. RIDER and Messrs. SHERBURNE, BARRETT, HARTT, LIPPINCOTT, RIGHTER, NORWOOD, and STEVENS. Lectures, T Th, 12, Rockefeller A. Laboratory sections: M W F, 2-4.30; T Th S, 8-10.30; T Th S, 9-11.30.

Qualitative work: the properties and reactions of the common elements and acids and their detection in various liquid and solid mixtures.

Quantitative work: the preparation and use of volumetric solutions and work in elementary gravimetric analysis.

Examinations for those who were unavoidably absent from the final examination in course 6 will be held at 2 p. m. on the day before instruction begins in the fall.

7. **Qualitative Analysis.** Repeated in second term, credit six hours. Prerequisite, course 1. Mr. RIDER and Mr. LIPPINCOTT. Lectures, T Th S, 8, Rockefeller B. Laboratory: first term, M W F, 2-4.30, S, 9-12; second term, T Th, 1.30-5.15, S, 9-12.

The properties and reactions of the common elements, and of the common inorganic and organic acids, also the qualitative analysis of a number of solutions and solid mixtures.

Students in science are advised and candidates for the degree of Bachelor of Chemistry are required to take this course instead of course 6.

*May not be counted for upperclass group.

19. Advanced Qualitative Analysis. Repeated in second term, credit one, two, or three hours. Prerequisite, courses 7, 12, and 30. Mr. RIDER. Laboratory sections at hours to be arranged.

Essentially a continuation of course 7. A study of the most approved methods for separating and detecting a large number of metals and acids not studied in course 7, including many of the rare elements. In certain cases a comparative study is made of different methods designed to accomplish a given separation. The qualitative analysis of a number of solutions, solid mixtures, and minerals will be required. For graduates and advanced undergraduates.] Not given in 1920-1921.

12. Quantitative Analysis, Elementary Course. Repeated in second term, credit six hours. Prerequisite, course 6 (or preferably 7). Mr. NICHOLS and Messrs. BRANDES, McELFRESH, MOODY, and CURPHEY. Lectures, T Th, 9, Morse 119.

Laboratory sections: first term, M T W, 2.00-5.30; T Th, 10-1; S, 8-1; second term, W Th F, 2-5.30; T Th, 10-1; S, 8-1. Morse.

Recitation sections at hours to be arranged.

The preparation and standardization of various volumetric solutions and their use in analyzing a variety of substances; gravimetric methods.

Students in science are advised and candidates for the degree of Bachelor of Chemistry are required to take this course instead of the quantitative analysis of course 6.

14. Quantitative Analysis, Advanced Course. Repeated in second term, credit two to four hours. Prerequisite, course 6 (or 7 and 12). Mr. NICHOLS and Messrs. BRANDES, McELFRESH, MOODY, and CURPHEY.

Laboratory sections: First term, M T W, 2-5.30; T Th, 10-1; S, 8-1. Second term, W Th F, 2-5.30; T Th, 10-1; S, 8-1. Morse.

Recitation sections at hours to be arranged.

Gravimetric, volumetric, and electrolytic methods of analysis, and methods of combustion analysis; analysis of iron ores, iron and steel, special alloys, slags, coal and coke, cements and cement materials, alloys, minerals, ores of copper, lead, zinc, mercury, manganese, tin, etc.

15. Quantitative Analysis, Advanced Lectures. Second term, credit two hours. Prerequisite, course 50 (first term). Mr. NICHOLS. M W, 10, Morse 119. Selected topics in advanced quantitative analysis.

16. Electrochemical Analysis. Repeated in second term, credit one to two hours. Prerequisite, course 12. Mr. NICHOLS and Mr. BRANDES.

Laboratory sections: hours to be arranged.

A study of the most approved electrochemical methods for the determination of silver, lead, copper, tin, nickel, cobalt, and zinc. Practice will be given in the analysis of alloys and ores.

18. Assaying. First term, credit three hours. Prerequisite, course 6 (or 7 and 12), and if possible a course in mineralogy. Mr. NICHOLS and Mr. BRANDES. Lectures, F, 10, Morse C. Laboratory, M W, 2-5.

Lectures on the theory and practice of the scorification and crucible assay, and on the metallurgy of copper, lead, zinc, silver, and gold. In the laboratory, practice is given in assay of zinc, lead, copper, gold, and silver ores, mattes, and bullion. Designed for students that are specializing in chemistry and as an elective for students in mechanical and civil engineering.

19. Qualitative and Quantitative Gas Analysis. Lectures. Repeated second term, credit two hours. Prerequisite, course 6 (or 7) and Physics 2. Course 19 should be preceded or accompanied by course 12. Mr. NICHOLS. M W, 11, Morse 119.

A discussion of the apparatus and methods employed (a) in the examination of the important industrial gases, (b) in the determination of the heating value of fuels, and (c) in gas evolution experiments. Problems are assigned which afford practice in the calculation and interpretation of results.

20. Technical Gas Analysis. Laboratory. Repeated second term, credit two hours. Open to those who are taking or have taken course 19. Mr. NICHOLS

and Messrs. BLACKBURN and SCHNEE. Laboratory sections: M T, 2-4.30; W Th, 2-4.30; T Th, 10-12.30; S, 8-1. Morse.

The analysis of gas mixtures with various forms of apparatus; the complete analysis of flue gas, coal gas, Pintsch gas, Blau gas, natural gas, producer gas, acetylene, and air; the determination of the heating power of gaseous, liquid, and solid fuels; and the analysis of various substances by gas analytical methods involving the use of the different types of gas evolution apparatus. Within certain limits the work may be selected to suit the requirements of the individual student.

[21. **Gas Analysis, Advanced Course.** Second term, credit one or more hours. Prerequisite, courses 19 and 20. Mr. NICHOLS. Laboratory practice at hours to be arranged.

Special topics in the field of either scientific or industrial gas chemistry, varied to suit the needs of the student.] Not given in 1920-1921.

24. **Elementary Chemical Spectroscopy.** Repeated second term, credit three hours. Prerequisite, course 6 (or 7 and 12), and Physics 2. Open only to those who are taking or have taken Physics 8c. Mr. PAPISH and Messrs. SHERBURNE and ———. Lectures, M W, 8, Morse 119. Laboratory sections, M T W Th F, 2-4.30, S, 8-10.30, Morse 107.

The lectures deal with the construction and with the use in chemical analysis of the spectroscope, polariscope, refractometer, and colorimeter. The laboratory instruction is devoted to the training of the student in the proper use of these instruments in the solving of chemical problems.

25. **Advanced Chemical Spectroscopy.** Laboratory practice. First term, credit two or more hours. Prerequisite, course 24. Mr. PAPISH and Messrs. SHERBURNE and ———. Laboratory sections at hours to be arranged.

This course is devoted to the study of arc, spark, and absorption spectra and to the application of spectroscopic methods to the identification of dye-stuffs. Practice in one or more of the subjects above mentioned may be selected by the student.

26. **Chemical Polarimetry and Refractometry.** Laboratory practice. Second term, credit two or more hours. Prerequisite, course 24. Mr. PAPISH, and Messrs. SHERBURNE and ———. Laboratory sections at hours to be arranged.

The practical application of polarimeters, refractometers, colorimeters, and nephelometers to the solution of problems arising in the chemical laboratory, special emphasis being laid upon the advantages of different types of instruments.

27. **Spectrographic Methods.** Laboratory practice. Either term, credit one or more hours. Prerequisite, course 24. It is advisable that this course be preceded by Physics 18. Mr. PAPISH. Laboratory hours to be arranged.

The application of photographic methods to arc, spark, and absorption spectroscopy. Practice is also given in the applications of ultra-violet spectroscopy in chemical analysis, and in the recognition of lines and the reading of wavelengths on photographs of spectra.

ORGANIC CHEMISTRY

30. **Organic Chemistry.** Throughout the year, credit six hours a term. Prerequisite, course 6 (or 7 and 12). Open to those who are taking course 12. Professor ORNDORFF, and Mr. JACKSON, and Messrs. CORNWELL, BEDIENT, HEMMER, PURDY, and KLINE: Lectures and written reviews, M W F, 9, Franklin 10. Laboratory sections: M T, 1-5.30; F, 1-5.30; and S, 8-12.30.

The lectures and written reviews serve as an introduction to the general subject of the chemistry of the compounds of carbon. In the laboratory the student prepares a large number of typical compounds of carbon and familiarizes himself with their properties, reactions, and relations. The detection of inorganic elements in organic compounds and the recognition of various groups or radicals is included in the laboratory work.

31. Organic Chemistry. Throughout the year, credit three hours a term. Prerequisite, course 6 (or 7 and 12). Open to those who are taking course 12. Professor ORNDORFF and Mr. BEDIENT. M W F, 9, Franklin 10. This course consists of the lectures and written reviews of course 30.

32. Elementary Organic Chemistry. First term, credit: with laboratory, six hours; lectures and recitations only, four hours. Students who are preparing for the study of medicine must take the laboratory work. Prerequisite, course 6 (or 7 and 12). Open to those who are taking course 12. Mr. JACKSON, and Messrs. CORNWELL, BEDIENT, HEMMER, PURDY, and KLINE. Lectures and oral and written reviews, M W F, 12, Franklin 10. Laboratory, M T, 2-5.

33. Special Chapters in Organic Chemistry. Throughout the year, credit two hours a term. Prerequisite, course 30. Professor ORNDORFF and Mr. CORNWELL. T Th, 9, W. Sibley 1.

Special attention is given to certain important chapters of organic chemistry. An attempt is made to acquaint the student with the classical researches in organic chemistry.

34. Advanced Organic Chemistry. Laboratory practice. Throughout the year, credit two to six hours a term. Open to those who have had or are taking course 33. Professor ORNDORFF, Mr. JACKSON, and Mr. CORNWELL. Hours to be arranged. The laboratory is open daily.

The course in the preparation of organic compounds is here continued, the preparations, however, being more difficult and requiring more experience and skill on the part of the student. The original literature is consulted, and, before taking up original work in this field, the student is required to repeat some extended and important piece of work, and to compare his results with those published.

35. The Coal Tar Dyestuffs. First term, credit one hour. Open to those who have had course 30 and have had or are taking course 33. Professor ORNDORFF. Lectures. Time and place to be arranged.

The methods of making the dyestuffs are discussed, also their properties, constitution, and relations to each other, the treatment being scientific rather than technical.

36. Stereochemistry. Second term, credit one hour. Prerequisite, course 30 or 31. Professor ORNDORFF. Time and place to be arranged.

The stereochemistry of the compounds of carbon and nitrogen. The necessity of considering the space relations of the atoms in certain classes of physical isomers is shown and the close agreement of facts and the theory is brought out.

37. Methods of Organic Analysis. Throughout the year, credit two to six hours a term. Prerequisite, course 30. Professor ORNDORFF and Mr. JACKSON. Hours to be arranged. The laboratory is open daily.

Designed for students who desire practice in the qualitative and quantitative analyses of commercial organic products such as alcohols, ethers, organic acids, glycerin, formalin, acetates, coal tar distillates, petroleum products, soaps, acetanilid, etc.

38. The Coal Tar Dyestuffs. Laboratory practice. Throughout the year, credit two to four hours a term. Open to those who have had or are taking course 33. Professor ORNDORFF and Mr. JACKSON. Hours to be arranged.

Various intermediate products used in the preparation of dyes are made and from these, representatives of the different groups of dyestuffs are prepared and studied.

INORGANIC CHEMISTRY

46. Advanced Inorganic Chemistry. Throughout the year, credit two hours a term. Prerequisite, course 30, and open to those who have completed or are taking courses 50 and 51. Professor DENNIS and Mr. LIVANT. Lectures, T Th, 11, Morse 119.

The chemical elements are discussed in the order in which they occur in the Periodic Table of Mendelëff, and special attention is paid to the group properties

of the elements and to the relations of the groups to one another. The rare elements and the rare earths are treated in as great detail as are the more common elements.

47. Advanced Inorganic Chemistry. Laboratory practice. Either term, credit two, three, or four hours. Prerequisite, course 30. Professors DENNIS and BROWNE, Mr. PAPISH and Mr. LIVANT.

The course comprises the study of the preparation, purification, properties and reactions of inorganic compounds, including those of the rarer elements. Instruction is also given in the elements of glass blowing.

Course 47 is designed to accompany course 46, but either course may be taken separately.

48. Selected Topics in Advanced Inorganic Chemistry. Throughout the year, credit two hours a term. Prerequisite, course 30. Courses 50 and 51 should precede or accompany this course. Professor BROWNE, T Th, 10.

In 1920-1921 the lectures will deal chiefly with (a) the hydronitrogens and their derivatives, (b) non-aqueous solutions, and (c) certain of the important recent advances in the field of inorganic chemistry.

[49. Chemistry of Gases. First term, credit one hour. Prerequisite, course 6 (or 7 and 12), and should be preceded or accompanied by 19 and 20.

The preparation, properties, and reactions of a large number of gases are discussed, and in many cases illustrated by experiments. The various generalizations concerning gases are considered, not only in the light of their scientific value, but also to some extent from the point of view of their application to the practical problems of the gas chemist and of the gas engineer.] Not given in 1920-1921.

PHYSICAL CHEMISTRY

50. Introductory Physical Chemistry. Throughout the year, credit three hours a term. Prerequisite, course 30 or 32, and Physics 2 and 8c. Assistant Professor BRIGGS and Messrs. POLLARD, THOMPSON, and BARTLETT. M W F, 9, Rockefeller B.

A systematic presentation of modern chemical theory. Special attention is paid to the theory of solution, reactions, reaction velocity, catalysis, chemical equilibrium, the Phase Rule, photochemistry, elementary electrochemistry, and to the application of the principles of physical chemistry to chemical practice.

51. Physical Chemistry Laboratory. Throughout the year, credit three hours a term. Open only to those who have taken or are taking course 50. Assistant Professor BRIGGS, and Messrs. POLLARD, THOMPSON, and BARTLETT. Three laboratory periods a week, M T, 2-4.30; Th F, 2-4.30; S, 8-1, Morse 205.

With the data obtained in the laboratory as a basis, detailed reports are written covering the following subjects: the calibration of pipettes, burettes, and measuring flasks; molecular weights by vapor density, freezing point, and boiling point methods; vapor pressure; distillation; viscosity; colloids; diffusion; adsorption; thermo-chemistry; reaction velocity; catalysis; dissociation; solubility; formation, separation, and identification of phases; study of photochemical effects.

52. Advanced Physical Chemistry. Lectures. Throughout the year, credit three hours a term. Prerequisite, course 50. Professor BANCROFT. M W F, 10, Morse D.

An exposition of the law of mass action in its application to chemical equilibrium and reaction velocities.

53. Applied Colloid Chemistry. Lectures. Throughout the year, credit two hours a term. Professor BANCROFT. T Th, 10, Morse 119.

The theory of colloid chemistry and its application in the arts. Open to candidates for the degree of Bachelor of Chemistry if they have taken course 50; to others only by special permission.

[55. Theoretical Electrochemistry. Lectures. Throughout the year, credit three hours a term.

The historical development of the subject with special reference to the theory of the voltaic cell. For advanced students in chemistry or physics.] Not given in 1920-1921.

56a. Applied Electrochemistry. Lectures. Throughout the year, credit two hours a term. Prerequisite, course 50. Assistant Professor BRIGGS and Mr. HOEL. M W, 12, Morse 119.

The theory of electrolysis and electromotive force; electrolytic extraction and refining of metals; electrolytic manufacture of organic and inorganic compounds; theory and practice of storage cells; preparation of compounds in the electric furnace.

It is advisable but not obligatory, to take 56b along with this course.

56b. Applied Electrochemistry. Throughout the year, credit two hours a term. Open to those who have taken courses 50 and 51, and have taken or are taking course 56a. Assistant Professor BRIGGS and Mr. HOEL. Laboratory practice: F, 8-1; 2-5; S, 8-1; other hours may be arranged. Morse 206.

Measurement of electrical constants; qualitative and quantitative study of conditions affecting electrolytic reactions; determination of current and energy efficiencies in electrolytic and electrothermal work; electrolytic preparation of organic and inorganic compounds; tests of storage batteries; preparation of compounds in the electric furnace; temperature measurements.

57. Advanced Laboratory Practice. Either term or throughout the year, credit up to six hours a term. Prerequisite courses determined in each case by the professor in charge. Professor BANCROFT, Assistant Professor BRIGGS, and Messrs. HOEL, POLLARD, THOMPSON, and BARTLETT. Hours and work to be arranged. Morse 207.

Students may elect in mass law, reaction velocity, or efficiency measurements with special reference to course 52; in photochemistry, photography, or colloid chemistry with special reference to course 53; in conductivity or electrometric determinations with special reference to course 55; in electrolytic or electric furnace products with special reference to course 56; in the application of physical chemical methods to organic chemistry.

CHEMICAL MICROSCOPY

65. Elementary Chemical Microscopy. Repeated second term, credit two hours. Prerequisite, course 6 (or 7 and 12), Professor CHAMOT and Miss WRIGHT. Lecture, F, 12, Morse 119. Laboratory sections: M T, 2-4; T Th, 10-12; Th, 2-4; F, 10-12. Morse 122.

The use of the microscope and its accessories; microscopic methods as applied to chemical investigations. The examination of crystalline compounds, recognition of textile and paper-making fibers, etc. The application of microscopic methods to quantitative analysis. The methods of microscopic investigation useful in metallurgical and chemical industries.

66. Advanced Chemical Microscopy. Laboratory practice. Repeated second term, credit two or three hours. Prerequisite, course 65. Professor CHAMOT and Miss WRIGHT. Laboratory sections: M T, 2-4; T Th, 10-11; Th, 2-4; F, 10-12.

Practice in the examination and analysis of inorganic substances containing the more common elements with special reference to rapid qualitative methods and to the analysis of minute amounts of material.

[66a. **Advanced Chemical Microscopy.** Laboratory practice. Repeated second term, credit two hours. Prerequisite, course 65. Professor CHAMOT. Microscopic chemical qualitative analysis as applied to the study and analysis of organic compounds.] Not given in 1920-1921.

67. Microscopy of Commercial Alloys. Laboratory practice. Second term, credit two or three hours. Prerequisite, course 65. Professor CHAMOT and Miss WRIGHT. Laboratory sections at hours to be arranged.

An introduction to the methods employed in microscopic examinations of metals, alloys, and other metallurgical products. Practice in grinding, polishing, and etching specimens for microscopic study. Metallographic microscopes and their use.

This course may be extended to include other materials of construction.

68. Microscopy of Foods and Beverages. Laboratory practice. First term, credit two hours. Prerequisite, course 65. Professor CHAMOT and Miss WRIGHT. Laboratory sections at hours to be arranged.

The application of microscopic methods to the examination of foods and beverages for the purpose of ascertaining their purity and for the detection of deteriorations, adulterations, and admixtures.

SANITARY CHEMISTRY

70. Elementary Sanitary Chemistry. First term, credit four hours. Prerequisite, course 30 or 32. Mr. GEORGIA and Mr. KENNEDY. Lectures, T Th, 12, Morse 119. Laboratory sections, M T, 2-4.30; Th F, 2-4.30.

The lectures may be elected separately as a two-hour course.

Methods employed in the analysis of foods, beverages, and food accessories with special reference to the detection and determination of adulteration and spoilage; the relation of the chemical composition of materials used in the household to the public health.

71. Elementary Sanitary Chemistry. Second term, credit four hours. Prerequisite, course 30 or 32. Mr. GEORGIA and Mr. KENNEDY. Lectures, T Th, 12, Morse 119. Laboratory sections: M T, 2-4.30; Th F, 2-4.30.

The lectures may be elected separately as a two-hour course.

Sources of potable water; pollution of water supplies; physical, chemical, bacteriological and microscopical examination of water for household and municipal purposes; examination of sewage and sewage effluents; methods and control of water purification, water softening, sewage disposal, and garbage disposal. Interpretation of analytical results and the preparation of sanitary surveys.

72. Chemistry of Foods and Food Products. Second term, credit two hours. Prerequisite, course 30 or 32. Professor CAVANAUGH. Lectures, M W, 12, place to be arranged.

The chemical composition, chemical properties and methods of manufacture of the principal foods and food products. Methods for the determination of the normal constituents of foods. Special attention is given to the chemistry of milk and milk products, cereal products, sugars, fruits, and fruit products.

[75. Advanced Sanitary Chemistry. First term, credit two hours. Prerequisite, course 71. Mr. GEORGIA. Lectures, T Th, 9, Morse D.

The course is designed to meet the needs of those students who desire to specialize in the field of water purification and sewage disposal.

Laboratory work to accompany this course may be elected under course 78.] Not given in 1920-1921.

76. Special Topics in Sanitary Chemistry. Second term, credit two hours. Prerequisite, course 30 or 32. Mr. GEORGIA. Lectures, T Th, 9, Morse D.

A discussion of more or less popular questions in this field. The topics considered in this course will be changed from year to year.

The lectures for 1920-1921 will deal with disinfectants and closely associated substances.

78. Advanced Sanitary Chemistry. Laboratory practice. Either term, credit two or more hours. Prerequisite, course 70 or 71, both lectures and laboratory. Mr. GEORGIA and Mr. KENNEDY.

Students who have had adequate preparation may elect work in any branch of sanitary chemistry, or in the examination of water for special industrial purposes.

AGRICULTURAL CHEMISTRY

85. Agricultural Chemistry, General Course. Second term, credit four hours. Lectures, M W F, 11. Rockefeller B. One recitation, to be arranged. May be taken with one laboratory period as a five-hour course. Professor CAVANAUGH and Assistant Professor RICE.

The relation of chemistry to agriculture, and an introduction to the study of the composition and chemical properties of plants, fertilizers, feedstuffs, insecticides, and fungicides.

87. Chemistry of Fertilizers and Insecticides. First term, credit three hours. Prerequisite, course 85. It is recommended but not required that this course be preceded by course 86 and accompanied by course 88. Lectures, M W F, 10, Morse 119. Professor CAVANAUGH.

A more detailed study of the chemistry of fertilizers and insecticides than is covered in course 85. The preparation, manufacture, and properties of old and new fertilizers and insecticides. Methods of sampling and analyses used by the Association of Official Agricultural Chemists.

For courses 86 and 88 see the announcement of the College of Agriculture.

100. Chemistry of Insecticides and Fungicides, Advanced Course. First or second term, credit two or more hours. Prerequisite, courses 87 and 88. Hours to be arranged. Professor CAVANAUGH.

SEMINARY

95. Seminary. Credit one hour. For seniors who are candidates for the degree of Bachelor of Chemistry. Morse 119.

RESEARCH

96. Research for Undergraduate Students. Throughout the year.

Seniors who are candidates for the degree of Bachelor of Chemistry are required to elect four hours a term in research under the direction of some member of the staff of instruction.

ECONOMICS

***51. Elementary Economics.** Throughout the year, credit three hours a term. One lecture and two recitations each week. Lectures, M, 9; repeated M, 11. Barnes Auditorium. Acting Professor GOODHUE. Recitations, T Th, 8, 9, 10, 11, 12; W F, 8, 9, 10, 11. Acting Professor GOODHUE and instructors. Section assignments will be made on registration days at Goldwin Smith 260.

An introduction to economics including a survey of the principles of value; money, banking, and prices; international trade; free trade and protection; wages and labor conditions; the control of railroads and trusts; socialism; principles and problems of taxation.

***52. Elements of Economics.** Throughout the year, credit two hours a term. Lectures, T, 9, and T, 11, Goldwin Smith A. Recitations, W Th F, 9, 10. The recitation sections will be arranged at the first Tuesday lectures.

A special course for students in civil and mechanical engineering. Not open to students in other colleges. A general survey of economic problems. Lectures, textbook, readings, and reports.

55a. Elementary Social Science. First term, credit three hours. Course 51 should precede or be taken with this course. Professor WILLCOX. T Th S, 9, Goldwin Smith 256.

An introductory course upon social science or sociology, its field and methods, with special reference to the human family as a social unit, to be studied by comparative, historical, and statistical methods.

*May not be counted for upperclass group.

55b. Elementary Social Science. Second term, credit three hours. Course 51 should precede or be taken with this course. Professor WILLCOX. T Th S, 9, Goldwin Smith 256.

A continuation of the preceding course but with especial reference to race and immigration questions and to the dependent, defective, and delinquent classes. Open to all who have taken at least one term of course 51.

58a. Elements of Accounting. Repeated in second term, credit three hours. Prerequisite, course 51 or its equivalent. Professor ENGLISH. First term, T Th S, 8, Goldwin Smith C; second term, M W F, 8, Goldwin Smith 256.

Theory of debit and credit; the journal and ledger; the development of books of original entry; analysis of income sheets and balance sheets.

58b. Principles of Accounting. Repeated in second term, credit three hours. Prerequisite, course 58a. Professor ENGLISH. First term, M W F, 8; second term, T Th S, 8, Goldwin Smith 256.

The issue and transfer of capital stock; bonds and their valuation; depreciation; reserves and reserve funds; sinking funds; analysis of income sheets and balance sheets.

59a. Cost Accounting. First term, credit three hours. Prerequisite, course 58b. Professor ENGLISH. M W F, 10, Goldwin Smith 256.

A study of the principal types of cost accounting systems and of the relation of cost accounts to financial accounts.

59b. Accounting Problems. Second term, credit three hours. Prerequisite, course 58b. Professor ENGLISH. M W F, 10, Goldwin Smith 256.

A study of the accounting problems which arise in the organization, reorganization and liquidation of business enterprises.

62. Industrial Organization. First term, credit two hours. Prerequisite, courses 51 and 58a; or 58a may be taken at the same time. Professor KIMBALL. T Th, 12, Sibley 4. For seniors and graduates; others by permission. (See I 12, Sibley College.)

63a. Corporation Finance. First term, credit three hours. Prerequisite, course 51. ————. T Th S, 11, Goldwin Smith 256.

A study of the business corporation, with special reference to its economic significance and effects and to the problems of its legal control, including analysis of the financial operations of railroads, public utilities, and industrial corporations.

63b. Monopoly and Competition. Second term, credit three hours. Prerequisite, course 51. ————. T Th S, 11, Goldwin Smith 256.

The regulation of competition, the conditions of monopolization, the problems of industrial combination, the public control of the rates and services of railroads and public utilities.

64. Money and Banking. Throughout the year, credit three hours a term. Prerequisite, course 51. ————. T Th S, 10, Goldwin Smith 142.

A discussion of the more important phases of the theory of money and credit is followed by a consideration of selected practical problems including the revision of the American banking system. Practical work is required in the analysis of the controlling conditions of the money market, of organized speculation in securities, and of foreign exchange.

66. Labor Problems. First term, credit three hours. Prerequisite, course 51 or 52. ————. M W F, 11, Goldwin Smith 256.

The history and organization of labor unions. Collective bargaining by trade unions and employers' associations. Mediation, conciliation, arbitration, compulsory investigations and wage boards in the United States and foreign countries. Special problems, such as immigration, woman and child labor, minimum wage, poverty, unemployment, social insurance, scientific management, profit sharing, cooperation, industrial education and welfare work.

70. Public Finance. Second term, credit three hours. Prerequisite, course 51 or 52. ————. M W F, 11, Goldwin Smith 264.

General principles of public finance, revenues and expenditures, the salient features of American taxation especially in the states and municipalities. Atten-

tion will be given to the leading proposals for tax reform, such as the single tax, the income tax, and the classified property tax; to administrative methods and machinery like the state tax commissions and the county assessors; and to efforts looking toward a control of public expenditures as, for example, the budget, and the limitation of the tax rate.

76a. Elementary Statistics. First term, credit three hours. Prerequisite, course 51. Professor WILLCOX. M W F, 9, Goldwin Smith 256. Laboratory, W, 2-4, Goldwin Smith 259.

An introduction to census statistics with especial reference to the federal census, and to registration statistics with especial reference to those of New York State and its cities. The course gives an introduction to the methods and results of statistics in these, its best developed, branches.

76b. Economic Statistics. Second term, credit three hours. Prerequisite, course 51. Professor WILLCOX. M W F, 9, Goldwin Smith 256. Laboratory, W, 2-4, Goldwin Smith 259.

A continuation of course 76a, dealing mainly with the agricultural and industrial statistics of the United States. Mature students who have not already had course 76a or its equivalent may be admitted by special permission. The course is an introduction to statistics in its application to more difficult fields, such as production, wages, prices, and index numbers.

86. Principles of Economics. First term, credit four hours. Consult instructor. Professor DAVENPORT. T Th, 11; S, 11-1, Goldwin Smith 264.

Intermediate theory, primarily for students majoring in economics who have had, preferably, one to two years of work in advance of 51; or for mature or graduate students desiring an introductory course more searching and difficult than 51.

87. Public Revenues. Second term, credit three hours. Primarily for advanced students. Professor DAVENPORT. T Th S, 11, Goldwin Smith 264.

The limits of state activity; justice in taxation; proportion vs. progression; problems of incidence; administrative aspects of income taxation; franchise and corporate taxation; the articulation of the various taxes.

88. Value and Distribution. Throughout the year, credit three hours a term. Professor DAVENPORT. Hours to be arranged.

A study of the chief problems of current economic theory. The works of the leading economic writers will be critically studied with a view to disclosing the basis of existing divergencies.

91. Demography of the United States. Throughout the year, credit two hours a term. Prerequisite, courses 51 and 76a or their equivalents. Professor WILLCOX. W, 2.30-4.30, Goldwin Smith 259.

An advanced course in the study of birth rates, death rates, and American statistics of marriage, divorce, crime, immigration, etc.

92. Research in Finance. Throughout the year, credit two or three hours a term. Hours to be arranged.

Individual or cooperative investigations of selected problems in money, banking, and corporation finance, in connection with lectures upon the sources of information and upon the use of appropriate methods of investigation.

93. Research in Accounting. Throughout the year, credit two or three hours a term. Professor ENGLISH. Hours to be arranged.

For especially qualified students interested in particular accounting problems.

Rural Economy. (See Rural Economy in College of Agriculture.)

EDUCATION

Psychology 1, 1a, or 1b is prerequisite to all courses in Education.

***1. Educational Psychology.** Repeated in second term, credit three hours. Professor OGDEN and Mr. WAKEMAN. Lectures and recitations. First term, M W F, 11, Goldwin Smith 264. Second term, T Th S, 12, Goldwin Smith 142.

*May not be counted for upperclass group.

A study of functional psychology with special reference to the learning process and its application to educational theory and practice.

2. **Principles of Education.** First term, credit three hours. Prerequisite, course 1. Professor OGDEN. M W F, 2, Goldwin Smith 234.

The nature and significance of education; biological and psychological foundations; the school as a social institution; educational ideals and values; the curriculum; administration and general methods.

3. **History of Education.** Second term, credit three hours. Prerequisite, course 1. Mr. WAKEMAN. M W F, 2, Goldwin Smith 234.

A general historical account of the development of educational aims, contents, and methods in relation to ethnological, psychological, and sociological factors.

4. **High School Teachers and Teaching.** Second term, credit two hours. Mr. ———. T Th, 11, Goldwin Smith 234. For seniors only.

The American high school and its development in recent years. The various types of high schools. Relation and duties of high school teachers to their students, to the college, and to the community and state.] Not given in 1920-21.

5. **Philosophy of Education.** Second term, credit three hours. Prerequisite, course 1, and at least one course in philosophy. Professor OGDEN. T Th S, 10, Goldwin Smith 248.

A study of education as interpreted by the more important philosophical conceptions and theories, with special application to the spirit and demands of modern society.

6. **Experimental Education.** Second term, credit two hours. Prerequisite, course 1, and Psychology 3. Mr. WAKEMAN. Hours to be arranged. Goldwin Smith 248.

The chief problems of experimental education; the application of psychological and statistical methods to problems of educational measurement; chief results and practical bearings.

7. **Mental Tests.** First term, credit two hours. Prerequisite, course 1, and Psychology 3. Mr. WAKEMAN. T Th, 2-4, Goldwin Smith 248.

Laboratory practice. Logical and mathematical treatment of experimental data; single tests of sensory capacity and of the special mental functions; the graded series of tests of intelligence in children and adults.

8. **Experimental Investigation.** Repeated in second term, credit and hours to be arranged. Prerequisite, course 6 or 7. Professor OGDEN and Mr. WAKEMAN. Goldwin Smith 251.

Experimental study of a special problem in educational psychology or in mental tests.

9. **Reading of German Educational Psychology.** First term, credit two hours. Prerequisite, course 1. Professor OGDEN. W, 4-6, Goldwin Smith 248.

The aim of the course is to aid in facility of translation and to familiarize the student with certain monographic literature.

10. **Educational Administration and Method.** Throughout the year, credit two hours a term. Prerequisite, course 1. Mr. ———. Hours to be arranged. Goldwin Smith 248.

Principles of Administration. Theory and practice of learning. Methods of instruction, examination, promotion, etc.] Not given in 1920-21.

11. **Aesthetic Education.** First term, credit two hours. Prerequisite, course 1. Professor OGDEN. T Th, 11. Goldwin Smith 248.

A Study of Greek Education in Music and Gymnastic with Modern Applications. Rhythm and proportion as means to efficient action and enjoyment.

20. **Seminary in Education.** Throughout the year, credit two hours a term. Professor OGDEN. M, 4-6, Goldwin Smith 248. Prerequisite, Education 1.

Topics relevant to the fundamental assumptions of educational theory will be chosen. Primarily for graduate students.

ENGLISH

Course 1 is for freshmen; courses 20, 22, 71, and 74 are primarily for sophomores. Prerequisites for admission to the remaining courses, for upperclassmen and graduates, are stated in the description of the courses.

***1. Introductory Course.** Throughout the year, credit three hours a term. Students who have not taken the course in the first term may enter in the second term in sections provided for them. Open only to underclassmen who have satisfied the entrance requirement in English. Assistant Professor SMITH; Messrs. HEBEL, KIRK, BALDWIN, CARROLL, FISKE, LONG, MANNING SMITH, HOTCHKISS, SANDERS, MARX, NELSON, GORDON, ———, and ———. Sections at the following hours: M W F, or T Th S, 8, 9, 10, 11, 12, 2. Rooms to be announced.

A study of composition in connection with the reading of representative works in English literature, including four plays of Shakespeare, two modern novels, selected essays, and poems of Browning and Tennyson. Registration in the course is in charge of Professor SMITH.

Students who elect English 1 must apply at Goldwin Smith A on Monday, Tuesday, or Wednesday of registration week for assignment to sections.

[3. English Literature. For Freshmen in Arts and Sciences. Tennyson, Browning, Milton, Shakespeare.] Not given in 1920-1921.

5. Short Story Writing. Throughout the year, credit three hours a term. Open to upperclassmen after consultation with the instructor. Intended especially for students who are looking forward to writing as a profession. Assistant Professor SMITH. T Th S, 10, Goldwin Smith 160.

8. English Usage and Style. Throughout the year, credit three hours a term. Prerequisite, course 20 or its equivalent. The instructor's permission must be obtained before enrollment in the course. Professor STRUNK. M W F, 9, Goldwin Smith 160.

A study of the theory of good English, with practical applications. How usage is determined; matters of dispute in vocabulary and idiom; proof-reading; essays and other exercises.

9. Teachers' Course. Second term, credit two hours. Professor NORTHUP. W F, 8, Goldwin Smith 162.

Lectures, readings, and conferences on the teaching of English in the secondary school. Open to seniors and graduates who intend to teach English.

10. Play Writing. Throughout the year, credit two hours a term. Open to seniors and graduates who show some special aptitude for the proposed work. Professor SAMPSON. T Th, 11, Goldwin Smith 160.

11. Old English. Throughout the year, credit three hours a term. Prerequisite, course 1. Open to upperclassmen. Assistant Professor MONROE. M W F, 9, Goldwin Smith 162.

Old English grammar. Reading of selections from the Old English Chronicle, King Alfred, Ælfric, and other representative prose texts, and of the simpler poetry. Supplementary lectures and collateral reading on the growth of the language.

No student will be recommended by the department for a high school teachership in English unless he has had this course or its equivalent. The course should be taken in the junior year.

15. The English Language. Throughout the year, credit one hour a term. Open to graduates and to seniors who are preparing to teach English. Assistant Professor MONROE. Hour to be arranged.

A study of selected topics in the history of the language, with readings and reports. This course may serviceably supplement course 9.

***20. Nineteenth Century Prose.** Throughout the year, credit three hours a term. Prerequisite, course 1. Professors PRESCOTT and NORTHUP, Assistant Professors MONROE and BROUGHTON, and Messrs. HEBEL and CARROLL. M W F, 9, 11, T Th S, 10, 12, Goldwin Smith 164.

*May not be counted for upperclass group.

Reading of English prose with special reference to style; practice in composition, with conferences.

Students who elect English 20 must apply at Goldwin Smith 164 on Wednesday or Thursday of registration week for assignment to sections.

***22. Nineteenth Century Poetry.** Throughout the year, credit three hours a term. Prerequisite, course 1. Students who have not taken the course in the first term may enter in the second term. Open to sophomores and upperclassmen. Professors SAMPSON and STRUNK, and Assistant Professor BROUGHTON. M W F, 9, Goldwin Smith 156; M W F, 11, Goldwin Smith 156; T Th S, 9, Goldwin Smith 156.

Wordsworth, Coleridge, Byron, Shelley, and Keats.

Students who elect English 22 must apply at Goldwin Smith 159 on Wednesday or Thursday of registration week for assignment to sections.

32. History of English Literature. Throughout the year, credit three hours a term. Open to graduates, and to upperclassmen who have taken two full years of English. Professor STRUNK. T Th S, 10, Goldwin Smith 162.

Lectures on English literature from the time of Chaucer to the present, with reading and reports; recitations on required reading.

35. Literary Biography. Second term, credit two hours. Open to upperclassmen who have had two years of English. Assistant Professor SMITH. T Th, 2, Goldwin Smith 164.

Boswell's Johnson, Lockhart's Scott, George Borrow.

37. Shakespeare. Throughout the year, credit three hours a term. Open to upperclassmen only. Professor STRUNK. M W F, 10, Goldwin Smith 156.

First term, comedies and histories; second term, tragedies and romances. Either term's work may be elected separately.

38. Eighteenth Century Poetry. Throughout the year, credit two hours a term. Open to upperclassmen only. First term, Professor PRESCOTT; second term, Assistant Professor MONROE. T Th, 12, Goldwin Smith 156.

English poets of the Restoration and the eighteenth century; Dryden, Pope, Thomson, Gray, Collins, Goldsmith, Cowper, and Burns; the lesser English and Scotch poets; beginnings of the English romantic movement.

39. Eighteenth Century Prose. Throughout the year, credit two hours a term. Open to upperclassmen only. Assistant Professor BROUGHTON. T Th, 9, Goldwin Smith 162.

Swift, Defoe, Addison, Steele, Johnson, Goldsmith, and Burke.

41. The English Drama to 1642. Throughout the year, credit three hours a term. Open to upperclassmen only. Professor ADAMS. T Th S, 11, Goldwin Smith 156.

First term: the origin of the drama; miracles; moralities; interludes; the first regular comedies and tragedies; the predecessors of Shakespeare. Second term: the contemporaries and successors of Shakespeare.

42. Elizabethan Prose. First term, credit three hours. Open to upperclassmen only. Professor ADAMS. T Th S, 10, Goldwin Smith 156.

The main authors studied are More, Elyot, Ascham, Lyly, Greene, Lodge, Nashe, Sidney, Raleigh, Bacon, Burton, Browne, and Hooker. Some attention will be paid to the Bible, literary criticism, and the translators.

43. Elizabethan Poetry. Second term, credit three hours. Open to upperclassmen only. Prerequisite, course 42. Professor ADAMS. T Th S, 10, Goldwin Smith 156.

The main authors studied are Wyatt, Surrey, Gascoigne, Sidney, Spenser, Daniel, Drayton, Shakespeare, Davies, Donne, and Herrick.

44. Shakespeare. Throughout the year, credit three hours a term. Open to upperclassmen only. Professor ADAMS. M W F, 11, Goldwin Smith 142.

Shakespeare's life; his dramatic technique; a detailed study of his chief plays

45. Modern Novelists. Throughout the year, credit two hours a term. Open only to upperclassmen who have passed twelve hours of work in English. Professor SAMPSON. T Th, 3, Goldwin Smith 156.

*May not be counted for upperclass group.

A study of some of the representative works of recent novelists: Meredith, Hardy, Henry James, Conrad, and others. Lectures, recitations, and a large amount of collateral reading.

47. The Art of Poetry. Throughout the year, credit two hours. Open to upperclassmen only. Professor PRESCOTT. M W, 10, Goldwin Smith 162.

A study of the nature of poetry in general, its themes, conceptions, and technique, with some stress on the principles of meter. Practice in writing the simpler forms of verse.

48a. American Literature. First term, credit three hours. Open to seniors and graduates. Professor PRESCOTT. M W F, 12, Goldwin Smith 160.

American literature of the colonial and revolutionary periods; the growth of literary independence; Irving, Bryant, and Cooper.

48b. American Literature. Second term, credit three hours. Open to seniors and graduates. Professor PRESCOTT. M W F, 12, Goldwin Smith 160. American prose and poetry of the nineteenth century.

49. Pastoral Poetry. Throughout the year, credit two hours a term. Open to upperclassmen and graduates. Assistant Professor BROUGHTON. Hours to be arranged.

A study of the sources, origin, and development of the appreciation of rustic life and landscape in English poetry. Among the authors considered are Theocritus, Virgil, Spenser, Shakespeare, Fletcher, Jonson, Milton, Pope, Thomson, Collins, Burns, and Wordsworth.

50. Milton. Throughout the year, credit two hours a term. Open to upperclassmen. Mr. HEBEL. T Th, 9, Goldwin Smith 160.

A study of Milton's poetry and selections from his prose.

52. Victorian Literature. Throughout the year, credit three hours a term. Open to upperclassmen and graduates. Professor NORTHUP. T Th S, 9, Goldwin Smith 134.

Lectures on the chief literary tendencies and characteristics of the period; studies of the leading poets and of some of the greater writers of prose. The work in this course is essentially different from that of courses 1 and 3.

55. Old English Literature. Second term, credit two hours. Open to graduates and qualified seniors. Assistant Professor MONROE. M W, 3, or hours to be arranged, Goldwin Smith 164.

Reading of selected Old English works including Beowulf or some of the Cynewulfian poetry; studies in textual criticism and in style and meter; supplementary reading.

56a. Middle English Literature. First term, credit three hours. Open to upperclassmen and graduates. Professor NORTHUP. M W F, 12, room to be announced.

Studies in the history of Middle English literature, with special reference to the romances and their relations to Continental literature.

56b. The Arthurian Legends. Second term, credit two hours. Open to upperclassmen and graduates. Professor NORTHUP. M W, 12, room to be announced.

An introduction to the comparative study of literature; the development of the Arthurian legends as illustrative of literary origins; the treatment of the legends by modern European poets.

59. Dramatic Structure. Throughout the year, credit three hours a term. Open to seniors and graduates. Professor SAMPSON. M W F, 3, Goldwin Smith 156.

A study of the principles of dramatic construction, based upon Greek, Elizabethan, and classical French drama (first term), and modern drama (second term). Reading of a hundred representative plays.

71. English Translations of Greek and Latin Classics. Throughout the year, credit three hours a term. Open to sophomores and upperclassmen. Professor COOPER. T, 3, Th, 3-5, Goldwin Smith 236.

Rapid reading in the best translations, with emphasis upon Greek masterpieces; for example, the *Iliad* and the *Odyssey*, the tragedies of Sophocles, and several dialogues of Plato. Translations from the Latin will be chosen for the bearing of the original works upon modern literature.

72. **Principles of Literary Criticism.** Throughout the year, credit three hours a term. Open to seniors and graduates. Professor COOPER. W, 3-5, and another hour to be arranged. Goldwin Smith 236.

A study of the chief theories of poetry, and chief kinds of literature, with illustrations drawn from writers both ancient and modern.

[73. **Dante in English.** Throughout the year, credit two hours a term. Open to seniors and graduates. Professor COOPER.] Not given in 1920-1921. To be given in 1921-1922.

Reading for the sake of historical perspective, followed by a study of the *Divine Comedy* in the best English translations.

74. **English Literary Types.** Throughout the year, credit three hours a term. Open to sophomores and upperclassmen. Professor COOPER. M W F, 10, Goldwin Smith 164.

A study of typical selections from the earlier periods of English literature, and of parallel selections from modern writers, to throw light upon English and American ideals. Students may be admitted at the beginning of either term after consultation with the instructor.

75. **Methods and Materials in the Study of English.** Throughout the year, credit two hours a term. Open to graduates. M, 3-5, Goldwin Smith 236.

A study of treatises on the method of scholarship, and of the relations between English and similar disciplines; an introduction to the bibliography of English. Candidates must be prepared to read French and German.

76. **Chaucer.** Throughout the year, credit two hours a term. Open to graduates. Professor COOPER. Wednesday, 7.30 p. m., English Seminary Room.

A survey of books and topics that are essential to the study of Chaucer; systematic reading of his works; a detailed examination of significant passages.

80. **Wordsworth and his Contemporaries.** Open to seniors and graduates. Assistant Professor BROUGHTON. Hours to be arranged.

A detailed study of the works of Wordsworth and their influence on contemporary English thought and literature.

81. **The Tudor-Stuart Drama.** For graduates only. Professor ADAMS. Hours to be arranged.

A detailed study of some one dramatist, or the investigation of some question relating to the period.

82. **Pastoral Poetry.** For graduates only. Assistant Professor BROUGHTON. Hours to be arranged.

Studies in the criticism and bibliography of the subject, Elizabethan pastorals, and foreign influences on the pastoral.

83. **Early Middle English.** For graduates only. Assistant Professor MONROE. Hours to be arranged.

Textual and historical study of Layamon's *Brut*, with special reference to its connection with the Arthurian legend.

84. **Problems and Methods in Elizabethan Research.** For graduates only. Professor ADAMS. Hours to be arranged.

A critical examination of the best recent Elizabethan scholarship, and of the more important periodicals and books of reference used in research. Each student will be assigned some problem for investigation.

86. **Middle English Seminary.** For graduates only. Professor NORTHUP. Hours to be arranged.

The topic for the year will be the works of John Lydgate.

87. **The Phonology, Inflections, and Meter of Old English.** For graduates only. Professor STRUNK. Hours to be arranged.

The relation of Old English to Modern English and to German. Reading of *Elene* or *Beowulf*.

88. **American Literature.** For graduates only. Professor PRESCOTT. Hours to be arranged.

The literary relations of England and America. Provincial and national traits in American literature.

89. **The Drama.** For graduates only. Throughout the year. Professor SAMPSON. Hours to be arranged.

A study of the technique of several of the chief Elizabethan and modern dramatists.

90. **The Georgian and Victorian Drama.** For graduates only. Professor NORTHUP. Hours to be arranged.

Studies, in part comparative, of representative plays of the period 1768-1885. Investigation of special problems.

91. **The Sonnets of Shakespeare.** For graduates only. Throughout the year. Professor ADAMS. Th, 3-5, rooms to be announced.

ENTOMOLOGY, LIMNOLOGY, AND NATURE STUDY

The work of this department is continued during the summer. For the third summer term of twelve weeks, see the Announcement of the College of Agriculture.

INTRODUCTORY ENTOMOLOGY

2. **The Ecology of Insects.** Third term, credit three hours. One lecture and two practical exercises, largely field work. Lectures, W, 8, Roberts Hall 392. Practical exercises, one W, 10-12.30, and one by appointment. Professor NEEDHAM and Dr. WELLHOUSE.

A general course in the study of the lives of insects in relation to their environment. Practical studies will be made of the activities of insects and of the rôle that they play in different natural associations. Observations will be made on the relations between their structures and instincts and the situations in which they live, and on many of the ways in which they find a living and establish homes.

3. **General Entomology.** First term, credit three hours. Prerequisite, Biology I or Zoology I. First term, lectures, W F, 9. Roberts Hall 392. Professor HERRICK. Practical exercises, Th or F, 2-4.30, or S, 8-10.30. Roberts Hall 392. Professor HERRICK and Mr. DETWILER and Mr. BUYS.

This course embraces lectures on the characteristics of orders, suborders, and the more important families, and on the habits of representative species. The practical exercises include a study of the structure of insects and practice in their classification. The lectures only (2 hours) are taken by those who have had courses 4 and 5. Laboratory fee, \$1.50.

4. **Elementary Morphology of Insects.** Either term, credit three hours. By appointment. Roberts 391. Professor JOHANSEN and Dr. WELLHOUSE and Mr. HUCKETT. An introductory laboratory course. Fee \$2.
(See note under course 5.)

5. **Elementary Systematic Entomology.** Either term, credit two hours. By appointment. Prerequisite, course 4. Roberts 391. Assistant Professor BRADLEY and Dr. WELLHOUSE and Mr. HUCKETT.
Laboratory fee, \$2.

Courses 4 and 5 are introductory laboratory courses, required of all students who plan to take advanced work in entomology. The work is individual, and both courses may be taken in one term.

SYSTEMATIC ENTOMOLOGY

11. **Advanced Systematic Entomology.** First term, credit three or more hours. Prerequisite, course 5. Assistant Professor BRADLEY. Three laboratory periods of three hours each during W Th F afternoons or S mornings. Roberts 301.

A training course in the identification and interpretation of obscure characteristics of insects. One hundred and thirty-five or more hours of work in the laboratory required.

12. **Taxonomy of Insects.** Throughout the year, credit four hours a term. Prerequisite, courses 3, 4, 5, 11, 14, and 20, and preferably 10. Professors NEEDHAM and JOHANSEN, Assistant Professors BRADLEY and MATHESON, and co-operating specialists. Lectures, F, 8. Laboratory, F, 10-1, and two other periods of three hours each to be arranged.

I. **Coleoptera.** First term. Assistant Professor BRADLEY.

A. **Heteroptera, Physopoda, Mallophaga.** Second term. Professor JOHANSEN.

B. **Homoptera.** Assistant Professor BRADLEY.

Diptera, Hymenoptera, Lepidoptera, Orthoptera, and Neuroptera not given in 1920-1921.

This course will continue throughout a number of terms, but the work of each term may be elected independently. The course is intended primarily for graduate students who desire a systematic survey of one or more of the orders of insects. Laboratory fee \$4.50.

13. **Classification of the Coccidæ.** First term, credit two hours. Prerequisite, courses 4, 5, and 11. Assistant Professor BRADLEY. Laboratory work by appointment, Roberts 301.

The scale insects are selected as the subject of this course because of their economic importance, but the work of the course is a survey of the whole group without undue emphasis upon the economic forms. Practice is had in the preparation of specimens for study. Laboratory fee, \$3.

14. **Entomological Literature and its Technics.** First term, credit three hours. Prerequisite, course 3 or 5, or Zoology 5. Assistant Professor BRADLEY.

A study of general entomological literature. Practice in the use of generic and specific indices, and bibliographies, and in the preparation of the latter. The methods of preparing technical papers for publication. The rules of nomenclature including the formation of scientific names.

This course is of a technical nature, and is intended to aid students who intend to specialize in entomology or systematic zoology in their contact with literature.

19. **Research in Systematic Entomology.** Throughout the year, credit three or more hours a term. Prerequisite, courses 3, 10, 11, 14, 20, and one term of course 12. Assistant Professor BRADLEY, and Professors NEEDHAM and JOHANSEN. Laboratory hours by arrangement. Roberts 301.

INSECT MORPHOLOGY

20. **Morphology and Development of Insects.** Throughout the year, credit two hours a term. Prerequisite, courses 3 (first term), 4 and 5. Lectures, assigned reading, and reports. Professor JOHANSEN. T Th, 10, Roberts 392.

21. **Histology of Insects.** Prerequisites, course 3 (first term), 4, 5, and 20. Professor JOHANSEN. Roberts Hall 392. First term: Technique in histological methods as applied to insects. Laboratory W, p. m., and two periods by appointment. Credit 3 hours. Laboratory fee \$4.50.

Second term: Comparative study of insect histology from prepared slides. Laboratory W, p. m., and one period by appointment. Credit 2 hours. Laboratory fee \$1.50.

27. **German Entomological Reading.** Without credit. First term. M W, 11. Open to advanced students in Entomology who have an elementary knowledge of German. Roberts Hall 392. Professor JOHANSEN.

28. **French Entomological Reading.** Without credit. Second term. M W, 11. Open to advanced students in Entomology who have an elementary knowledge of French. Roberts Hall 392. Professor JOHANSEN.

29. **Research in Morphology of Insects.** Throughout the year, credit three or more hours a term. Prerequisite, courses 3, 4, and 5. Professor JOHANSEN and NEEDHAM. Laboratory open daily except S, 8-5; S, 8-1, Roberts 391.

Special work arranged with reference to the needs and attainments of each student. Laboratory fee, \$1.50 an hour.

PARASITOLOGY AND MEDICAL ENTOMOLOGY

30. **Parasites and Parasitism.** Second term, credit two hours. Must be preceded or accompanied by Zoology 1. Assistant Professor MATHESON and Mr.

———. Lectures, M, 9. Practical exercises, M, 2-4.30, Roberts Hall 392. A consideration of the origin, and biological significance of parasitism, and of the structure, life history, and economic relations of representative parasites.

31. **The Relations of Insects to Disease.** Second term, credit two hours. Prerequisite, course 3. Lecture W, 10. Roberts 392. Practical exercise W, 2-4.30. Assistant Professor MATHESON.

Causation and transmission of disease by insects and other arthropods. Laboratory fee, \$2.

LIMNOLOGY

50. **General Limnology.** Second term, credit three hours. Open only to students who have taken or are taking Biology 1. Professor NEEDHAM and Mr. SIBLEY. Lectures, Th, 8, Roberts 392. Laboratory, Th, 2-4.30, and one period by appointment, Roberts 492.

An introduction to the study of the life of inland waters. Aquatic organisms in their qualitative, quantitative, seasonal, and ecological relations. Laboratory fee, \$2.50.

53. **Minute Freshwater Fauna and Plancton.** First and second terms, credit one hour a term. Dr. HAUSMAN. One laboratory period of three hours to be arranged. Roberts Hall 399.

A study of the systematic, physiological, and ecological relationships of the microscopic and other minute fauna of fresh waters. Especial attention will be given to the protozoa during the winter months, and to the collection and examination of plancton during the spring and fall. Laboratory fee, \$1.50.

59. **Research in Limnology.** Throughout the year, credit three or more hours a term. Prerequisite, course 50 or the equivalent. Professor NEEDHAM and Assistant Professor EMBODY. Laboratory and field work by appointment, Roberts 492, and Biological Field Station.

NATURE STUDY

*60. **Natural History.** Repeated in second term, credit one hour. Professor NEEDHAM, Mr. ALEXANDER, and assistants. Field work only, with morning sections 8-10.30 or 10.30-1 daily, and afternoon sections 2-4.30 daily except S.

This course comprises a series of studies of the sources of our living in nature. Weekly field trips will be made about the University campus and farm and vicinity to seek out the wild relatives of our cultivated crops and domesticated animals, and to study the natural resources of our environment. Laboratory fee \$2.

Seminary. Throughout the year. M, 4.30-5.30, Roberts 392.

The work of an entomological seminary is conducted by the *Jugatae*, an entomological club which meets for the discussion of the results of investigations by members.

*May not be counted for upperclass group.

GEOLOGY

GENERAL GEOLOGY

***1. Elementary Geology.** Repeated in second term, credit three hours. Professor RIES, and Messrs. ELSTON, WEEKS, and LOUNSBERY. Lectures, first term, T Th, 11, Sibley Dome; second term, T Th, 9, Sibley Dome. Laboratory period, M T W Th F afternoon or S morning. Students must register for laboratory assignments at Elementary Geology laboratory, McGraw Hall, before beginning of course. One all-day excursion required.

Planned to give beginners the fundamental principles of this branch of science. Those desiring additional work in geology are advised especially to take one or more of the following courses: 1a, 2, 11, 21, 32.

1a. Dynamic and Structural Geology. Second term, credit two hours. Prerequisite, course 1 or its equivalent. Prof. RIES. T Th, 11, McGraw.

This course comprises study of certain dynamic and structural phenomena and of the main facts underlying some of the greater problems of geology.

PHYSICAL GEOGRAPHY

***2. Elementary Physical Geography.** Throughout the year, credit three hours a term. Assistant Professor VON ENGELN, and Mr. LOUNSBERY. Lectures M W, 9, McGraw, Geological Lecture Room. Laboratory W or Th, 2-4.30.

High school courses are not the equivalent of this course and will not be so considered as a prerequisite for advanced courses. All students are required to go on one all-day excursion to Enfield Gorge and Falls and Connecticut Hill.

3. Geography of North America. Throughout the year, credit two hours a term. Prerequisite, an elementary knowledge of physical geography, the equivalent of course 2. Assistant Professor VON ENGELN. T Th, 10, McGraw, Geological Lecture Room.

A course describing the physiographic features of North America with discussion of their influence upon the settlement and development of the various sections. Illustrated lectures.

[4. Geography of Europe. Alternates with course 3.] Not given in 1920-1921.

5. Glaciers and Glaciation. Second term, credit three hours. Prerequisite, course 2 or, with permission, course 1. Assistant Professor VON ENGELN. Lectures, M W, 11, McGraw. Laboratory, T, 2-4.30, McGraw.

A study of living glaciers and the phenomena of the glacial period. Field excursions during the laboratory period in the spring; longer excursions on Saturday. Mapping and interpretation of glacial deposits.

6. Commercial Geography. First term, credit two hours. Assistant Professor VON ENGELN. Lectures, T Th, 9, McGraw, Geological Lecture Room. Lectures, reading, and term report.

A consideration of the geographic factors affecting production and distribution of commodities, with special reference to the rational development of natural resources, particularly of North America. Discussion of routes of commerce, localization of industry, modern city sites, utilization of tropical lands, etc.

7. Map Interpretation. Second term, credit one hour. Prerequisite, Geography 1 or 2, or, by special permission, their equivalent. Mr. ELSTON. Laboratory M, 2-4.30, McGraw, Physical Geography Laboratory.

For students desiring knowledge of various types of maps leading to a practical understanding and interpretation of their several purposes and particular uses.

8. Advanced Physiography, Experimental and Research Work. Throughout the year. Credit, variable. Assistant Professor VON ENGELN. Hours to be arranged, McGraw. Registration only by permission.

*M ay not be counted for upperclass group.

Original investigation is undertaken by each student. Reading, conferences, excursions, and presentation of reports of progress to correlate with work. In general, graduate students registering for a minor in physical geography will be expected to take up some problem in this course.

9. **Seminary.** Throughout the year, credit two hours a term. For upper-classmen and graduate students with requisite preparation. Registration only by permission. Assistant Professor VON ENGELN. M, 4.30, McGraw, Physical Geography laboratory.

Preparation and reading of reports upon special topics. Abstracts and discussions of current physiographic literature.

Meteorology and Climatology. (See announcement of the College of Agriculture.)

MINERALOGY AND PETROGRAPHY

*11. **Elementary Mineralogy.** Repeated in second term, credit three hours; if taken after course 12, credit two hours. Prerequisite, Chemistry 1. Professor GILL and Mr. BOWEN. Lectures, M W, 8, McGraw, Geological Lecture Room. Laboratory sections to be arranged.

For beginners who desire a general knowledge of the commonest minerals and their uses, the properties by which they are recognized, and their significance as constituents of the earth's crust, or as sources of useful substances.

12. **Crystallography.** Repeated in second term, credit three hours; if taken after course 11, credit two hours. Prerequisite, Chemistry 6 or 7, and Physics 1. Professor GILL and Mr. BOWEN. Lectures, T Th, 8, McGraw, Geological Lecture Room. Laboratory hours to be arranged.

13. **Mineralogy.** Second term, credit three hours; if taken after course 11, credit two hours. Prerequisite, course 12. Hours to be arranged. McGraw, Geological Lecture Room. Professor GILL.

For students wishing to become acquainted with the commoner minerals and with the scientific and practical problems which they suggest.

14. **Blowpipe Determination of Minerals.** First term, credit one hour. Prerequisite, course 11 or 13 and Chemistry 6 or 7. Professor GILL. One laboratory period Saturday morning, McGraw, Mineralogical Laboratory.

15. **General Lithology.** Second term, credit one hour. Prerequisite, courses 1 and 11. Professor GILL and Mr. BOWEN. Lectures, recitations, and laboratory practice, F, 8-10, or W, 2-4. McGraw, Mineralogical Laboratory.

An elementary course designed to teach recognition of the various kinds of rocks, their mineral composition, mode of origin, etc.

16. **Crystal Measurement and Drawing.** Second term, credit two hours. Prerequisite, course 12. Professor GILL. Hours to be arranged, McGraw, Mineralogical Laboratory. Laboratory, measurement of crystals, with computation and drawing. Course 16 should be taken by students who intend to continue in course 17 or in course 20.

17. **Optical Determination of Minerals.** First term, credit three hours. Prerequisite, course 13. Professor GILL. M W, and laboratory to be arranged. McGraw, Mineralogical Laboratory.

18. **Petrography.** Second term, credit three hours. Prerequisite, course 17. Professor GILL. M W, and laboratory to be arranged. McGraw, Mineralogical Laboratory.

19. **Seminary in Mineralogy and Crystallography.** Throughout the year, credit one hour a term. Prerequisite, courses 12, 13, 17. Professor GILL. Hour to be arranged, McGraw.

20. **Advanced or Special Work in Mineralogy and Petrography.** Throughout the year. Prerequisite courses dependent on nature of work. Professor GILL. Hours to be arranged, McGraw. Adapted to the needs of the individual student.

*May not be counted for upperclass group.

PALEONTOLOGY AND STRATIGRAPHIC GEOLOGY

*21. **Historic Geology.** First term, credit three hours. Prerequisite, course 1 or its equivalent; a course in invertebrate zoology is also desirable. Professor HARRIS. Lectures, T Th, 11, McGraw 28. Laboratory hours to be arranged.

An elementary review of the geologic history of the earth and its inhabitants with special emphasis on the American continent; the second half of the ordinary course in Elementary Geology. Field excursions take the place of laboratory work when weather permits.

22. **General Stratigraphic Geology.** Throughout the year, credit three hours a term. Prerequisite, courses 1 and 21. Professor HARRIS. Three periods a week, M W F, 10, for lectures; laboratory or field work, hours to be arranged, McGraw 28.

First term: Paleozoic of the world; second term: Mesozoic and Cenozoic of the world.

23. **Geological Surveying.** First term, credit two hours. Prerequisite, courses 1 and 21 or equivalents, and spherical trigonometry. Professor HARRIS. Hours to be arranged. McGraw 28.

24. **Invertebrate Paleontology.** Credit two hours each term. Prerequisite, a three-hour course in biology. Professor HARRIS. M W, 9 (or other hours if more convenient). McGraw 28.

25. **Special Geologic Problems and Research.** Prerequisites will depend largely on the nature of the problems attacked. Outside of the consideration of a few local Paleozoic questions the energy of this branch of the department will be largely concentrated for the next three years on systematic conchology with greatest emphasis on American Tertiary Gastropoda and Pelecypoda. Professor HARRIS. McGraw 28.

ECONOMIC GEOLOGY

*31. **Engineering Geology.** Throughout the year, credit three hours a term. Professor RIES, Mr. SMYTHE and ———. Lectures, M W, 10. Laboratory, M T W Th F, 2, McGraw.

Discussion of the practical application of geologic principles and the occurrence of such economic materials as are of importance to engineering students.

32. **General Economic Geology.** Throughout the year, credit three hours a term. First term, prerequisite, course 1 or equivalent; second term, prerequisite, courses 1 and 11, or their equivalent. Professor RIES. Lectures, M W, 11; laboratory, Th, 2. McGraw.

The origin, nature, distribution, and uses of the non-metallic and metallic products of the earth's crust. First term, the non-metallics, including coal, oil, gas, clays, salt, fertilizers, etc.; second term, the metallic products, including the ores of iron, copper, lead, zinc, gold, silver, etc.

35. **Clay Investigation.** Prerequisite, courses Geology 1 or 31 and Chemistry 1 or its equivalent. Can be taken either one or two terms. Professor RIES. Hours to be arranged. McGraw. Lectures and laboratory work. Credit variable.

36. **Advanced or Special Work in Economic Geology.** Throughout the year. Prerequisite courses dependent on the nature of the work. Professor RIES. Hours to be arranged. Credit 3 hours. McGraw.

37. **Seminary in Economic Geology.** Throughout the year, credit two hours a term. Prerequisite, courses 1, 11 or 13 and 32. Professor RIES. Hours to be arranged, McGraw.

*May not be counted for upperclass group.

GERMAN

***1. Course for Beginners: Oral Training, Grammar, Composition, Translation.** Repeated in second term, credit six hours.

First term, Daily, 10, Goldwin Smith 177. Professor POPE. Second term, Daily, 10, Goldwin Smith 177. Professor POPE.

This course is equivalent to first year and second year German of the entrance requirements (credit two units). It may be elected for three hours' credit by students who have entrance credit for only one unit of German (first year German).

***1a. Course for Beginners: Oral Training, Grammar, Composition, Translation.** Throughout the year, credit three hours a term. Assistant Professor ANDREWS. M W F, 12, Goldwin Smith 183.

This course is equivalent to first year and second year German of the entrance requirements (credit two units). It may be elected in the second term by students who have had first year German (one unit).

***3. Oral Training, Grammar, Composition, Translation.** Repeated in second term, credit five hours. Prerequisite, course 1 or entrance credit for two units of German (first year German and second year German).

First term, M T W Th F, 10, Goldwin Smith 183. Professor FAUST. Second term, M T W Th F, 10, Goldwin Smith 183. Assistant Professor ANDREWS.

This course is equivalent to third year German of the entrance requirements.

***3a. Oral Training, Grammar, Composition, Translation.** Throughout the year, credit three hours a term. Assistant Professor ANDREWS. T Th S, 12, Goldwin Smith 183.

This course is equivalent to third year German of the entrance requirements.

***4. Elementary German Composition and Conversation.** Throughout the year, credit three hours a term. Open to those who are taking or have taken course 3. Professor POPE. M W F, 12, Goldwin Smith 190.

Exercises conducted in German. It is advisable to combine course 4 with course 3 or 5.

***5. Intermediate German Course.** Throughout the year, credit three hours a term. Prerequisite, course 3, or its equivalent.

First term, Assistant Professor ANDREWS; second term, Professor BOESCHE. T Th S, 10, Goldwin Smith 190.

German grammar treated topically. Translation and oral exercises in German on the text. Reading from modern German prose. Course 4 may be combined with course 5.

***8. Scientific German.** Second term, credit three hours. Prerequisite, courses 1-3 or three years of German in High School. Professor BOESCHE. M W F, 11, Goldwin Smith 183.

10. Advanced German Composition and Conversation. Throughout the year, credit three hours a term. Prerequisite, courses 1-5 or the equivalent. Professor BOESCHE. M W F, 10, Goldwin Smith 190.

Exercises conducted in German. Theme-writing. This course is essential for the pursuit of advanced work in the department, and must be completed by students who desire to be recommended as teachers of German.

11. Lessing's Life and Works. First term, credit three hours. Prerequisite, courses 1-5. Professor POPE. T Th S, 11, Goldwin Smith 190.

12. Schiller's Life and Works. Second term, credit three hours. A continuation of course 11, but may be elected separately. Prerequisite, courses 1-5. Professor BOESCHE. T Th S, 11, Goldwin Smith 190.

13. Goethe's Life and Works. First term, credit three hours. Primarily for juniors and seniors. Prerequisite, courses 1-5 or the equivalent. Professor BOESCHE. T Th S, 9, Goldwin Smith 190.

*May not be counted for upperclass group.

14. **Goethe's Faust**, part 1 and selected portions of part 11. Second term, credit three hours. Primarily for juniors and seniors. Prerequisite, courses 1-5 or the equivalent. Professor POPE. T Th S, 9, Goldwin Smith 190.

15. **History of German Literature**. First term, credit three hours. Prerequisite, courses 1-5 or the equivalent. Professor FAUST. M W F, 9, Goldwin Smith 190.

An outline lecture course beginning, in the first term, with the Old High German period and extending to the middle of the eighteenth century; in the second term beginning with Lessing and extending to the present time. Lectures, recitations, and collateral reading.

16. **Contemporary German Literature**. Throughout the year, credit three hours a term. Prerequisite, courses 1-5 or the equivalent. Professor FAUST.

A study of the literature of modern Germany, including foreign influences. Lectures in German, recitations, and collateral reading.] Not given in 1920-1921.

17. **The German Drama of the Nineteenth Century**. First term, credit three hours a term. Prerequisite, courses 1-5 or the equivalent. Recitations, lectures in German, and collateral reading. Professor FAUST.] Not given in 1920-1921.

37. **Middle High German**. Throughout the year, credit three hours a term. Prerequisite, courses 1-5, 10, and at least six hours of advanced work in German literature. Assistant Professor ANDREWS. M W F, 11, Goldwin Smith 178.

39. **Teachers' Course in German Composition**. Throughout the year, credit two hours a term. Admission by permission only. Professor BOESCHE. T Th, 12, Goldwin Smith 177.

40. **Teachers' Course in Methods**. First term, credit two hours. Prerequisite, courses 1-5, 10, and twelve hours of advanced work in German literature or philology. Professor FAUST. T, 2-4, Goldwin Smith 181.

42. **Gothic**. First term, credit three hours. Professor BOESCHE. Primarily for graduates.] Not given in 1920-1921.

43. **Old High German**. First term, credit three hours. Prerequisite, course 37. Professor BOESCHE. M W F, 11, Goldwin Smith 190. Primarily for graduates.

48. **Principles of Germanic Philology**. Second term, credit two hours. Prerequisite, course 42. Assistant Professor ANDREWS.] Not given in 1920-1921.

49. **Seminary in German Literature**. First term, credit two hours. Professor FAUST. F, 2-4, Goldwin Smith 181. For graduates only.

50. **Seminary in German Literature**. Second term, credit two hours. Professor POPE. Hours to be arranged. Goldwin Smith 182. Primarily for graduates.] Not given in 1920-1921.

52. **Seminary in German Philology**. Second term, credit two hours. Professor BOESCHE. Primarily for graduates.] Not given in 1920-1921.

GOVERNMENT AND PUBLIC LAW

*1. **Political Institutions**. First term, credit three hours. Lectures, M W, 10, Goldwin Smith B, Professor ORTH; quiz hours to be arranged, Assistant Professor SABY.

An introduction to the study of politics, with special reference to American government. Lectures, readings, reports, quizzes. Students desiring to specialize in politics should take this course in their sophomore year.

*2. **Comparative Politics**. Second term, credit three hours. Lectures, M W, 10, Goldwin Smith B, Professor ORTH; quiz hours to be arranged, Assistant Professor SABY.

A study of the political institutions of the leading European countries with special reference to constitutionalism and the representative system, imperialism

*May not be counted for upperclass group.

and nationalism, and the changes wrought by the Great War. Lectures, readings, reports, quizzes.

3. **Municipal Administration.** First term, credit three hours. Open to upperclassmen. Assistant Professor SABY. T Th S, 9, Goldwin Smith 236.

A study of the development of municipal government, special attention being paid to American conditions.

Lectures, readings, and reports. Each student will be required to make a careful, detailed study of some city.

4. **Municipal Problems.** Second term, credit three hours. Open to upperclassmen. Assistant Professor SABY. T Th S, 9, Goldwin Smith 236.

A study of special problems in municipal functions: city planning, the street railway, water and gas supply, health, police, charity and correction, education, recreation, etc. Lectures, readings, and reports. Each student will be required to make a special study of some problem.

5. **State Administration.** Second term, credit three hours. Prerequisite, course 1. Professor ORTH. M W F, 11, Goldwin Smith 256.

A study of the government of the American state: its relation to local government; the powers and functions of administrative boards and commissions; the police power, judicial control; suggested changes in state governmental organization.

Lectures, readings, and reports. Each student will be required to make a comprehensive study of some particular state.

6. **The American Party System.** First term, credit two hours. Prerequisite, course 1. Professor ORTH.

A study of the evolution of the American political party; its relation to the machinery of government; election laws; the development of state control over the machinery of party. Lectures, readings, and reports.] Not given in 1920-21.

7. **Constitutional Government.** Second term, credit three hours. Prerequisite, course 1. Professor ORTH. Lectures, textbooks, and reports.

A study of the development of the American constitutional system.] Not given in 1920-1921.

8. **History of Political Thought.** First term, credit three hours. Assistant Professor SABY. M W F, 9, Goldwin Smith 236. For advanced students in Political Science.

A study in the development of political thought from the Greeks to modern times in its relation to the history and development of political institutions. Lectures, textbook, and assigned readings.

9. **Modern Political Thought.** Second term, credit three hours. Assistant Professor SABY. M W F, 9, Goldwin Smith 236. For advanced students in Political Science.

A general survey of the more important modern political movements. Ideas and ideals underlying the present political unrest. The various political ideas that have at different times striven for supremacy in American political life. Lectures, textbook, and assigned reading.

10. **The Nature of the State.** Second term, credit two hours. Assistant Professor SABY. M W, 12, Goldwin Smith 236. For advanced students in Political Science.

A critical study of the nature and development of the state. Textbook, readings, and group discussions.

11. **International Law and Diplomacy.** First term, credit three hours. M W F, 12, Goldwin Smith B. Lectures, textbook, and reports. Open to upperclassmen in Arts and Sciences, to students in Law, and to approved upperclassmen in other colleges.

While this course aims to present a systematic view of the rights and obligations of nations in times of peace and war, it particularly emphasizes our con-

temporary international problems and the participation of the United States in the development of international law.] Not given in 1920-1921.

***21. Elements of Business Law.** First term, credit two hours. Professor ORTH. T Th, 12, Goldwin Smith B. Lectures, textbook, quizzes. Open to upperclassmen in all colleges except Law.

A brief survey of that portion of private law which deals especially with contracts, negotiable instruments, agency, and sales.

***22. Government Control of Industry.** Second term, credit three hours. Prerequisite, course 21. Professor ORTH. T Th, 12, Goldwin Smith B. Lectures, reports, quizzes. Open to upperclassmen in all colleges except Law.

A scrutiny of the policy of governmental control of industry from the legal and political point of view, emphasis being laid on the development of the police power and its application to the regulation of corporations and private enterprises and the more recent extension of governmental functions.

Courses 21 and 22 are designed primarily to meet the needs of students who contemplate entering business and not the profession of law, and credit for these courses will not be given to law students.

31. Research in Politics. Throughout the year, credit one to three hours a term. Professor ORTH. Hours to be arranged.

A research course for advanced students in public law and political science.

32. Seminary in Political Science and Public Law. Throughout the year, credit two hours a term. Professor ORTH. W, 2.30, Political Science Seminary.

An advanced course for the study of some special topic to be announced. Open to especially qualified students by permission of the professor in charge.

GREEK

***1. Elementary Greek.** The essentials of the grammar; simpler exercises in composition; selections from Xenophon's *Anabasis*, books I-VII; selections from the New Testament in Greek. Throughout the year, credit six hours a term. This course however is continuous throughout the year, and no credit will be allowed for the first term alone. Assistant Professor JONES. Daily, 8, Goldwin Smith 134.

Designed for students who wish to acquire, by extraordinary effort in one year, the ability to read Attic prose.

2. Plato, Selections; Homer's Odyssey. Throughout the year, credit three hours a term. Professor BRISTOL and Assistant Professor JONES. T Th S, 10, Goldwin Smith 236.

A continuation of the work begun in course 1, which, or at least two years of high school Greek, is prerequisite.

3. Euripides, Sophocles. Reading of the *Alcestis* and *Oedipus the King*, with an introduction to the Greek drama. First term, credit three hours. Assistant Professor JONES. M W F, 10, Goldwin Smith 236.

4. Greek Composition. Throughout the year, credit one hour a term. Prerequisite, course 2 or the equivalent. Assistant Professor JONES. Hour to be arranged. Goldwin Smith 236.

5. New Testament Greek. Throughout the year, credit two hours a term. Dr. WHITE. W F, 8, Barnes Hall Library.

First term, Gospel according to St. Luke. Introduction to the grammar and vocabulary of Biblical Greek; second term, Acts of the Apostles. Prerequisite, course 1 or its equivalent.

[6. Herodotus. Selections chosen to include the account of the conflicts between East and West. First term, credit two or three hours. Professor BRISTOL.] Not given in 1920-1921.

*May not be counted for upperclass group.

[*7. **Myths of the Epic Cycle.** Second term, credit two hours. Assistant Professor JONES.] Not given in 1920-21.

9. **Dramatic Poetry.** Selected plays of Aeschylus, Sophocles, and Euripides, beginning with the Prometheus Bound. Second term, credit two hours. Assistant Professor JONES. T Th, 11, Goldwin Smith 236.

[10. **Lytic Poetry.** Selections from Hiller-Crusius' *Anthologia Lyrica* to illustrate the various types of personal poetry.] Not given in 1920-1921.

11. **Aristophanes.** The Clouds will be read entire, and parts of other plays. Second term, credit two hours. T Th, 12, Goldwin Smith 236. Assistant Professor JONES.

12. **The Republic of Plato.** Throughout the year, credit three hours a term. Professor HAMMOND. Reading of the Greek text. Intended for students of Greek literature and of Greek philosophy. Hours to be arranged.

[15. **Thucydides.** First term, credit two hours. Professor BRISTOL.] Not given in 1920-1921.

20. **Greek Seminary.** Throughout the year, credit three hours a term. Professor BRISTOL. W, 2.30, and one other hour to be arranged. Library, Greek and Latin Seminary Room.

An interpretative study of Demosthenes, with a survey of the development of Greek oratory. For graduates, and, by special permission, qualified seniors.

[21. **Introduction to the Study of Languages.** First term, credit two hours. Professor BRISTOL.] Not given in 1920-1921.

GREEK ART AND ANTIQUITIES

Courses 1, 2, 3, 4a, and 4b in this department do not require any knowledge of Greek or of Latin. Courses 5, 6 and 7 presuppose facility in reading Greek. Course 7 is primarily for those expecting to study in Athens.

A. **Greek Art.** November to March inclusive. Professor ANDREWS. Th, 5, Goldwin Smith Museum of Casts.

An introductory course of popular illustrated lectures on Greek sculpture, Greek antiquities, and Greek topography. Planned and timed especially to meet the needs of students in the technical and professional colleges, but open to all students and to the public. No university credit.

1. **History of Greek Sculpture.** Repeated in second term, credit three hours. Professor ANDREWS. First term, M W F, 9; second term, M W F, 11, Goldwin Smith Museum of Casts.

Lectures in the Museum of Casts. Intended to be supplemented by course 3, but may be taken separately. Not open to students who have had course 2.

2. **History of Greek Sculpture.** Throughout the year, credit two hours a term. Professor ANDREWS. T Th, 11, Goldwin Smith Museum of Casts. May not be entered in the second term. Not open to students who have had course 1. Lectures in the Museum of Casts.

3. **Greek Antiquities.** Repeated in second term, credit three hours. Professor ANDREWS. First term, M W F, 11; second term, M W F, 9, Goldwin Smith Museum of Casts.

Lectures on pre-Greek art and civilization and on Greek terra cottas, bronzes, gems, and coins. Illustrated by the material in the Museum of Casts and by stereopticon views. Intended to be taken with course 1, but may be taken separately.

4a. **Greek Pottery.** First term, credit two hours. Professor ANDREWS. T Th, 9, Goldwin Smith Museum of Casts.

Preferably to follow course 3.

*May not be counted for upperclass group.

4b. **Greek Architecture.** Second term, credit two hours. Professor ANDREWS. T Th, 9, Goldwin Smith Museum of Casts. Preferably to follow course 3.

5. **Pausanias.** Throughout the year. Credit two hours a term. Professor ANDREWS. Hours to be arranged after consultation. Goldwin Smith 35.

A reading course in the sources of knowledge of Greek topography with special reference to Athens, supplemented by illustrated lectures and by reading from Thucydides and Herodotus.

6. **Greek Epigraphy.** Credit two hours. Professor ANDREWS. Hours to be arranged after consultation. Goldwin Smith 35.

A study of Greek alphabets and inscriptions, chiefly from the large collection of squeezes owned by the department. For graduates and qualified undergraduates.

7. **Modern Greek.** Credit two hours. Professor ANDREWS. Hours to be arranged after consultation. Goldwin Smith 35.

The literary language and the colloquial idiom. Athenian newspapers and stories in the vernacular will be read.

HISTOLOGY AND EMBRYOLOGY

1. **The Tissues: Histology and Histogenesis.** First term, credit four hours. No prerequisite, but previous work in biology (zoology and botany) or physiology is recommended. Professor KINGSBURY and assistants. Lectures, M W, 11, Stimson. Laboratory, M W, 2-4.30, Stimson.

For students of biology or those preparing for medicine. The cell and cellular origin of the body and the structure and development of its component tissues. Each student will prepare or receive a series of typical microscopic preparations.

2. **The Organs: Histology and Development.** Second term, credit four hours. Prerequisite, course 1 or the equivalent. Professor KINGSBURY and assistants. A continuation of course 1. Courses 1 and 2 together give the fundamental facts of the microscopic structure and development of the body.

3. **Special Histology and Technique.** First term, credit two hours. Prerequisite, courses 1 and 2, or 1 and 4, or the equivalent. Mr. ———. Two periods, T, p. m., Th, p. m., Stimson.

In this course a more detailed knowledge of histology and greater facility in technique are gained by practical work in one or more of the fields of histology. Designed for those who desire a good working knowledge of histological methods for use in biology and in medicine and who have shown aptitude and ability.

4. **Embryology of Vertebrates.** Second term, credit four hours. Prerequisite, course 1 or the equivalent. Lectures or recitations, Professor KINGSBURY. F, 11, W, 8, Stimson Hall. Laboratory, Mr. ———. T, p. m., Th, p. m., Stimson.

For students of biology or zoology, or those preparing for medicine. Preparation and study of embryological specimens from all the chief groups of vertebrates. Particular emphasis is placed on the embryology of the amphibian, chick, and pig. The student also acquires a knowledge of special methods useful in embryological work.

5. **The Nervous System and Organs of Special Sense: Histology and Development.** Second term, credit two hours. Prerequisite, course 1 or the equivalent. Laboratory work with demonstrations and quizzes. Professor KINGSBURY and Mr. ———. M, 8-1 and 2-3.

Designed for students who wish a more detailed consideration of the nervous system and organs of special sense than can be given in other more general courses.

7. **Advanced Histology and Embryology.** Throughout the year, credit three or more hours a term. Prerequisite, courses 1, 2, 3, or the equivalent. Laboratory work with conferences at hours to be arranged. Professor KINGSBURY and Mr. ———.

Designed for those who are preparing theses or for those who wish to undertake special investigations in histology and embryology.

8. **Seminary.** Throughout the year, credit one hour. Prerequisite, courses 1 and 2, or 4; may be taken with course 3 or 7. Hours to be arranged, Stimson.

For discussion of current literature and presentation of original work by members of the department staff and by those doing advanced work in the department.

HISTORY

A. **The History of Civilization.** Throughout the year. THE FACULTY OF HISTORY. F, 12, Goldwin Smith A.

A course of public lectures on some of the principal epochs and characters of history, and on their significance in the progress of humanity. The lectures will be open to all students and to the public, but no university credit will be given.

*1. **Greek History.** First term, credit three hours, upperclassmen two hours only. Professor WESTERMANN. M W, 11, and an hour for quiz sections to be arranged. Goldwin Smith A.

The political and cultural history of the Mediterranean world as affected by the ancient Greeks, from the beginnings of European civilization to 146 B. C. Textbook, lectures, quizzes, and collateral reading.

*2. **Roman History.** Second term, credit three hours, upperclassmen two hours only. Professor WESTERMANN. M W, 11, and an hour for quiz sections to be arranged. Goldwin Smith A.

The political development of the Roman state and the Hellenistic-Roman influence in the ancient Mediterranean world to the end of the fourth century of our era. Text-book, lectures, quizzes, and collateral reading.

3. **Greek Civilization.** First term, credit two hours. Professor WESTERMANN. T Th, 11, Goldwin Smith 242.

The development of Greek religious, social, and scientific ideas and of Greek literary genius, to the time of Alexander. Open to upperclassmen and graduates.

4. **Hellenistic-Roman Civilization.** Second term, credit two hours. Professor WESTERMANN. T Th, 11. Goldwin Smith 242.

The intellectual and social life of the Mediterranean world in the period of the Greek expansion eastward into Asia, and the changes in Greek culture brought about by its contact with the peoples of the Middle East and the western Mediterranean countries. Open to upperclassmen and graduates.

8. **Seminary in Ancient History.** Throughout the year, credit two hours a term. Professor WESTERMANN. Hours to be arranged. Consult the instructor.

An intensive study of the Ptolemaic and Roman administration of Egypt. Open to graduates, and to seniors by special permission.

11. **The Middle Ages.** First term, credit three hours. Professor BURR. M W F, 9, Goldwin Smith 245.

The history of Christendom from the eve of the Middle Ages to the dawn of the Renaissance (300-1300 A. D.), with special attention to the life of society and the progress of civilization. Lectures and examinations.

12. **The Age of Renaissance and Reformation.** Second term, credit three hours. Professor BURR. M W F, 9, Goldwin Smith 245.

The political, social, and religious history of Christendom during this age of transition (1300-1600 A. D.), with especial attention to the beginnings of modern life and thought. Lectures and examinations.

14a. **Life in the Thirteenth Century.** From Monk to Friar: a study of the dialogues of Caesarius of Heisterbach and the chronicle of Salimbene. First term, credit one hour. Professor BURR. M, 4-6, Library, European History Seminary Room.

A reading knowledge of Latin (as much, say, as is needed to read Caesar or Livy) is prerequisite.

*May not be counted for upperclass group.

14b. **Life in the Sixteenth Century.** From Humanist to Reformer: a study of the reminiscences of Conrad Pellican and Thomas Platter. Second term, credit two hours. Professor BURR. M, 4-6. Library, European History Seminary room.

This course requires a reading knowledge either of Latin or of German.

[15. **The Rise of Tolerance.** Throughout the year, credit two hours a term. Professor BURR. T Th, 9, Library, European History Seminary Room.

A research class for study of the history of intellectual and religious liberty in Christendom. Open to seniors and graduates properly equipped in language and in history, and serving as a "seminary" in the history of the Middle Ages and of the age of Renaissance and Reformation. Course 75 should, if possible, be taken at the same time.] Not given in 1920-1921.

16. **Canon Law.** Throughout the year, credit two hours a term. Professor BURR. Hours to be arranged. Library, European History Seminary Room. Consult the instructor.

The constitutional history of the Christian Church and the elements of ecclesiastical law. Primarily for graduates, but open by permission to qualified seniors.

22. **History of Modern Europe.** Throughout the year, credit three hours a term. Professor BECKER. M W F, 3, Goldwin Smith 242.

A survey of European history from the beginning of the seventeenth century to the present. Political, economic, and intellectual movements will be emphasized in proportion to their international or European character and importance.

23. **The French Revolution.** First term, credit two hours. Professor BECKER. T Th, 3, Goldwin Smith 242.

A study of the revolution from 1789 to 1795, with a preliminary survey of conditions in France before 1789. An elementary knowledge of modern European history is assumed, and a reading knowledge of French will be found of great advantage. The work of the course will consist of informal lectures, discussions, and the preparation of a paper by each student.

24. **The Napoleonic Era.** Second term, credit two hours. Professor BECKER. T Th, 3, Goldwin Smith 242.

A study of the organization of France under Napoleon, the establishment of the Napoleonic empire, the restoration of Europe in 1814-15, and the attempt to establish a European Federation or Concert of the Powers from 1815 to 1825. An elementary knowledge of modern history is assumed, and a reading knowledge of French will be found of great advantage. The work of the course will consist of informal lectures, discussions, and the preparation of a paper by each student.

28. **Seminary in Modern European History.** Throughout the year, credit two hours a term. Professor BECKER. Library, European History Seminary Room. Hour to be arranged.

An opportunity for advanced students to undertake special investigation from the sources in some subject connected with the French Revolution or the intellectual history of the eighteenth century. Open to graduates and to properly qualified seniors.

*31. **English History, 1066-1689.** First term, credit three hours: upperclassmen two hours only. Professor NOTESTEIN. T Th, 10, and a third hour for recitation. Goldwin Smith A.

An outline of political, social, and constitutional history. Textbooks, lectures, and assigned readings.

*32. **English History, 1689-1921.** Second term, credit three hours, upperclassmen two hours only. Professor NOTESTEIN. T Th, 10, and a third hour for recitation. A continuation of course 31. Prerequisite, course 31 or equivalent satisfactory to instructor. Goldwin Smith A.

33. **English History, 1763-1858.** First term, credit three hours. Professor NOTESTEIN. M W F, 9, Goldwin Smith 242. Emphasis will be laid upon cabinet and party development, colonial policy, upon the Industrial Revolution and the social and parliamentary reform following 1815. Lectures, assigned

*May not be counted for upperclass group.

readings, and reports. Prerequisite, courses 31 and 32 or an equivalent satisfactory to the instructor.

34. **English History, 1858-1921.** Second term, credit three hours. Professor NOTESTEIN. M W F, 9, Goldwin Smith 242.

Political, social and diplomatic history. A lecture course with assigned reading and reports. Prerequisite, courses 31 and 32 or an equivalent satisfactory to the instructor.

40. **Anglo-German Relations, 1900-1914.** First term, credit two hours Professor NOTESTEIN. M, 4-6, Goldwin Smith 236. A research course open only to select seniors and graduate students.

41. **Selected Topics in English History, 1640-1660.** Second term, credit two hours. Professor NOTESTEIN. M, 4-6, Goldwin Smith 236.

A research course. Open only to graduate students.

[51. **The British Empire in America, 1600-1783.** First term, credit three hours. Professor HULL.

Referring especially to the colonial history of the United States and the establishment of their independence. Textbook, lectures, and readings.] Not given in 1920-1921.

*52. **American History, 1783-1850.** First term, credit three hours; upperclassmen two hours only. Professor BRETZ. M W F, 9, Goldwin Smith C.

Problems following the Revolution; formation of the new national government; European complications; second war with Great Britain; domestic problems; rise of sectional parties. Textbooks, lectures, and readings. Primarily for sophomores.

*53. **American History, 1850-1914.** Second term, credit three hours; upperclassmen two hours only. Professor BRETZ. M W F, 9, Goldwin Smith C.

Secession and civil war, reconstruction, recent political and constitutional history. Textbooks, lectures, and readings. Prerequisite, course 52. Primarily for sophomores.

[54. **Economic History of the Colonies, 1600 to 1800.** First term, credit three hours. Professor HULL.

Colonization and settlement as business enterprises; the agricultural conquest of the coast; the competition between slave, indentured, and free labor; the commerce of the British Empire and its relation to the American Revolution.] Not given in 1920-1921.

[55. **Economic History of the United States, since 1800.** Second term, credit three hours. Professor HULL.

Commerce during the European wars; the introduction of manufactures; the westward movement; industrial differentiation of the sections; agriculture for export; the amalgamation of railways and the combination of industries.] Not given in 1920-1921.

56. **Constitutional History of the United States.** First term, credit two hours. Professor BRETZ. T Th, 9, Goldwin Smith 234.

The course deals with the leading constitutional questions since the civil war. The constitutional aspects of current political questions are also studied. Prerequisite, courses 52 and 53. Upperclassmen only.

[58. **Foreign Relations of the United States, 1783-1914.** Second term, credit three hours. Prerequisite, courses 52 and 53. Professor HULL.] Not given in 1920-1921.

59. **American History, 1750-1848: The Settlement of the Middle West.** Second term, credit two hours. Professor BRETZ. T Th, 9, Goldwin Smith 234.

Exploration of the west, early settlers in the Ohio Valley, admission of states, disposal of the public lands, military and diplomatic relations with foreign powers on Northwest and Southwest. For upperclassmen. Prerequisite, courses 52 and 53.

*May not be counted for upperclass group.

60. **American History.** Investigation of topics in a selected field. Throughout the year, credit two hours a term. Professor BRETZ. Library, American History Room, Tuesday, 2-4.

Primarily for upperclassmen who have a special interest in history and who have had courses 52 and 53. Consult the instructor before registering. First meeting Tuesday, October 5, 1920.

61. **Seminary.** Throughout the year, credit two hours a term. Professor BRETZ. Library, American History Room. Thursdays, 2-4.

For graduates and open to qualified seniors by permission. First meeting, Thursday, October 7, 1920.

[71. **The Sciences Auxiliary to History.** First term, credit one hour. Professor BURR.

A glance at the aims, the methods, the literature, and the use to history of the more important auxiliary science: anthropology, ethnology, archæology, philology, epigraphy, palæography, diplomatics, sphragistics, numismatics, heraldry, genealogy, chronology, geography. Not open to underclassmen.] Not given in 1920-1921.

72. **Historical Geography.** Throughout the year, credit one hour a term. Professor BURR. S, 11, Library, European History Seminary Room.

A thorough study of the geography of history. Not open to underclassmen, and intended for those who have given much attention to history.

73. **Palæography and Diplomatics.** Throughout the year, credit one hour a term. Professor BURR. S, 12, Library, European History Seminary Room.

The reading of manuscripts and the interpretation of documents. Attention is devoted chiefly to the palæography of Latin and the languages using the Latin alphabet (e. g., English, French, German, Italian). The course is a first-hand study of the manuscripts and facsimiles in the University collection.

[75. **Historical Method.** First term, credit one hour. Professor BURR. History: its nature, its scope, its materials, its methods. Open only to seniors and graduates, and intended especially for those who are looking forward to the teaching of history or to historical research.] Not given in 1920-1921.

76. **The Teaching of History.** Course for teachers. Second term, credit two hours. S, 8-10, Library, European History Seminary Room. Professor BURR with aid from his colleagues. Open only to seniors and graduates who are specializing in history.

77. **Introduction to the Literature of History.** A general survey, period by period, of the sources and literature of history. F, 3 (or as may be arranged). First meeting, Friday, October 8, European History Seminary Room. Professors SCHMIDT, WESTERMANN, BURR, BECKER, NOTESTEIN, HULL, BRETZ. For graduates only.

Oriental History. (See Semitic Languages and Literatures, courses 9a*, 9b*.)

LATIN

*A. **Elementary Latin.** This course is intended for those who, after entering the University, have come to feel the need of Latin and wish by special effort to acquire a reading knowledge of ordinary prose in a single year. M T W Th F, 8, Goldwin Smith 124. Professor ELMER. Credit five hours a term. The course is however continuous through the year, and no credit will be allowed for the first term alone. May be elected for five hours' total credit by students who have entrance credit for only one unit of Latin.

*B. **Cicero, Selected Orations; Virgil, Aeneid, Books I-IV.** Throughout the year, credit three hours a term. Prerequisite, course A or entrance credit for two units of Latin (first year and second year Latin). Professor ELMER. M W F, 2, or hours to be arranged, Goldwin Smith 124. May be entered in the second term by students who have entrance credit for only three units of Latin.

*May not be counted for upperclass group.

*1. **Cicero, De Amicitia; De Senectute; Horace, Odes and Epodes; Latin Writing.** Throughout the year, credit three hours a term.

Sec. 1, M W F, 10, Goldwin Smith 120. Professor BENNETT.

Sec. 2, M W F, 11, Goldwin Smith 128. Professor DURHAM.

Sec. 3, M W F, 12, Goldwin Smith 128. Professor DURHAM.

*1a. **Freshman Latin Composition and Conversation.** Throughout the year, credit one hour a term. Professor DURHAM. A systematic drill intended for those who are taking course 1.

[*2. **Sight Translation: Gellius, Selections; Ovid, Metamorphoses.** Oral translation at sight. Throughout the year, credit one hour a term.] Not given in 1920-1921.

*3. **Sight Translation: Selections from Petronius, Cato, Publilius Syrus; Early Christian Hymns; Cicero's Second Philippic.** Throughout the year, credit one hour a term.

Sec. 1, T, 11, Goldwin Smith 124. Professor ELMER.

Sec. 2, S, 10, Goldwin Smith 124. Professor ELMER.

Sec. 3, S, 11, Goldwin Smith 124. Professor ELMER.

Especially recommended as collateral work for those who are taking course 1, but open to all students. Courses 2 and 3 are given in alternate years.

*7. **Classic Myths in English Literature.** Lectures, translations, and illustrative reading from English literature. Prerequisite, preparatory Latin. Second term only, credit two hours. Professor DURHAM.

This course is not intended as a substitute for any of the regular courses in Latin, and it may not be taken to satisfy the underclass requirement in foreign language.

8. **Terence, Phormio; Catullus; Horace, Satires and Epistles; Tacitus, Agricola and Germania.** Throughout the year, credit three hours a term. Prerequisite, course 1. Professor DURHAM. T Th S, 9, Goldwin Smith 128.

9. **Sight Translation for Sophomores.** First term, credit one hour. Prerequisite, course 1. Professor DURHAM. S, 12, Goldwin Smith 128.

11. **Selections from Cicero's Letters; Cicero, De Oratore, Book I.** Throughout the year, credit two hours a term. Prerequisite, course 1 or the equivalent. Professor ELMER. T Th, 2, or hours to be arranged, Goldwin Smith 124.

[12. **Selections from the last six books of Virgil's Aeneid; Cicero, De Officiis.** Throughout the year, credit two hours a term. Prerequisite, course 1 or the equivalent. Professor ELMER.] Not given in 1920-1921.

Courses 11 and 12 are given in alternate years.

16. **Selections from the Republican Literature; Plautus, the Captives and Mostellaria; Lucretius; Lectures on the History of Roman Literature.** Throughout the year, credit three hours a term. Prerequisite, course 8, 11, or 12. Professor BENNETT. T Th S, 9, Goldwin Smith 120.

[17. **Literature and History of the Early Empire: Suetonius, Lives of the Caesars; Pliny's Letters; Tacitus's Annals.** Throughout the year, credit three hours a term. Prerequisite, course 8, 11, or 12. Professor BENNETT. T Th S, 9, Goldwin Smith 120.] Not given in 1920-1921. Courses 16 and 17 are given in alternate years.

18. **Lyric Poetry.** First term, credit two hours. Open to students who have taken or are taking course 16 or 17. Professor DURHAM. Goldwin Smith 128.

21. **Intermediate Course in Latin Writing.** Throughout the year, credit one hour a term. Prerequisite, course 1. Professor ELMER. W, 3, or hour to be arranged. Goldwin Smith 124.

26. **Teachers' Training Course.** Throughout the year, credit two hours a term. Open, upon personal application to the professor, to students who

*May not be counted for upperclass group.

have had course 8, 11, or 12, and have taken or are taking course 16 or 17. Professor BENNETT. W F, 12, Goldwin Smith 120.

[27. **Roman Life and Art.** Throughout the year, credit two hours a term. Professor BENNETT.

Topography and architectural remains of the city of Rome; a systematic consideration of the constitution of the Roman family, status of women, marriage, children, education, slavery, the Roman house and its furniture, food, dress, baths, games and amusements, books, trade, travel, religion, death, burial, etc. Lectures illustrated by lantern views, photographs, and material in the Museum of Casts.] Not given in 1920-1921.

34. **Cicero, in Verrem, Fourth Oration of the Actio Secunda.** Throughout the year, credit one hour a term. Prerequisite, course 8, 11, or 12 or the equivalent. Professor ELMER. Th, 3, Goldwin Smith 124.

This course is especially designed to develop in students the ability to understand and to appreciate the Latin without translating.

[35. **Advanced Course in Sight Translation: Cicero's Philippics.** Throughout the year, credit one hour a term. Open to juniors and seniors who have taken or are taking either 16 or 17. Professor ELMER.] Not given in 1920-1921.

45. **Latin Writing, Advanced Course.** Throughout the year. Professor ELMER. W, 3, Goldwin Smith 124. For graduates. Undergraduates who have taken course 21 may also be admitted to this course.

47. **Vulgar Latin.** Throughout the year, credit two hours a term. Professor DURHAM. Goldwin Smith 128.

50. **Latin Epigraphy.** Throughout the year, credit two hours a term. Professor DURHAM. T Th, 12, Goldwin Smith 128.

The interpretation of selected inscriptions. Special topics in the administrative history of the Roman Empire will be assigned for investigation. Open to graduates and to qualified undergraduates.

MATHEMATICS

Examinations for the removal of conditions in courses 1 to 8 are held in September just before registration, and near the end of each term. For further information regarding the time and place of these examinations students should apply to Professor OWENS.

All students taking any of the courses from 1 to 15 inclusive should go to White 8 on one of the registration days at the beginning of each term for assignment to sections.

Students wishing to take any of the courses numbered above 15 are asked to meet in White 5 at 3.30 p. m. on the day following the last day of registration of each term to arrange their schedules.

*1. **Solid Geometry.** Repeated in second term, credit three hours. First term, T Th S, 10; second term, M W F, 10.

*2. **Advanced Algebra.** Repeated in second term, credit five hours. Daily exc. S, 9.

*2E. **Advanced Algebra.** Repeated in second term, credit three hours. M W F, 9.

Open only to students who have met the entrance requirements in intermediate algebra.

*3. **Plane Trigonometry.** Repeated in second term, credit three hours. First term, M W F, 10; second term, T Th S, 10.

4, 5, 6. **Analytic Geometry and Calculus.** For students in the College of Engineering. Prerequisite, courses 1, 2, 3 or their equivalent.

4. First term, credit three hours. Repeated in the second term.

5. Second term, credit five hours. Daily except S. Continuation of course 4.

[6. First term, credit three hours. Continuation of course 5.] To be given n 1921-22 and thereafter.

6 (2). **Analytic Geometry and Calculus.** First term, daily, credit six hours. Continuation of course 6 (1) as given previous to September 1920.

*May not be counted for upperclass group.

7. **Analytic Geometry and Calculus.** For candidates for the degree of B. Chem. Prerequisite, courses 1, 2, 3, or their equivalent.

7 (1) First term, daily except S, credit five hours.

7 (2) Second term, daily except S, credit five hours. Continuation of 7 (1).

*8. **Analytic Geometry and Calculus.** For students in the College of Architecture. Throughout the year, credit three hours a term. Prerequisite, courses 1, 2, 3 or their equivalent.

*15. **Elementary Course in Higher Mathematics.** Throughout the year, credit two hours a term. Prerequisite, courses 1, 2 and 3, or their equivalent. Professor SNYDER. T Th, 9, White 24.

Intended for students who do not plan to take many courses in mathematics, but who nevertheless wish to become acquainted with the principal ideas of the subject. The object will be to make clear the fundamental aims, methods, and results of a number of subjects, rather than to develop the technique of any one. The course will deal with theory of numbers, vector analysis, groups; advanced synthetic geometry, including some topics in projective, non-euclidean, and higher dimensional geometry; analytic geometry, calculus, famous problems of mathematics; algebra of logic, foundations of mathematics. Lectures, assigned reading, and exercises.

21. **Theory of Numbers.** Second term, credit three hours. Assistant Professor RANUM. White 9.

An elementary treatment of congruences and quadratic forms, including a discussion of the abelian groups involved.

23. **Modern Higher Algebra.** Throughout the year, credit three hours a term. Prerequisite, course 7. Mr. VANDIVER. White 9.

Rational algebraic functions, determinants, matrices, symmetric functions, linear transformations, invariants, covariants, etc.

41. **Elementary Differential Equations.** Throughout the year, credit three hours a term. Prerequisite, course 7 or its equivalent. Assistant Professor GILLESPIE. M W F, 9, White 1.

42. **Advanced Calculus.** Throughout the year, credit three hours a term. Prerequisite, course 7 or its equivalent. Assistant Professor OWENS. T Th S, 9, White 2.

The course is a study of the processes of the calculus, their meanings and applications. It is designed to furnish a necessary preparation for advanced work in analysis and applied mathematics.

44. **Infinite Series.** Second term, credit three hours. Prerequisite, course 7 or its equivalent. Dr. ROBISON. White 21.

The theory of convergence and the algebraic and functional properties of series; special types of series; introduction to the study of divergent series.

45. **Theory of Functions of a Complex Variable.** Throughout the year, credit three hours a term. Assistant Professor CRAIG. Hours to be arranged.

The elements of the theory of functions of one complex variable will be presented from the points of view of Cauchy, Riemann, and Weierstrass.

[46. **Elliptic Functions and Integrals.** Throughout the year, credit three hours a term. Dr. H.M. MORSE.

The theory will be based on the Weierstrass sigma function, and the Jacobi theta function. Special attention will be given to its applications to problems in mathematical physics. A knowledge of the elements only of the theory of functions is presupposed.] To be given in 1921-1922.

61. **Projective Geometry.** Throughout the year, credit three hours a term. Prerequisite, course 7 or its equivalent. Dr. H. B. OWENS. M W F, 11, White 4. The elements of projective geometry treated synthetically.

62. **Advanced Analytic Geometry.** Throughout the year, credit three hours a term. Prerequisite, course 5 or its equivalent.

*May not be counted for upperclass group.

The course consists of a study of homogeneous coordinates, anharmonic properties of conics, and an introduction to the geometry of algebraic curves.

63. Algebraic Geometry. Throughout the year, credit three hours a term. Prerequisite, courses 7 and 61. Professor SNYDER, White 24.

Systems of curves, birational transformations, and the theory of algebraic correspondence in two and three dimensions. •

67. Differential Geometry of Curves and Surfaces. Throughout the year, credit three hours a term. Dr. MORSE.

The course will commence with an analysis of those fundamental properties of curves that can be characterized in the neighborhood of a point with the aid of the derivative and differential. Various types of space curves, ruled and developable surfaces, triply orthogonal surfaces, congruences of curves, conformal mapping, deformation and applicability of surfaces, minimal and isothermic surfaces, surfaces of curvature of one sign, and geodesics, will be studied.

69. Metric Geometry in the Plane. Throughout the year, credit three hours a term. Prerequisite, course 7 or its equivalent. Assistant Professor CARVER. White 20.

A study of the metric properties of the triangle, the chain theorems for the plain n -line, and the metric properties of certain rational curves. The method of conjugate (or circular) coordinates will be developed and used throughout the course.

80. Differential Equations of Mathematical Physics. Throughout the year, credit three hours a term. Assistant Professor HURWITZ. White 6.

The derivation of the differential equations, with appropriate boundary conditions, which arise in certain problems of mathematical physics; the mathematical properties of solutions and the physical meaning of these properties. No previous work in solving differential equations is required, but course 42 or its equivalent is essential.

***82. Introduction to the Mathematics of Finance.** First term, credit two hours. Repeated in the second term. Professor TANNER. M F, 12, White 28. Designed primarily for students in accounting, finance, and actuarial work.

83. Theory of Probabilities. Throughout the year, credit three hours a term. Assistant Professor OWENS. T, Th, S, 12 White, 10.

Theory of probabilities with applications to problems in statistics, curve-fitting, theory of errors, life-tables, insurance, correlation, etc. to suit individual needs. The work is arranged so that students may begin at mid-year without much inconvenience.

85. Vector Analysis and Electro-magnetic Theory. First term, credit three hours. Prerequisite, course 7 or its equivalent. Professor SHARPE. White 10.

A brief course in vector analysis will be followed by applications to electro-magnetic theory.

87. Celestial Mechanics. Throughout the year, credit three hours a term. Prerequisite, course 7. Dr. REED.

The problem of two, three, and n bodies, the theory of orbits, perturbations, etc.; concluding with a study of the fundamental equations of dynamics.

MUSIC

The courses offered by the Department of Music are designed to afford to all students having sufficient native ability, the opportunity to study music as a part of the college course. The aim is to make musical training contribute to liberal culture.

Credit for courses 1 to 7 inclusive may be counted as part of the thirty hours which a student may elect outside the College of Arts and Sciences but may not be counted as part of the ninety hours required in the College. (See paragraph 1b, page ix.)

*May not be counted for upperclass group.

Individual examinations for admission to all courses in music, for new students and others not previously classified, will be held as follows:

Courses 1, 3, 5, and 7 daily, Tuesday, September 28, to Saturday, October 2, inclusive, 4.00 to 5.30, Sage Chapel.

Courses 10, 12, 14, 16, 17, and 18, Tuesday, September 28, Wednesday, September 29, and Thursday, September 30, 11 to 12.30, Sage Chapel.

1. **Elementary.** Throughout the year, credit two hours a term. Open to all students showing sufficient aptitude to pursue the subject with profit. Professor DANN. T, 7.15 p. m.; Th, 4.45 p. m., Sage Chapel.

Ear training, elementary sight reading, and elementary theory, including construction of the major scale (without key signature); normal, harmonic, and melodic minor scales; notation of chromatic scale with each key-signature; intervals, triads and their inversions; voice training and part singing. Attendance is required at the Sunday morning service at Sage Chapel for which service the members of this class form the choir.

3. **Intermediate.** Throughout the year, credit two hours a term. Open to students who have completed course 1 or who meet the requirements prescribed in course 1. Professor DANN. Hours to be arranged. Sage Chapel.

Advanced musical dictation, melody writing, more advanced sight reading and study of standard sacred and secular music.

5. **Choral.** Throughout the year, credit one hour a term. Open to any student possessing a voice of satisfactory quality and volume, who is qualified to sing the larger choral works to be given at the annual music festival in May. Professor DANN. First term, Th, 7.15 p.m., Sage Chapel; second term, M W, 7.15 p. m., Stimson Hall.

This course may not be repeated for credit or taken for credit at the same time as course 7.

General vocal training, including posture, breathing, the study of vowels and consonants as applied to singing, together with intensive study of the larger choral compositions. Members of the class form a part of the festival chorus.

7. **Advanced Choral.** Throughout the year, credit two hours a term. Professor DANN. M, 7.15; T, 4.45; Sunday, 2.30, Sage Chapel.

This course may not be repeated for credit.

Preparation and public presentation of the best choral works, sacred and secular. This course is offered as advanced training to students possessing good singing voices and the ability to read at sight music of moderate difficulty. The class is limited to one hundred and eight members, distributed approximately as follows: thirty-two sopranos, twenty-four contraltos, twenty-two tenors, and thirty basses. All vacancies are filled by competition at the beginning of the first term.

Members of this class constitute the choir at the Sunday Vesper service in Sage Chapel and form a part of the festival chorus.

10. **Harmony.** Throughout the year, credit two hours a term. Prerequisite, course 1 or the equivalent. Assistant Professor QUARLES. M W, 12, Sage Chapel.

A course dealing with the construction and interconnection of triads and chords of the seventh.

12. **Advanced Harmony and Elementary Form.** Throughout the year, credit two hours a term. Prerequisite, course 10 or the equivalent. Assistant Professor QUARLES. M W, 10, Sage Chapel.

The first term completes the study of harmony, and the second term deals with the fundamental principles of musical form. This course should be combined with course 16.

14. **Applied Form and Composition.** Throughout the year, credit two hours a term. Open to students who have completed course 12, and to others equally qualified. Assistant Professor QUARLES. M W, 11, Sage Chapel.

A course in practical composition. Analysis of musical masterpieces. It is recommended that courses 14 and 17 be pursued simultaneously.

16. Counterpoint. Throughout the year, credit two hours a term. Assistant Professor QUARLES. Open to students who have completed course 10, and to others equally qualified. T Th, 10, Sage Chapel.

A course dealing with the principles of melodic combination. It should be pursued in combination with course 12.

17. Canon and Fugue. Throughout the year, credit two hours a term. Open to students who have completed course 16, and to others equally qualified. Assistant Professor QUARLES. T Th, 11, Sage Chapel.

A continuation of course 16, giving practical work in contrapuntal forms. It should be taken with course 14.

18. History and Appreciation of Music. Throughout the year, credit two hours a term. No preliminary training required. Assistant Professor QUARLES. T Th, 12, Sage Chapel.

A general survey of the historical development of music from earliest time to the present. Current musical topics.

PHILOSOPHY

***1. Problems of Philosophy.** First term, credit three hours. Lectures, Professor THILLY. M W, 11, Goldwin Smith B. Recitations, Professor THILLY, Dr. PAINE, and Dr. COOKE. F, 11, Goldwin Smith B, 225, 227.

The fundamental problems of philosophy, together with a critical study of the most important types of philosophical theory.

***2. Logic.** First term, credit three hours. Dr. PAINE. M W F, 12, Goldwin Smith 227.

This course will cover practically the same ground as course 3, which is given in the second term. More emphasis will, however, be laid upon the criticism and construction of various forms of argument both deductive and inductive.

***3. Logic.** Second term, credit three hours. Professor CREIGHTON. T Th S, 11, Goldwin Smith 225. Dr. PAINE. T Th S, 9, Goldwin Smith 227.

The general character of the thinking process, its laws of development, and the methods by which thought actually proceeds to solve the problems presented to it; the analysis of logical arguments and the detection of fallacies, in both the deductive and the inductive processes of reasoning. Creighton's Introductory Logic will be used as a textbook.

***4. The Fine Arts: their Philosophy and History in Outline.** First term, credit three hours. Professor HAMMOND. T Th S, 10, Goldwin Smith 225.

An elementary course on æsthetics. Lectures, assigned readings, and examinations.

4a. The Renaissance. Second term, credit three hours. Professor HAMMOND. T Th S, 10, Goldwin Smith 225.

Lectures and assigned readings. A philosophical study of the civilization of the Renaissance, with special reference to the fine arts, the rise of humanism, and the beginnings of modern philosophical and political theories.

5. History of Philosophy. Throughout the year, credit three hours a term. Professor CREIGHTON. T Th S, 9, Goldwin Smith 225.

The history of philosophical speculation from its origin among the Greeks to the present time; the various philosophical systems in their relation to the science and general civilization of the ages to which they belong, and their application to social, political, and educational problems; the speculative problems of the present century, and especially the philosophical meaning and importance of the notion of evolution or development. Reading will be assigned from time to time but there will be no class textbook. Open to juniors, seniors, and graduates.

5a. Supplement to 5. Two hours, time to be arranged. For honor students and others who have the necessary qualifications. Lectures, discussions and

*May not be counted for upperclass group.

reports on reading, running parallel to and supplementing the instruction given in course 5. Professor CREIGHTON and Mr. MORROW.

***6. Moral Ideas and Practice.** Second term, credit three hours. Lectures, Professor THILLY. M W, 11, Goldwin Smith B. Recitations, F, 11, Goldwin Smith B, 225.

The evolution of moral ideas and practice from primitive times to the present, with an examination of the fundamental virtues.

7. Ethics. First term, credit three hours. Professor THILLY. M W F, 10, Goldwin Smith 225.

A study of the moral consciousness and of the principles of human conduct in their relations to the individual and society.

7a. Social and Political Ethics, and the Philosophical Theory of the State. Second term, credit three hours. Professor THILLY. M W F, 10, Goldwin Smith 225. Open to juniors, seniors, and graduates.

9. Philosophical Ideas in Nineteenth Century Literature. First term, credit three hours. Professor ALBEE. M W F, 12, Goldwin Smith 225.

This course does not presuppose previous acquaintance with philosophy. After considering the tendencies of eighteenth century thought, particularly as represented by British empiricism, the course will deal with the interpretations of life offered by well-known authors of the nineteenth century, English, continental, and American, and the relation of such interpretations to the recognized tendencies of contemporary philosophy.

9a. The Philosophy of William James. Second term, credit two hours. Professor ALBEE. M W, 12, Goldwin Smith 227.

A study of pragmatism as developed in the writings of William James. Lectures and discussions. Primarily for juniors and seniors.

[*11. **Philosophical Results and Applications.** Professor CREIGHTON.] Not given in 1920-1921.

12. The Theory of Evolution: Its History and Significance. Throughout the year, credit one hour a term. Dr. PAINE. S, 11, Goldwin Smith 227.

Intended primarily for undergraduates. No acquaintance with the history or special terminology of philosophy is presupposed.

13. Origin and Development of Religious Ideas. First term, credit two hours. Dr. PAINE. T Th, 12, Goldwin Smith 227.

The origin of religious belief and the conditions of its development, with a brief examination of various forms of primitive religion; the history and significance of the more highly developed religions, such as Brahmanism, Buddhism, Judaism, Mohammedanism, and Christianity.

14. Psychology and Philosophy of Religion. Second term, credit two hours. Dr. PAINE. T Th, 12, Goldwin Smith 225.

Psychological analysis of some of the more important types of contemporary individual and social religious experience; relation of religion to science; the question of the place of religion in a philosophical account of the world.

16. Reading of Philosophical German. Throughout the year, credit two hours a term. F, 2-4, Goldwin Smith 220.

The text for class use will be Windelband's *Platon*.

17. Sources of Ancient and Medieval Philosophy. Second term, credit two hours. Professor HAMMOND. M W, 12, Goldwin Smith 222.

Critical examination of the sources; lectures on historical problems, and discussions.

Primarily for graduates, and open to seniors only by special permission.

18. Types of Metaphysical Theory. First term, credit two hours. Prerequisite, courses 1 and 5 or the equivalent. T Th, 12, Goldwin Smith 225. Professor CREIGHTON.

[*19. **The Development of Modern Philosophical Problems.** Professor CREIGHTON.] Not given in 1920-1921.

*May not be counted for upperclass group.

20. **History of Ethics, Ancient, Medieval, and Renaissance.** First term, credit two hours. Professor HAMMOND. M W, 11, Goldwin Smith 220.

Lectures and assigned readings. Primarily for seniors and graduates.

21. **History of Modern Ethics.** Second term, credit two hours. Professor ALBEE. M W, 11, Goldwin Smith 227.

The history of modern ethics with special reference to the commonly recognized methods of ethics. The history of British ethics will receive particular attention as illustrating the gradual differentiation of ethics as an independent science or philosophical discipline. Primarily for seniors and graduates.

26. **The Ethics of Modern Utilitarianism.** Throughout the year, credit three hours a term. Professor THILLY. M W F, 3, Goldwin Smith 220. Open to qualified seniors and graduates.

27. **The Republic of Plato.** Throughout the year, credit three hours a term. Professor HAMMOND. Reading of the Greek text. M W F, 10, Goldwin Smith 222. This course is intended for students of Greek literature as well as of Greek philosophy.

[29. **Modern Idealistic Theories of Ethics.** Throughout the year, credit three hours a term. Professor THILLY. Primarily for graduates.] Not given in 1920-1921.

30. **Empiricism and Rationalism.** First term, credit three hours. Professor ALBEE. T Th S, 11, Goldwin Smith 220.

Lectures and discussions. The empirical movement as represented by Locke, Berkeley, and Hume, and the rationalistic movement as represented especially by Leibniz. Primarily for graduates.

31. **The Critical Philosophy of Kant.** Second term, credit three hours. Professor ALBEE. T Th S, 11, Goldwin Smith 220.

Lectures and discussions. A study of the Critique of Pure Reason and of the Critique of Judgment with frequent references to standard commentaries and to more recent interpretations. Primarily for graduates.

32. **Early Rationalism: Spinoza and Leibniz.** Second term, credit two hours. Professor ALBEE. T Th, 12, Goldwin Smith 220.

A critical study of early rationalism with special reference to the divergent tendencies represented by Spinoza and Leibniz. Primarily for graduates.

[33. **The Philosophy of Bergson.** First term, credit two hours. Professor ALBEE. Primarily for graduates.] Not given in 1920-1921.

[34. **Logical Theory.** Throughout the year, credit two hours a term. Professor ALBEE. Lectures, reading of prescribed authors, and discussions. Primarily for graduates.] Not given in 1920-1921.

35. **Modern British Idealism.** First term, credit two hours. Professor ALBEE. T Th, 12, Goldwin Smith 220. The lectures will deal mainly with representative works of T. H. Green, Bradley, and Pringle-Pattison. Primarily for graduates.

37. **Seminary in Ethics.** Throughout the year, credit two hours a term. Professor THILLY. Th, 3-5, Goldwin Smith 220. The Fundamental Concepts of Ethics.

38. **Seminary in Ancient and Medieval Philosophy.** Throughout the year, credit two hours a term. Professor HAMMOND. M, 3-5, or hours to be arranged. Goldwin Smith 220.

The work in 1919-20 will be devoted to the reading and discussion of selected dialogues of Plato and the Politics of Aristotle in English translation.

40. **Seminary in Logic and Metaphysics.** T, 3-5, Goldwin Smith 231. Professor CREIGHTON and Dr. PAINE.

The subject for 1920-21 will be announced at the beginning of the year.

41. **Seminary in Aesthetics.** Historical Study of æsthetic theories. Throughout the year, credit two hours a term. Professor HAMMOND. Hours to be arranged. Open to seniors by permission.

PHYSICAL EDUCATION

These courses are especially designed for the training of teachers and supervisors of physical education, although open to students who are preparing themselves as teachers of other subjects and who desire to supplement that preparation. Previous courses in chemistry, physics, biology, physiology, anatomy, psychology, and education are recommended.

20a. Principles of Physical Education. For juniors and seniors. First term, credit three hours. Lectures T Th, 8, Goldwin Smith 236. Three to five hours of practice at hours to be arranged. Professor YOUNG and Miss BÖCHER.

History and literature of physical training, laying emphasis upon distinguishing characteristics of various peoples, as to habits of living and forms of physical activity and the part these have played in their national development. Special attention will be given to its progress in Europe and America during the past century. The practice work of courses 20a and 20b will consist of lower grade methods (gymnastic stories, rhythm, singing games, marching, and free hand work), and assigned hours of teaching in outside schools.

20b. Principles of Physical Education. For juniors and seniors. Second term, credit three hours. Lectures T Th, 8, Goldwin Smith 236. Three to five hours of practice at hours to be arranged. Professor YOUNG and Miss BÖCHER.

Theory of play, its social and educational value, the development of the playground and recreation movement; also the organization and administration of recreative centers and of athletics in schools and colleges.

21. Hygiene. For juniors and seniors. First term, credit two hours. Professor YOUNG and Dr. CHENOWETH. T Th, 12, Stimson Hall.

Sanitary aspects of school and house environment, methods and scope of health instruction and supervision, and also phases of general sanitary science met with in industrial and recreation centers.

22. Physical Inspection. For juniors and seniors. Second term, two hours. T Th, 12, Stimson Hall. Professor YOUNG and Dr. CHENOWETH.

Study of the normal so as to recognize the defects and deformities most commonly met with, and to enable teachers to understand something of the nature, causes, and symptoms of the more common diseases; also to apply first-aid measures in cases of emergency.

23a. Principles of Physical Education. For seniors. First term, three hours. Lectures M W, 8, Goldwin Smith 236. Three to five hours of practice work at hours to be arranged. Professor YOUNG and Miss BÖCHER.

Physiology of exercise, kinesiology, and prescription of exercises with their application to defects of posture, development, nutrition, circulation, and nervous system. The practice work in courses 23a and 23b will consist of upper grade and high school methods (marching and tactics, heavy and light apparatus, folk and asthetic dancing, and games) and assigned work in the gymnasium and on the athletic field.

A considerable amount of time during the year will be devoted to practice teaching in outside schools.

23b. Principles of Physical Education. For seniors. Second term, three hours. Lectures M W, 8, Goldwin Smith 236. Three to five hours of practice work at hours to be assigned. Professor YOUNG.

A study of the physical basis of education and the normal growth rates in children and adolescents and the various factors by which these are affected. History and uses of anthropometry, with tests and measurements in common use.

Special attention is called to the courses in anatomy.

PHYSICS

Students expecting to elect Physics for their upperclass group are advised to complete Mathematics 7 or its equivalent before the beginning of their junior year.

Students desiring to follow Physics as a profession either in education or in research or testing laboratories may consult with the Department concerning the opportunities in these fields. The members of the department will be glad to advise such students regarding the courses best suited to their needs. A circular outlining a four-year undergraduate course in Physics may be obtained upon application at the department office.

Examinations for those who were unavoidably absent from either term examination in courses 2 to 7 and for those who have conditions to make up will be held on Monday, September 27, 1920, at 9 a. m. in Rockefeller A. Similar examinations in connection with courses 8 to 14 will be held in Rockefeller A at 2 p. m. on the same day. Students expecting to take any of these examinations should notify the department not later than September 20, 1920.

Entrance Physics is not accepted as an equivalent of any of the courses offered by the department.

***2. Introductory Experimental Physics.** Primarily for students in engineering and chemistry. Repeated in second term, credit five hours. Three lectures, one classroom and one two-hour laboratory period a week. Technical students should not take this course earlier than the term in which they begin the study of analytic geometry. Lectures T Th S, 9, or T Th S, 11, Rockefeller A. Professors MERRITT, SHEARER, and GIBBS. Classroom and laboratory work, hours to be arranged. Assistant Professor HOWE and Messrs. COLLINS, CURTISS, JENNESS, JONES, KENNEDY, LING, MOON, NORTHROP, PIERCE, RICHMOND, SCOTT, SHERMAN, STACY, TYNDALL, and WILBER, and Mrs. HYATT.

***3. Introductory Experimental Physics.** Primarily for students in Arts and Sciences. Repeated in the second term, credit six hours. Three lectures, two recitations, one two-hour laboratory period a week. Lectures T Th S, 9, or T Th S, 11, Rockefeller A. Professors MERRITT, SHEARER, and GIBBS. Classroom and laboratory work, hours to be arranged. Instructing staff same as in Physics 2.

4a. General Physics. Primarily for students in Arts and Sciences. Classroom work covering heat, magnetism, and electricity. First term, credit three hours. Prerequisite, course 2 or 3 or the equivalent. Professor GIBBS. M W F, 8.

4b. General Physics. Primarily for students in Arts and Sciences. Classroom work covering properties of matter, sound, and light. Second term, credit three hours. Prerequisite, course 2 or 3 or the equivalent. Professor GIBBS. M W F, 8.

Physics 4a and 4b are designed to meet the needs of students who desire a somewhat detailed survey of the fundamentals of physics. Course 4a may be taken either before or after 4b.

***7. General Physics.** Recitations and problem work, primarily for students in engineering. Repeated in the second term, credit three hours. Prerequisite, course 2. Hours as assigned, Rockefeller. First term, Mr. BAYLEY, Second term, Assistant Professor MURDOCK and Messrs. BAYLEY, HYATT, ———, ———, and ———.

8c. Heat and Light. Theory and problems. Required of candidates for B.Chem. First term, credit two hours. Prerequisite, course 2 and Mathematics 7 (1). Two classroom periods a week as arranged. Rockefeller as assigned. Assistant Professor BIDWELL and Mr. ———.

9c. Magnetism and Electricity. Theory and problems. Required of candidates for B.Chem. Second term, credit two hours. Prerequisite, courses 2, 8c, and 14 (2 hours) and Mathematics 7 (2). Two additional hours of Physics 14 must be taken with 9c. Two classroom periods a week as arranged. Rockefeller as assigned. Assistant Professor BIDWELL and Mr. ———.

10. Introductory Physical Experiments. Either term, credit three hours. Prerequisite, course 2 or the equivalent. A knowledge of trigonometry is desirable. Two laboratory periods a week, two and one-half hours each, with reports. Rockefeller —. Professor RICHTMYER and Mr. CURTISS.

*May not be counted for upperclass group.

Fundamental experiments covering properties of matter, heat, light, sound, magnetism, and electricity. Primarily intended for students in the College of Arts and Sciences who wish a general knowledge of experimental physics.

11a. Electricity. Theory and problems. Required of candidates for M.E. and E.E. First term, credit two hours. Prerequisite, course 3 and Mathematics 6 (2). Two classroom periods a week as arranged. Rockefeller as assigned. Assistant Professor BIDWELL, and Messrs. GRANTHAM, BECKER, CHAO, HYATT, MOTT-SMITH, and RICHMOND.

11b. Heat and Light. Theory and problems. Required of candidates for M.E. and E.E. Second term, credit two hours. Prerequisite, course 3 and Mathematics 6 (2). Two classroom periods a week as arranged. Rockefeller as assigned. Assistant Professor BIDWELL, and Messrs. GRANTHAM, BECKER, CHAO, HYATT, MOTT-SMITH and RICHMOND.

12. Physical Measurements. Primarily for students in Arts and Sciences. Either term or throughout the year, credit one to four hours a term. One or two, two and one-half-hour laboratory periods. Prerequisite, the calculus and at least six hours of physics taken from the preceding courses, or five hours of Physics if course 4 be taken simultaneously. Hours to be arranged. Rockefeller. Professor RICHTMYER and Mr. CURTISS.

Quantitative laboratory work in mechanics, heat, light, sound, electricity, and magnetism, with special reference to methods of measurement, sources of error and their elimination, the adjustment and use of instruments of precision, graphical methods of interpreting results. A limited number of experiments more or less qualitative are also included, dealing with such physical phenomena as gyroscopic action, electrical waves, photo-electricity, radio activity, various spectra, etc.

14. Physical Measurements. Required of candidates for B. Chem., C.E., M.E., and E.E. Either term or throughout the year, credit two or four hours a term. Prerequisite, analytic geometry and the calculus, and at least seven hours of physics taken from preceding courses or course 3, if course 11(a) or 11(b) be taken simultaneously. Professor BLAKER and Messrs. HYATT, BECKER, CHAO, R. J. KENNEDY, H. T. KENNEDY, KITTREDGE, LEWIS, METZGER, MOTT-SMITH, PADDON, PURDY, and RICHMOND. Nine sections as assigned. Rockefeller 250.

Physical measurements in properties of matter, mechanics, heat, light, sound, magnetism and electricity; the adjustment and use of instruments of precision. Results and errors are carefully discussed.

18. Theory and Practice of Photography. Repeated in second term, credit two hours. Prerequisite, course 2 and Chemistry 1 or their equivalent. Professor RICHTMYER and Dr. RODGERS. Lecture M 12, and one three-hour laboratory period weekly, as arranged. Lecture, Rockefeller B. Laboratory, Rockefeller 332.

A study of the fundamental principles of photography including the making of lantern slides, the use of various kinds of dry plates and papers, the after treatment of negatives and bromide enlarging.

An extra hour may be elected by those students interested in special photographic problems that are related to physics, botany, floriculture, forestry, entomology, etc.

19. Scientific Photography. With special reference to its applications to problems of research. Repeated in the second term, credit one to four hours. Prerequisite, courses 12 or 14 and 18, and Chemistry 1. Hours to be arranged. Professor RICHTMYER and Dr. RODGERS.

A study of special problems in scientific photography; the use of various plates and ray filters; speed of plates and papers; photographic microscopy with and without polarized light; the photographic study of various spectra, etc.

[20. Heat. Second term, credit four hours. Prerequisite, courses 4a, 4b, and 12 (2 hours) and Mathematics 7 or their equivalent. Assistant Professor BIDWELL.] Not given in 1920-1921.

Physics 20 and 21 are given in alternate years.

21. Light. Second term, credit four hours. Prerequisite, courses 4b and 12 (2 hours) and Mathematics 7 or their equivalent. M W F S, 10. Rockefeller C. Assistant Professor HOWE.

Geometrical optics: thick lenses, compound lenses, optical instruments, stops. Wave theory of light; interference, diffraction, dispersion, polarization, double refraction.

[22a. Electricity and Magnetism. First term, credit five hours. Prerequisites courses 4a, 4b and 12 (4 hours), and Mathematics 7, or their equivalent. Professor BLAKER.] Not given in 1920-1921.

[22b. Electricity and Magnetism. Second term, credit two hours. Prerequisite, course 22a. Assistant Professor MURDOCK.] Not given in 1920-1921.

Physics 22, 23, and 24 are given in alternate years.

23. Properties of Matter and Mechanics. First term, credit five hours. Prerequisite, courses 4a, 4b and 12 (2 hours), and Mathematics 7, or their equivalent. Daily except Saturday, 10. Rockefeller C. Assistant Professor MURDOCK.

An introductory discussion of analytical mechanics; a study of terrestrial and universal gravitation, the elastic properties of isotropic media, surface tension, diffusion and viscosity; and a brief discussion of the mechanics of fluids.

24. Wave Motion and Sound. Second term, credit two hours. Prerequisite, course 23. T Th, 10. Rockefeller C. Assistant Professor MURDOCK.

The mechanics of vibratory motion and wave motion, waves in elastic media, electromagnetic waves and surface waves on fluids. The subject will be developed with special reference to sound.

25. Advanced Laboratory Practice. Either term or throughout the year, credit one to three hours a term. Prerequisite, course 12 (4 hours), or the equivalent. Hours to be arranged. Rockefeller 301. Assistant Professor MURDOCK and Mr. GRANTHAM.

Considerable time is spent on each of a small number of experiments selected to meet the requirements of the individual student. The course is intended for the following: Those wishing to take up special topics for detailed study, those taking courses 20 to 24 and desiring to supplement them in the laboratory, those preparing to do research work and wishing to develop their laboratory technique. Students planning to take this course throughout the year should elect course 26 in the first term.

26. Theory of Measurements. First term, credit two hours. Prerequisite, course 12 (4 hours), and Mathematics 7 or their equivalent. T Th, 8. Rockefeller C. Assistant Professor MURDOCK.

Theory of units, theory of errors, precision of results, methods of computation and the critical discussion of derived results.

[27. Photometry and Spectrophotometry. First term, credit three hours. One lecture and two laboratory periods a week. Prerequisite, courses 10 or 12 or the equivalent. Hours to be arranged. Professor RICHTMYER.

Photometrical methods and apparatus, spectrophotometry, physiological optics, with particular reference to general experimental methods in physics and chemistry.] Not given in 1920-1921.

28. Introduction to Modern Physical Theories. Primarily for seniors (or first year graduate students) specializing in Physics, but open to others who have had course 12 or 14, or the equivalent. Lectures and assigned reading. Second term, credit three hours. Hours to be arranged. Professor RICHTMYER.

A summary of the development and present inter-relations of such subjects as electro-magnetic theory, spectrum phenomena, electron theory, photo-electricity, X-rays, radio-activity, quantum theory, and the bearing of these on the structure of the atom and on other problems of modern physics.

29. High Temperature Measurements. Two laboratory periods and one lecture a week as arranged. Second term, credit three hours. Prerequisite, course 12 or 14. Assistant Professor BIDWELL. Rockefeller.

The calibration and use of thermo-junctions, resistance thermometers, radiation and optical pyrometers; the construction of arc and resistance furnaces for the laboratory; a study of properties of materials at high temperatures, with such original problems as time permits.

33. Alternating Currents. First term, credit two hours. Prerequisite, course 12 or 14. Professor BEDELL. T Th, 11. Rockefeller.

A study of the underlying principles of alternating electric currents; the development of graphical methods of analysis as a basis for testing and for the solution of practical problems.

34. Electrical Laboratory. Either term or throughout the year, credit as arranged. Prerequisite, course 12 or 14. Professor BEDELL and Mr. HOLMES. Daily 9-1. Rockefeller.

Testing of direct and alternating-current apparatus, and the investigation of special problems. The character of the work will be varied to meet individual needs.

36. Advanced Alternating Currents. Second term, credit two hours. Prerequisite, course 33. Professor BEDELL. Hours to be arranged. Rockefeller.

Discussion of the theory and measurement of alternating currents. A seminary for graduates only.

37. Theses in Applied Electricity. Second term, or throughout the year, credit two to eight hours a term. Prerequisite, course 12 or 14. Professor BEDELL. Hours to be arranged. Rockefeller.

38. Aerodynamics and the Mechanics of Flight. Second term, credit two hours. Prerequisite, Physics 14. Professor BEDELL.

A study of horizontal flight, climbing, gliding, propellers, airplane characteristics and conditions for stability are included.

[40. Electric Waves and Oscillations. Experimental lectures. Throughout the year, credit one hour a term. Professor MERRITT.] Not given in 1920-1921.

Physics 40 and 41 are given in alternate years.

40a. Electric Waves and Oscillations. Laboratory. Second term, credit one to four hours. Prerequisite, Physics 12 and 40, or their equivalent. Professor MERRITT. Laboratory accommodations limited.

41. Electrical Conduction in Gases. Experimental lectures. Throughout the year, credit one hour a term. F, 12. Rockefeller B. Professor MERRITT.

[42. Spectroscopy and Luminescence. Throughout the year, credit two hours a term. Prerequisite, course 21 or its equivalent. Professor GIBBS.] Not given in 1920-1921.

Physics 42 is given every other year.

43. X-Rays. Lectures and laboratory work for non-medical students. Properties, production, measurement and application of X-rays. Open to students who have had courses in general physics including laboratory work. First term, credit three hours. Hours to be arranged. Professor SHEARER.

44. X-Rays. Lectures and special laboratory. Primarily for students in medicine or biology. Prerequisite, courses in general physics including laboratory and a working knowledge of photography. Second term, credit two hours. Hours to be arranged. Professor SHEARER.

45. Advanced X-Rays. Laboratory and research in X-rays and allied phenomena, including the study of crystals, and such special problems as may be of interest. Professor SHEARER.

47. Radioactivity. Lectures and laboratory. Throughout the year, credit three hours a term. Hours to be arranged. Professor SHEARER.

50. Physics Seminary. Throughout the year, credit one hour a term. Hour to be arranged. Professor MERRITT.

50b. Junior Physics Seminary. Throughout the year, credit one hour a term. Hour to be arranged. Professor RICHTMYER.

A colloquium conducted by juniors and seniors specializing in physics, open to others who have had the necessary preparation.

[51. **Theoretical Physics.** Mechanics and thermodynamics. Throughout the year, credit four hours a term. Prerequisite, course 23 or its equivalent. Primarily for graduates. Assistant Professor KENNARD.] Not given in 1920-1921.

Physics 51 and 52 are given in alternate years.

52. **Theoretical Physics.** Electricity and magnetism. Throughout the year, credit four hours a term. Prerequisite, course 22a or its equivalent, unless course 52a is taken simultaneously. Primarily for graduates. M W F S, 8. Assistant Professor KENNARD.

52a. **Electricity and Magnetism.** A review of the experimental facts for graduates who are taking course 52 and have not had the equivalent of course 22a. Throughout the year, credit two hours a term. T Th, 8. Assistant Professor KENNARD.

[53. **Theoretical Physics.** Physical optics. Assistant Professor HOWE.] Not given in 1920-1921.

Physics 53 is given every other year.

54. **Thermodynamics.** Throughout the year, credit three hours. Prerequisite, Mathematics 7 or its equivalent. Mathematics 42 is advised, though not required, as a preliminary course. Hours to be arranged. Professor TREVOR.

55. **Kinetic Theory of Matter.** Lectures, readings, and problems, with special reference to gases. First term, credit two hours. Assistant Professor KENNARD.

56. **The Radiation Problem.** Critical review of the problem and its bearing upon equipartition, quantum theory, and electronic and atomic theories. Second term, credit two hours. Assistant Professor KENNARD.

PHYSIOLOGY AND BIOCHEMISTRY

*3. **Elementary Human Physiology.** Repeated in second term, credit three hours. First term, M W F, 10, Professor SIMPSON and assistants. Second term, section A, M W F, 10, Professor SIMPSON and assistants; section B, M W F, 12, Mr. BURLAGE. In registering for this course in the second term students are required to specify the section they desire to attend.

An introductory course for students of the biological sciences; also for students who expect to teach physiology in the secondary schools. The lectures will be fully illustrated by experiments, lantern slides, and diagrams.

6. **Laboratory Work in Physiology.** Repeated in second term, credit two or more hours. Professor SIMPSON, Mr. BURLAGE, Mr. LIDDELL, and assistants. Five hours a week, hours and days for the first term to be arranged; in second term, any hours T Th, between 10 a. m. and 5.30 p. m.

A beginning course in practical physiology. May be taken after or along with course 3.

7. **Seminary.** Second term, credit one hour. A seminary in physiology and biochemistry is held at which current literature is discussed, and at which the results of original investigations carried on by workers in the laboratories are presented for criticism. Students are required to attend these meetings and to take part in the discussions, and each student is expected to give a communication on at least one occasion during the term.

8. **Advanced Work and Research in Physiology.** Throughout the year. Professor SIMPSON and assistants. Daily, Stimson Hall, Advanced Laboratory. In connection with this course a weekly or fortnightly seminary is held.

9. **Hæmatology.** First term, credit two hours. Prerequisite, Human Physiology 3. Mr. BURLAGE. Lecture, S, 9. Laboratory S, 10-1 p. m., Stimson Hall. A course on general methods of blood examination.

*May not be counted for upperclass group.

14. Elementary Biochemistry. First term, credit three hours. Prerequisite, Chemistry 32 or the equivalent. Assistant Professor SUMNER and Mr. BODANSKY. Lectures, M W, 12; conferences, F, 12, Stimson Hall Ampitheatre.

Designed to impart an elementary knowledge of the substances met with in living, especially animal, tissues, and the chief facts of digestion, metabolism, and nutrition.

(Courses 14 and 14a will not be accepted for the requirements of biochemistry in the medical college. Chemistry students are advised to take course 18.)

14a. Laboratory Work in Biochemistry. First term, credit two hours. Open to those who are taking or have taken course 14. Assistant Professor SUMNER and Mr. BODANSKY. M W, 2-5.

16. Advanced Biochemistry Lectures. Throughout the year, credit one hour a term. Assistant Professor SUMNER and Mr. BODANSKY. S, 8.

17. Special Chapters in Biochemistry. First term, credit two hours. Assistant Professor SUMNER and Mr. BODANSKY. T Th, 12.

18. Biochemistry for Medical Students. Second term, credit two hours. Prerequisite, Chemistry 32 or its equivalent. F S, 9, Stimson Hall Ampitheatre. Assistant Professor SUMNER and Mr. BODANSKY.

18a. Laboratory Work in Biochemistry. Second term, credit three hours. Prerequisite, Chemistry 32. F, 10-1, 2-5, and S, 10-1. Assistant Professor SUMNER and Mr. BODANSKY.

Courses 18 and 18a comprise lectures and experimental work on fats, carbohydrates, proteins, colloids, digestion, and metabolism. The concluding part of course 18a is devoted to modern methods of quantitative urine analysis.

20. Advanced and Research Work in Chemistry. Throughout the year. Assistant Professor SUMNER. Daily 8-6.

Note—If a sufficient number of students desire a general course in biochemical preparation methods this will be given second term. M W, 2-5. Assistant Professor SUMNER and Mr. BODANSKY.

PSYCHOLOGY

***1. Elementary Psychology.** First term, credit three hours. Professor TITCHENER, Professor WELD, Dr. HOISINGTON, Mr. DIMMICK, and Mr. BISHOP. Lectures, T Th, 11, Goldwin Smith C; class-room work, S, 10, or 11.

Not open to juniors or seniors. Primarily for sophomores in the College of Arts and Sciences.

***1a. Elementary Psychology.** First term, credit three hours. Dr. DALLENBACH and Mr. DIMMICK. Lectures, M W, 12, Goldwin Smith C; class-room work, F, 10, 11, or 12. Open to sophomores, juniors, and seniors.

***1b. Elementary Psychology.** Second term, credit three hours. Dr. HOISINGTON, and Mr. BISHOP. Lectures, M W, 12, Goldwin Smith C; class-room work, F, 10, 11, or 12. Open to sophomores, juniors, and seniors.

2. General Psychology. Problems and Points of View. Second term, credit three hours. Prerequisite, course 1, 1a, or 1b. Professor WELD. Lectures, T Th, 11, Goldwin Smith C; class-room work, S, 10, 11, or 12.

3. Experimental Psychology: Qualitative. Repeated in second term, credit three hours. Prerequisite, course 1, 1a, or 1b. Professor WELD, Dr. DALLENBACH, Dr. HOISINGTON, Mr. BISHOP, and Mr. DIMMICK. M W F, 2-4, Morrill, Psychological Laboratory.

4. Experimental Psychology: Quantitative. Repeated in second term, credit three hours. Prerequisite, courses 1, 1a, or 1b, and 3. Professor WELD, Dr. DALLENBACH, Dr. HOISINGTON, Mr. BISHOP, and Mr. DIMMICK. M W F, 2-4, Morrill, Psychological Laboratory.

*May not be counted for upperclass group.

[5. **Systematic Psychology: Sensation, Image.** First term, credit three hours.] Not given in 1920-1921.

5a. **Systematic Psychology: Perception, Idea.** First term, credit three hours. Prerequisite, course 3, or by special permission course 2. Professor WELD and Mr. BISHOP. Lectures M W F, 9, Morrill 42.

[6. **Systematic Psychology: Feeling, Attention, Action.** Second term, credit three hours.] Not given in 1920-1921.

6a. **Systematic Psychology: Memory, Imagination and Thought; Emotion and Volition.** Second term, credit three hours. Prerequisite, course 3, or by special permission course 2. Dr. DALLENBACH and Dr. HOISINGTON. Lectures, M W F, 9, Morrill 42.

7. **Reading of German Psychology.** First term, credit one hour. Professor WELD. Hour to be arranged. Morrill 46.

8. **Reading of French Psychology.** Second term, credit one hour. Professor WELD. Hour to be arranged. Morrill 46.

9. **Psychological Problems.** Throughout the year, credit one to five hours a term. Prerequisite, course 4. Professor WELD, Dr. DALLENBACH and Dr. HOISINGTON. Morrill, Psychological Laboratory.

(For particulars of graduate work see the Announcement of the Graduate School.)

PUBLIC SPEAKING

1. **Public Speaking.** Throughout the year, credit three hours a term.

Sec. 1, M W F, 8, Goldwin Smith 21. Assistant Professor HUNT and Mr. UTTERBACK.

Sec. 2, M W F, 9, Goldwin Smith 21. Professor WINANS and Mr. WICHELS.

Sec. 3, M W F, 10, Goldwin Smith 21. Assistant Professor HUNT and Mr. WICHELS.

Sec. 4, M W F, 12, Goldwin Smith 21. Assistant Professor MUCHMORE and Mr. CAPLAN.

Sec. 5, T Th S, 10, Goldwin Smith 21. Mr. CAPLAN.

Designed to give the student the fundamentals of speech preparation and to help him acquire a simple, direct manner of speaking. Individual instruction by appointment.

The '86 Memorial Prize in declamation is awarded annually in connection with this course. (See pamphlet on prizes.)

1a. **Public Speaking.** Second term, credit three hours

Sec. 1, T Th S, 8, Goldwin Smith 21. Mr. WICHELS.

Sec. 2, T Th S, 9, Goldwin Smith 21. Mr. UTTERBACK.

Sec. 3, M W F, 11, Goldwin Smith 21. Mr. CAPLAN.

This course repeats the work of the first term in course 1.

*8. **Voice Training.** Repeated in second term, credit one hour. Assistant Professor MUCHMORE. M W F, 10, Goldwin Smith 26.

An elementary course for the improvement of untrained voices, and for the development of flexibility, strength, and purity of tone. The work will necessarily include exercises to give poise and freedom to the body. Recommended to all students in this department, but equally adapted to those who wish only to use their voices better in conversation. Individual instruction by appointment.

8a. **Voice Training.** Second term, credit one hour. Prerequisite, course 8 and consent of instructor. Assistant Professor MUCHMORE. Hours to be arranged. Goldwin Smith 26.

Practice and discussions of assigned readings relating to the science underlying voice training. Especially for teachers.

10. **Oral Reading.** Throughout the year, credit two hours a term. Assistant Professor MUCHMORE. T Th, 11, Goldwin Smith 21.

*May not be counted for upperclass group.

Reading based on interpretative study of prose, poetry, and drama of assured literary value. The aim of the course is simple, intelligent, and expressive reading, and the literary appreciation necessary to such reading.

12. Argument and Debate. Throughout the year, credit three hours a term. Prerequisite, course 1 or 1a. Assistant Professor HUNT. T Th S, 12, Goldwin Smith 21.

The aim is training in analysis, the use of authorities, the weighing of evidence, and fair-minded discussion.

15. Advanced Public Speaking. Throughout the year, credit three hours a term. Prerequisite, four hours in other courses of this department, including two hours of 1 or 1a, and the consent of the instructor. Professor WINANS. M W F, 12, Goldwin Smith 26.

Problems of interest and persuasion studied, speeches of various kinds prepared and delivered, notable speeches analyzed.

[16. Great Orations. First term, credit two hours. Prerequisite, course 1. Professor WINANS. Open to graduates and seniors.

A study based upon masterpieces of oratory considered with special reference to their occasions.] Not given in 1920-1921.

20. Seminary. Throughout the year, credit two hours a term. For graduates. Open to seniors by permission. Th, 4-6, Goldwin Smith 28.

For the study of special subjects in the history, literature, psychology, and pedagogy of public speech.

29. Oral Expression for Architects. First term, credit three hours.

(See Announcement of College of Architecture.)

ROMANCE LANGUAGES

FRENCH

***1. Elementary Course.** Repeated in the second term, credit six hours; for upperclassmen, four hours only. First term, three sections, daily 8, 9, 12; second term, three sections, daily 8, 9, 12. Goldwin Smith 283.

This course is equivalent to first year French and second year French of the entrance requirements (credit two units).

***1a. Elementary Course.** Throughout the year, credit three hours a term. M W F, 12, Goldwin Smith 124.

Not open to students in the College of Arts and Sciences. No credit is given for a single term.

***2. Intermediate Course.** First term, credit three hours. Prerequisite, first year French of the entrance requirements. T Th S, 10, Goldwin Smith 283.

This course is designed primarily for those who offer first year French for entrance.

***3. Advanced Course.** Repeated in the second term, credit five hours; for upperclassmen, four hours only. Prerequisite, course 1, 2 or second year entrance French. First term, three sections, daily except S, 9, 10, 12; second term, four sections, daily except S, 8, 9, 10, 12. Goldwin Smith 290.

***3a. Intermediate Course.** Throughout the year, credit three hours a term. Prerequisite, courses 1 and 2 or second year entrance French. T Th S, 12, Goldwin Smith 124.

Not open to students in the College of Arts and Sciences. No credit is given for a single term.

***4a. Advanced Translation.** Repeated in the second term, credit three hours. Prerequisite, course 3 or third year entrance French. M W F, 9, Goldwin Smith 264; M W F, 10, Goldwin Smith 124; M W F, 11, Goldwin Smith 283; T Th S, 10, Goldwin Smith 264.

*May not be counted for upperclass group.

This course is prerequisite for all the following courses in French, except 5, which may be profitably taken with it.

*4b. **Advanced Translation.** Repeated in the second term, credit three hours. Prerequisite course 4a. First term, three sections, M W F, 9, Goldwin Smith 124; M W F, 11, Goldwin Smith 277; T Th S, 10, Goldwin Smith 221; second term, four sections, M W F, 9, Goldwin Smith 124; M W F, 10, Goldwin Smith 283; M W F, 11, Goldwin Smith 277; T Th S, 10, Goldwin Smith 221.

*5a. **Elementary Composition.** Repeated in the second term, credit three hours. Prerequisite, course 3 or third year entrance French. First term, three sections, M W F, 10, Goldwin Smith 283; M W F, 2, Goldwin Smith 283; T Th S, 9, Goldwin Smith 183; second term, two sections, M W F, 9, Goldwin Smith 281; T Th S, 10, Goldwin Smith 283.

*5b. **Elementary Composition.** Repeated in the second term, credit three hours. Prerequisite, course 5a. First term, one section, M W F, 12, Goldwin Smith 256; second term, two sections, M W F, 10, Goldwin Smith 264; T Th S, 9, Goldwin Smith 183.

6. **History of French Literature.** Throughout the year, credit three hours a term. Prerequisite, course 4a or its equivalent. Professor MASON. M W F, 11, Goldwin Smith 290.

Lectures on French literature since the Middle Ages, with outside reading and reports.

[7. **Literature of the Seventeenth Century.** Throughout the year, credit three hours a term. Prerequisite, course 6. Professor GUERLAC.] Not given in 1920-1921.

[8. **Literature of the Eighteenth Century.** Throughout the year, credit three hours a term. Prerequisite, course 6. Professor GUERLAC.] Not given in 1920-1921.

[9. **Literature of the Nineteenth Century.** Throughout the year, credit three hours a term. Prerequisite, course 6. Professor MASON.] Not given in 1920-1921.

10. **Contemporary French Literature.** Throughout the year, credit three hours a term. Prerequisite, course 6. Professor MASON. M W F, 9, Goldwin Smith 120.

14a. **Intermediate Composition.** Repeated in the second term, credit three hours. Prerequisite, course 5b. Assistant Professor PUMPELLY. First term, two sections, M W F, 9, Goldwin Smith 183; M W F, 12, Goldwin Smith 264; second term, two sections, M W F, 12, Goldwin Smith 264; T Th S, 9, Goldwin Smith 264.

14b. **Intermediate Composition.** Repeated in the second term, credit three hours. Prerequisite, course 14a. Assistant Professor PUMPELLY. First term, one section, M W F, 10, Goldwin Smith 277; second term, two sections, M W F, 9, Goldwin Smith 177; M W F, 12, Goldwin Smith 256.

16. **French Phonetics.** Second term, credit two hours. Prerequisite, course 5. Professor MASON. T Th, 10, Goldwin Smith 227.

18. **Intermediate Composition.** Second term, credit three hours. Prerequisite, course 14b. Assistant Professor PUMPELLY. M W F, 10, Goldwin Smith 221.

20. **Advanced Composition.** Throughout the year, credit three hours a term. Prerequisite, course 14. Professor GUERLAC. M W F, 10, Goldwin Smith 242.

[21. **Prose of the Sixteenth Century.** Second term, credit three hours. Prerequisite, course 6. Professor MASON.] Not given in 1920-1921.

22. **Poetry of the Sixteenth Century.** Second term, credit one hour. Prerequisite, course 6. Professor MASON. Th, 9, Library, French Seminary Room.

*May not be counted for upperclass group.

23. **French Philology.** Throughout the year, credit three hours a term. Prerequisite, four units of entrance Latin. Assistant Professor PUMPELLY. T 10, Th 2.30-4.30, Goldwin Smith 234.

24. **Voltaire and His Time.** Throughout the year, credit three hours a term. M W F, 11, Seminary Room. Open to seniors and graduates. Professor GUERLAC.

Study of Voltaire as the center of the literary life of the eighteenth century.

26. **Old French Texts.** Throughout the year, credit two hours a term. Prerequisite, course 23 or its equivalent. ———. Th, 2.30-4.30.

27. **Modern French Seminary.** Throughout the year, credit two hours a term. Professor MASON. T, 2.30, Library, French Seminary Room. Primarily for graduates.

[28. **French Criticism.** Throughout the year, credit one hour a term. Professor MASON.] Not given in 1920-1921.

[30. **The Teaching of French.** Second term, credit two hours. Open to seniors and graduates. Professor MASON.] Not given in 1920-1921.

35. **Lectures in French.** Second term. Credit two hours. Professor GUERLAC. T Th, 11, Goldwin Smith 283.

France of to-day. Lectures, readings, and reports on France as a country and as a nation.

ITALIAN

*1. **Elementary Course.** Throughout the year, credit three hours a term. Professor HAMILTON. T Th S, 9, Goldwin Smith 242.

Grammar, composition, translation of modern prose and poetry. This course may not be taken in the same year as Spanish 1. The course is continuous throughout the year, and no credit will be allowed for the first term alone.

2. **Italian Poetry: Dante, Leopardi, Carducci.** Throughout the year, credit three hours a term. Prerequisite, course 1, or second year Italian of the entrance requirements. Professor HAMILTON. T Th S, 11, Goldwin Smith 290.

3. **Petrarch and the Renaissance.** Throughout the year, credit two hours a term. Prerequisite, course 2. Professor HAMILTON. Hours to be arranged. Primarily for graduates.

[5. **Old Italian.** Throughout the year, credit two hours a term. Professor HAMILTON.] Not given in 1920-1921.

ROMANCE PHILOLOGY

[1. **Low Latin.** Second term, credit two hours. Professor HAMILTON. Hours to be arranged. The development of Low Latin and its relation to the Romance languages. Primarily for graduates.] Not given in 1920-21.

2. **Old Provençal.** First term, credit two hours. Professor HAMILTON. Hours to be arranged.

[5. **Romance Phonetics.** First term, credit three hours. Professor KENISTON. T Th S, 10.] Not given in 1920-21.

The mechanics of speech; a study of the organs of speech and the principal sounds produced by them in Latin and the modern languages. Special attention will be devoted to the Romance languages.

SPANISH

*1. **Elementary Course.** Repeated in second term, credit six hours; for upperclassmen, four hours only. First term, three sections daily 8, 9, 12; second term, two sections, daily 8, 12. Goldwin Smith 277.

*1a. **Elementary Course.** For students in Engineering and Agriculture. Throughout the year, credit three hours a term. M W F, 12, Goldwin Smith 281.

*May not be counted for upperclass group.

Not open to students in Arts and Sciences; continuous throughout the year and no credit for the first term alone.

***2. Intermediate Course.** First term, credit three hours. T Th S, 11, Goldwin Smith 277.

For students entering with one unit of credit in Spanish.

***3. Advanced Course.** Repeated in second term, credit five hours; for upper-classmen, four hours only. Prerequisite, course 1, 1a, 2 or second-year entrance Spanish. First term, two sections, daily exc. S, 9, 10, Goldwin Smith 281; second term, two sections, daily exc. S, 9, 12, Goldwin Smith 221.

***4a. Advanced Translation.** Repeated in second term, credit three hours. Prerequisite, course 3 or third-year entrance Spanish. First term, two sections, M W F, 8, T Th S, 12; second term, two sections, T Th S, 9, T Th S, 10, Goldwin Smith 281.

***4b. Advanced Translation.** Repeated in second term, credit three hours. Prerequisite, course 4a. First term, one section, M W F, 10, Goldwin Smith 264; second term, two sections, M W F, 8, T Th S, 12, Goldwin Smith 281.

Courses 4a and 4b are prerequisite for all the following courses in Spanish, except courses 5a and 5b, which may profitably be taken in connection with them.

***5a. Elementary Composition and Conversation.** Repeated in the second term, credit three hours. Prerequisite, course 3 or third-year entrance Spanish. First term, two sections, T Th S, 9, Goldwin Smith 177; T Th S, 10, Goldwin Smith 277; Second term, M W F, 9, M W F, 10, Goldwin Smith 277.

***5b. Elementary Composition and Conversation.** Repeated in second term, credit three hours. Prerequisite, course 5a. First term, one section, T Th S, 11, Goldwin Smith 281; second term, two sections, T Th S, 9, T Th S, 10, Goldwin Smith 277.

7a. Intermediate Composition and Conversation. Repeated in second term, credit three hours. Prerequisite, course 5. Sr. ZAPATA Y TORRES. First term, T Th S, 12, Goldwin Smith 190; second term, T Th S, 11, Goldwin Smith 277.

7b. Intermediate Composition and Conversation. Second term, credit three hours. Prerequisite, course 7a. Sr. ZAPATA Y TORRES. T Th S, 12, Goldwin Smith 264.

9. Advanced Composition and Conversation. Throughout the year, credit three hours a term. Prerequisite, course 7. Sr. ———. M W F, 11, Goldwin Smith 281.

Courses 7a, 7b, and 9 are conducted in Spanish.

10. History of Spanish Literature. Throughout the year, credit three hours a term. Prerequisite, course 4b. Professor KENISTON. T Th S, 11, Goldwin Smith 283.

Lectures, outside reading, reports, and discussions.

19. Literature of the Nineteenth Century. First term, credit three hours. Prerequisite, course 4b. Sr. ———. M W F, 10, Goldwin Smith 221.

Lectures, outside reading, reports. The course will be conducted in Spanish.

20. Contemporary Spanish Literature. Second term, credit three hours. Sr. PÉREZ DE AYALA. M W F, 10, Goldwin Smith 281.

Lectures, outside reading, reports. The course will be conducted in Spanish.

***25. Modern Spanish Civilization.** Second term, credit two hours. Sr. PÉREZ DE AYALA. W F, 12, Goldwin Smith 225.

Lectures in English and outside reading on the various aspects, social, politica and artistic, of modern Spanish life. This course does not require a reading knowledge of Spanish.

29. Spanish-American Literature. First term, credit three hours. Prerequisite, course 10 or 19. Professor KENISTON. T Th S, 10, Goldwin Smith 227.

A study of the main literary movements of Spanish America.

*May not be counted for upperclass group.

30. **The Teaching of Spanish.** Second term, credit three hours. Professor KENISTON. T Th S, 10, Goldwin Smith 242.

For students intending to teach Spanish. Course 30 is offered in alternate years.

Primarily for Graduates

[41. **Old Spanish.** Throughout the year, credit three hours a term. The phonology and morphology of Spanish; reading of selected Old Spanish texts.] Not given in 1920-1921.

43. **Seminary.** Throughout the year, credit two hours a term. Professor KENISTON. W, 2-4, French Seminary Room.

Materials and methods of research in the field of Spanish literature. The subject for 1920-1921 will be: Literary Criticism in the Golden Age.

SCANDINAVIAN LANGUAGES AND LITERATURES

1. **Old Icelandic.** Throughout the year, credit two hours a term. Assistant Professor HERMANNSSON. T Th, 11, Goldwin Smith 177.

Grammar; reading of selected sagas, Eddic and skaldic poems. For advanced students and graduates.

2. **Danish (and Dano-Norwegian).** Throughout the year, credit two hours a term. Assistant Professor HERMANNSSON. M W, 11. Goldwin Smith 177.

Grammar; reading of works by modern Danish and Norwegian authors (Holberg, Björnson, Ibsen, and others).

[3. **Swedish.** Throughout the year, credit two hours a term. Assistant Professor HERMANNSSON.

Grammar; reading of works by modern Swedish authors.] Not given in 1920-1921.

[4. **Old Norse Mythology.** First term, credit one hour. Assistant Professor HERMANNSSON.] Not given in 1920-1921.

5. **Old Norse-Icelandic Literature.** First term, credit two hours. Assistant Professor HERMANNSSON. W F, 12. Goldwin Smith 177.

Lectures on Old Norse-Icelandic literature (the Skalds, Eddas, and sagas), with a survey of Danish and Swedish literatures down to the beginning of the sixteenth century.

6. **Modern Scandinavian Literatures.** Second term, credit two hours. Assistant Professor HERMANNSSON. W F, 12. Goldwin Smith 177.

Lectures on Scandinavian literatures since the sixteenth century.

[7. **Scandinavian History.** Throughout the year, credit two hours a term. Assistant Professor HERMANNSSON.

Lectures on social and political conditions in the Scandinavian countries from the earliest times down to the present day.] Not given in 1920-1921.

SEMITIC LANGUAGES AND LITERATURES

1a. **Hebrew.** Throughout the year, credit three hours a term. Professor SCHMIDT. M T Th, 2, Goldwin Smith 127.

Open only to juniors, seniors, and graduates.

1b. **Advanced Hebrew.** Throughout the year, credit two hours a term. Prerequisite, course 1a. Professor SCHMIDT. T Th, 8, Goldwin Smith 127.

The Book of Jeremiah, and Hebrew meter.

2a. **Arabic.** Throughout the year, credit two hours a term. Professor SCHMIDT. T Th, 9, Goldwin Smith 127.

Open only to juniors, seniors, and graduates.

2b. **Advanced Arabic.** Throughout the year, credit two hours a term. Prerequisite course 2a. Professor SCHMIDT. W F, 2, Goldwin Smith 127.

Meccan suras, and Prolegomena of Ibn Khaldun.

3. **Ethiopic.** Throughout the year, credit two hours a term. Prerequisite, courses 1a, 2a. Professor SCHMIDT. T Th, 3, Goldwin Smith 127. Primarily for graduates.
- 4a. **Assyrian.** Throughout the year, credit two hours a term. Prerequisite, courses 1a, 2a. Professor SCHMIDT. T Th, 4, Goldwin Smith 127.
- 4b. **Aramaic.** Throughout the year, credit two hours a term. Prerequisite, course 1a. Professor SCHMIDT. T Th, 5, Goldwin Smith 127. Inscriptions, Daniel ii-vii, and the Elephantine Papyri.
- 5a. **Egyptian.** Throughout the year, credit two hours a term. Prerequisite, courses 1a, 2a. Professor SCHMIDT. W, 4-6, Goldwin Smith 127. Hieroglyphic texts. Primarily for graduates.
- 5b. **Coptic.** Throughout the year, credit two hours a term. Prerequisite, course 5a. Professor SCHMIDT. F, 4-6, Goldwin Smith 127. Selections from the Gospels and from Pistis Sophia. Primarily for graduates.
6. **Biblical Literature.** Throughout the year, credit two hours a term. Professor SCHMIDT. M W, 3, Goldwin Smith 120. General introduction to the Bible. Open to juniors, seniors, and graduates. No knowledge is required of Semitic languages or of Greek.
7. **Semitic Seminary.** Throughout the year, credit two hours a term. Prerequisite, courses 1a, 4b. Professor SCHMIDT. M, 4-6, Goldwin Smith 127. The Psalms and Odes of Solomon in the Syriac, and the Zadokite document.
8. **Comparative Semitic Philology.** Throughout the year, credit one hour a term. Professor SCHMIDT. F, 3, Goldwin Smith 127. For graduates only.
- 9b. **Oriental History.** Throughout the year, credit two hours a term. Professor SCHMIDT. T Th, 10, Goldwin Smith 256. A general survey of the history of Africa. Open to juniors, seniors, and graduates.

ZOOLOGY

- *1. **General Zoology.** Throughout the year, credit three hours a term. Professors REED, and YOUNG, Miss FISHER, Miss MEKEEL and Miss McMULLEN. Lectures, Goldwin Smith B, sec. 1, M W, 9; sec. 2, T Th, 11. Laboratory sections, McGraw 2, M T W Th F, 2-4.30, F S, 8-10.30. Laboratory fee, \$4.50 a term. A general survey of the animal phyla, the life processes, adaptations, reaction to environmental stimuli, the relationships of animals and the principles of zoology. Registration with the department before instruction begins is necessary for the assignment of laboratory and lecture sections.
- 1a. **Elements of Zoology.** Second term, credit three hours. Assistant Professor YOUNG. Lecture, Th, 10, McGraw 5. Laboratory, T Th, 2-4.30, McGraw 2b. For veterinary students only. An elementary study of the principles of zoology, mode of life and classification of animals, and the zoology of the domestic species. Laboratory fee, \$4.50.
2. **Morphology of Invertebrates.** Throughout the year, credit three hours a term. Hours to be arranged. Professor REED and ———. A thorough and detailed study of the morphology and development of invertebrate types based upon laboratory dissections, microscopical studies of parts, and observations upon living animals. Prerequisite, course 1. Laboratory fee, \$5.
3. **Comparative Anatomy of Vertebrates.** Throughout the year, credit three hours a term. Professor REED and Mr. GAMBLE. Laboratory, T Th, 2-4.30, S, 8-10.30. A thorough dissection and study of the several systems of organs with a representative of each class of vertebrates. Prerequisite, course 1 or 5. Laboratory fee, \$5 a term.
4. **Comparative Morphology and Phylogenesis of Vertebrates.** Throughout the year, credit two hours a term. Professor REED. Lectures, W F, 10, McGraw 5.] Given in alternate years. Not given in 1920-1921.

*May not be counted for upperclass group.

The various systems of organs are considered with reference to the significance of structure, and development in establishing homologies with observations upon the evolution of vertebrate types. Prerequisite, embryology (may accompany or precede), and one of the following: course 3, 12, or medical human anatomy.

5. Systematic Vertebrate Zoology and Ecology. Throughout the year, credit three hours a term. Assistant Professor WRIGHT. Lectures, M, 8, McGraw 7. Laboratory, sec. 1, M W, 2-4.30, McGraw 9; sec. 2, T Th, 2-4.30, McGraw.

6. Field Ornithology. Second term, credit three hours. Lecture, W, 11. McGraw 5. Field work and laboratory, T Th, 2-4.30, or W F, 2-4.30. Assistant Professor ALLEN and Mr. LEISTER.

This course is intended primarily for students wishing to gain a knowledge of local birds, their habits, songs, nests, and eggs, their relation to agriculture, and the general principles of their conservation. Field work will be supplemented by laboratory studies, and, after the first of May, field trips will be held at 5.30 a. m. Laboratory fee, \$2.

7. Ichthyology. Advanced Systematic and Field Zoology. Second term, credit three hours. Assistant Professor WRIGHT. Lectures, T Th, 9, McGraw 7. Laboratory, F, 2-4.30 or S, 8-10.30.

[**8. Herpetology.** Second term, credit three hours. Assistant Professor WRIGHT.] Not given in 1920-1921.

9. Advanced Ornithology. First term, credit three hours. Prerequisite, course 5 or 6. Lecture, W, 11, McGraw 5. Laboratory and field work, T Th, 2-4.30. Assistant Professor ALLEN and Mr. LEISTER.

A consideration of the birds of the world. The lectures will include the structure and classification of birds; geographical distribution; the literature and institutions of ornithology. Laboratory periods will be devoted to the identification of skins of native and exotic representatives of the different families of birds. The first part of the term will be devoted to field work on the fall migration, and the identification of birds in winter plumage. Laboratory fee, \$2.

10. Mammalogy. First term, credit three hours. Assistant Professor WRIGHT. Lectures, W F, 10, McGraw 7. Laboratory, F, 2-4.30, or S, 8-10.30.

[**11. Economic Ornithology and Mammalogy.** First term, credit three hours. Should be preceded by course 5 or 6; presupposes an elementary knowledge of botany and entomology. Assistant Professor ALLEN and Mr. LEISTER.] Not given in 1920-1921.

12. Comparative Mammalian Anatomy. Throughout the year, credit three hours a term. Mr. GAMBLE and Mr. ———. This course is designed to present the fundamentals of mammalian structure, to give practice in acquiring manipulative skill in dissection, and to lay the foundation for the phylogenetic history of the human body.

Laboratory fee, \$5 a term.

13. Special Problems and Research. Throughout the year, credit from one to more hours. For seniors and graduates only. Opportunity is given for the pursuits of special phases of zoological study, further than is permitted by the more elementary courses, and for investigation.

Permission necessary for registration.

14. Seminary in Systematic Vertebrate Zoology. Throughout the year, credit one hour a term. Zoogeography of the Old World. Assistant Professor WRIGHT. Hours to be arranged.

15. Department conference. Fortnightly throughout the year or at times to be announced. No credit. For the discussion of current literature and the presentation and criticism of original investigations. Required of major students in general zoology and animal morphology.

UNIVERSITY REQUIREMENTS FOR THE DEGREES A.B. AND B. CHEM.

HYGIENE AND PREVENTIVE MEDICINE

All freshmen and sophomores are required to take lectures in hygiene. These lectures will cover (a) General Hygiene, (b) Individual Hygiene, (c) Group Hygiene, (d) Intergroup Hygiene. The lectures will be given once a week at times and places to be announced.

MILITARY SCIENCE AND TACTICS

1. **Practical and Theoretical Training.** Throughout the year. Every able-bodied male student, a candidate for a baccalaureate degree, who is required to take five, six, seven, eight, or more terms in residence, must take in addition to the scholastic requirements for the degree, one, two, three, or four terms respectively in the Department of Military Science and Tactics. Three hours a week. Two hours on either T, W, or Th, 3.15-5.15 p. m. as student may elect; and F, 4.45-5.45 p. m. New York State Drill Hall.

The requirements in Military Science and Tactics must be completed in the first term of residence; otherwise the student will not be permitted to register again in the University without the consent of the University Faculty.

The course of training is that prescribed by the War Department as basic for units of the Reserve Officers Training Corps, and includes physical drill, infantry drill, field artillery drill, machine gun drill, rifle shooting, personal hygiene, first-aid, camp sanitation, signaling, bayonet combat, map reading, military history, construction of intrenchments and obstacles, and the fundamental principles of strategy and tactics to include the detachment and regiment.

2. **Elective Military Training.** Throughout the year, credit two hours a term. Hours by assignment. New York State Drill Hall.

This is the advanced course prescribed by the War Department for units of the Reserve Officers Training Corps, and includes three hours each week in the performance of the duty of officer or non-commissioned officer with organizations undergoing the training given under course 1, and two hours each week of theoretical instruction in preparation for such duties. Prerequisite, course 1 or its equivalent.

Course 2 may be elected only by permission of the Dean of the College of Arts and Sciences, and the Professor of Military Science and Tactics, but credit for this course may not be counted toward the ninety hours required in this college (see page ix). To enjoy the benefits offered by the Federal Government the student must agree to continue the course for four terms, and to attend two summer camps having a duration of about one month each.

PHYSICAL TRAINING FOR MEN

1. **For Freshmen Excused from Drill.** Throughout the year, three periods a week. Class and squad work and prescribed exercises. Mr. AUER and assistants.

2. **For Sophomores Excused from Drill.** Throughout the year, three periods a week. Class and squad work and prescribed exercises. Mr. AUER and assistants.

3. **For Juniors and Seniors.** Building up and corrective exercises as prescribed by the Medical Examiners as a result of the term's physical examination required of all students in the University. Mr. HUTCHINSON.

4. **Boxing and wrestling instruction** for a small fee, at hours to be arranged. Mr. GILVIN.

5. **Swimming instruction**, 4 to 6 p. m., daily except Monday and Saturday. Mr. ESCHWEILER.

PHYSICAL TRAINING FOR WOMEN

6. **For Freshmen.** Throughout the year, three periods a week. Miss CANFIELD, Miss BÖCHER, Miss NEELY, and Miss HARRISON.

7. **For Sophomores.** Throughout the year, three periods a week. Miss CANFIELD, Miss BÖCHER, Miss NEELY, and Miss HARRISON.

The work of the two years consists of outdoor games and exercises from the beginning of the year to Thanksgiving, and from the Easter vacation to the end of the year. From Thanksgiving to Easter the work is in large part indoors, and consists of floor exercises, folk and aesthetic dancing, and indoor games, in all of which certain prescribed tests must be met at the end of each period. For further information as to the required work in physical training, see the handbook issued by the Department.

8. **For Juniors and Seniors.** Building up and corrective exercises as prescribed by the Medical Examiners as a result of the term's physical examination required of all students in the University.