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# The Graduate School

# for 1933-34

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# THE GRADUATE SCHOOL

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1933–34

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THE SECRETARY OF THE FACULTY.
THE DEAN, *Chairman ex officio.*

## CALENDAR FOR THE GRADUATE SCHOOL FOR 1933–34

### FIRST TERM

| | | |
|---|---|---|
| 1933 | | |
| Sept. | 25 | Registration of new students. |
| Sept. | 26 | |
| Sept. | 26 | Registration of old students. |
| Sept. | 27 | |
| Sept. | 28 | Instruction begins. |
| Oct. | 12 | Last day for filing candidacy blanks in order to receive residence credit for the term. |
| Oct. | 20 | Last day for payment of tuition for the first term. |
| Dec. | 15 | Last day for announcing titles of theses by candidates for advanced degrees to be conferred in June. |
| 1934 | | |
| Jan. | 4 | Last day for making application for February, 1934, degrees. |
| Feb. | 7 | Last day for completing requirements for advanced degrees to be conferred in February. |

### SECOND TERM

| | | |
|---|---|---|
| Feb. | 9 | Registration. |
| Feb. | 10 | |
| Feb. | 12 | Instruction begins. |
| March | 5 | Last day for payment of tuition for the second term. |
| March | 15 | Last day for filing applications for fellowships and graduate scholarships. |
| May | 15 | Last day for making application for June, 1934, degrees. |
| June | 12 | Last day for completing requirements for advanced degrees to be conferred at Commencement. |
| June | 18 | Commencement. |

### SUMMER SESSION, 1934

| | | |
|---|---|---|
| July | 7 | Summer Session Registration. |
| August | 17 | Summer Session ends. |

# THE GRADUATE SCHOOL

## HISTORY AND ORGANIZATION

THE initiation of graduate studies at Cornell University was coincident with the establishment of the University; the first advanced degree was conferred at the second annual Commencement. Until 1896 there was no formal organization of graduate studies, which were intrusted to the direction of the University Faculty, although beginning with 1890 a standing Committee on Graduate Work of the University Faculty had general charge of Graduate study. In 1896 graduate work was definitely organized as a Graduate Department under the immediate charge of the University Faculty. In 1909, on the recommendation of that Faculty, the Board of Trustees established the Graduate School, to have exclusive jurisdiction over all graduate work and advanced degrees.

The Faculty of the Graduate School has exclusive jurisdiction over all graduate work and advanced degrees and consists of three groups: (1) an *ex-officio group*, including the President of the University who is the presiding officer; the Provost of the University, who in the absence of the President is the presiding officer; the Deans of the several Faculties of the University; and the Directors of the New York State Experiment Stations; (2) a variable academic group consisting of those professors, assistant professors, and instructors who, as members of special committees, are actively engaged in supervising the work of graduate students; (3) a permanent academic group including those members of the University Faculty who, during five consecutive years, have been members of group (2).

Professors, assistant professors, instructors who hold the Doctor's degree, and such other members of the teaching staff of the University as the Faculty may authorize, are eligible for membership on the Special Committees in charge of the work of graduate students.

For the convenient discussion of questions which chiefly concern those engaged in related fields of work, the members of the faculty of the Graduate School are divided into nine groups, as follows:

A. Languages and Literatures.

B. History, Political Science, Philosophy, Psychology, Agricultural Economics, Farm Management, Rural Sociology.

C. Mathematics, Astronomy, Physics, Chemistry, Geology, Physical Geography, Geodesy.

D. Biological Sciences.

E. Engineering, Architecture, Applied Physical Sciences, Rural Engineering, Landscape Design.

F. Science Departments of the Cornell University Medical College in New York City.

G. Agricultural Sciences.

H. Law.

I. Education.

The General Committee of the Graduate School consists of four members at large, elected by the Faculty; nine members elected, one by each group; the Secretary of the Faculty; and the Dean, who is *ex-officio* chairman of the General Committee.

For the more effective administration of graduate work leading to advanced professional degrees, the Faculty of the Graduate School is divided into Divisions as follows:

Division of Agriculture and Forestry for the degrees M.S. in Agr. and M.F.

Division of Architecture and Fine Arts for the degrees M.Arch., M.L.A., and M.F.A.

Division of Chemistry for the degree M.Chem.

Division of Education for the degrees A.M. in Ed. and M.S. in Ed.

Division of Engineering for the degrees M.M.E., M.C.E. and M.E.E.

Division of Law for the degrees J.S.D. and LL.M.

## THE PURPOSE OF GRADUATE STUDIES

It is the purpose of the Graduate School to offer facilities for advanced study and for research with the two-fold purpose (1) of providing a student with a comprehensive view of a field of knowledge and (2) of training him for individual investigation in that field. Candidates for the master's degree will normally give more emphasis to the first of these two purposes, although the importance of some first-hand contact with research should be emphasized. Candidates for the doctor's degree, after acquiring a broad view of a field of knowledge, will be expected to engage intensively in research in that field partly to cast new light on some phase of it, and partly to cultivate the power of expressing an independent and unprejudiced judgment.

In furnishing this opportunity for independent study and investigation, the Graduate School seeks to make the conditions such as will enable the student to devote himself wholly to his chosen field. Unhampered by restrictions that necessarily obtain in undergraduate work, he will come into freedom of association with older scholars, who will seek to make his work profitable to him by giving him such aid and directions as he may need. Inasmuch as subjects differ greatly, the requirements for all subjects cannot be stated in terms at once specific and uniform. In some departments of knowl-

edge original research may begin with the student's entrance into the School; in other subjects much preliminary work may be necessary to fit the student for profitable research.

*In carrying on studies in the Graduate School, the student is expected to assume the initiative and the responsibility.* It is important to recognize from the beginning that graduate work does not consist in the fulfillment of routine requirements, and that the various opportunities for study, as well as the advice and assistance of teachers, are to be regarded simply as aids to the student in acquiring for himself the discipline and method of independent scholarship.

All courses of study offered in the University, and all the facilities for study and investigation afforded by its libraries, museums, and laboratories are open to graduate students in so far as they are qualified to make use of such facilities.

## ADMISSION

To be admitted to the Graduate School of Cornell University, as a candidate for an advanced degree, (1) an applicant must have received a baccalaureate, or equivalent, degree from a college or university of recognized standing; and (2) as judged by his previous scholastic record, or otherwise, must show promise of ability satisfactorily to pursue advanced study and research.

## ADMISSION TO CANDIDACY FOR ADVANCED DEGREES

In order to undertake work leading to an advanced degree, the student must be admitted (1) to the Graduate School and (2) to candidacy for the desired degree. Applicants whose previous training is adequate for advanced work in a given field but who either do not wish to become candidates for an advanced degree or cannot meet the requirements for entrance to such candidacy, may arrange for a program of work as "non-candidates."

Graduation from any one of the colleges of Cornell University, or from any other institution in which the requirements for the first degree are substantially equivalent, is prerequisite to admission to the Graduate School. In other cases studies pursued after graduation, and experience gained by professional work or otherwise, are taken into consideration in deciding whether the candidate's preparation as a whole is such as to justify his admission to the Graduate School.

Correspondence regarding admission should be addressed to "The Graduate School, Cornell University, Ithaca, N. Y." In many cases students may find it desirable either before or after making formal application for admission, to correspond directly with one or more professors in the proposed field of work in order to secure

further information regarding facilities for advanced study and research, than is contained in this announcement. Application for admission must be made in duplicate on special forms obtainable on request, and must be filed in the office of the Graduate School in the preceding spring if possible, ordinarily not later than August 10 and January 20 for entrance to the first and second terms, respectively, and not later than June 25 for entrance to the summer session. It may be impossible to give consideration to applications received after these dates. The applicant must submit complete official transcripts of all previous collegiate studies.*

College graduates whose training is regarded as less than one term short of that required for the corresponding first degree at Cornell, may be admitted to the Graduate School, but not to candidacy for an advanced degree until the shortage shall have been removed. College graduates whose training is regarded as a term or more short of that required for the corresponding first degree at Cornell may not be admitted to the Graduate School until such shortage shall have been reduced to less than one term.

Seniors in the colleges of Cornell University who have completed all requirements for the Bachelor's degree except that of residence, may, with the approval of the deans of their respective colleges, be admitted to the Graduate School.

In order that a prospective student may be assured that his preparation is adequate for satisfactory graduate work in a particular field of study, he should, as soon as he has satisfied himself of his eligibility for admission to the Graduate School, confer by letter or otherwise with one or more professors in that field. A further reason for such early conference is that in some fields the available facilities and personnel set a limit to the number of students that can be accepted. It is imperative, for example, that applicants for work with major in Physics shall arrange in advance with some member or members of the physics department for such work.

In order to become a candidate for an advanced degree the student must select, within his chosen field of study, a branch thereof to which he intends to devote a larger part of his time and which is termed his Major Subject. In addition, candidates for the doctorate must select two other subjects, to be chosen with reference to the direct bearing upon the major subject. These are termed the Minor Subjects. Except as otherwise provided, a candidate for one of the master's degrees selects one such minor subject. Any group of subjects recognized as of graduate standing, which has a basic unity, is considered a proper field of study. As a general principle, however, when the Major Subject is selected from the applied sciences, it is desirable that the theoretical science

*In the case of graduates of Cornell University this is not necessary, since the records are conveniently accessible.

or sciences most directly involved should be chosen as Minor Subjects.

The student must next *select* one or more professors in each subject which he has chosen for major or for minor study to serve as members of his Special Committee; and he must secure their consent so to serve.

The subsequent work of the student is in charge of this Special Committee, a representative of his Major Subject being chairman. The student is expected to confer freely with the members of his Special Committee, both in regard to the general plan of his work and in connection with individual courses of study. A candidate for an advanced degree must present to the Dean, not later than two weeks after registration in the Graduate School, a statement of his Major and Minor Subjects approved by the members of his Special Committee.

Changes in the personnel of his Special Committee may be made by a graduate student with the approval of the continuing members. Any vacancy on a Special Committee, due to the absence of a member on leave from the University, is filled by the Dean on recommendation by the member on leave and with the consent of the student and the added member. Any graduate student who desires an examination in the summer must arrange for any necessary examining substitute on his Special Committee and file with the Dean before the first of June preceding the examination notice of such arrangement together with written approval both of the substitute and of all the members of the Special Committee.

Candidates for one of the advanced technical degrees, M.C.E., M.M.E., M.E.E., M.Chem., M.S. in Agr., M.F., M.Arch., LL.M., M.L.A., and M.F.A. must ordinarily have had training equivalent to that required for the corresponding first degree at Cornell University.

No student may be admitted to candidacy for any of the degrees M.A., M.A. in Ed., M.S., M.F., M.Arch., M.L.A., M.F.A., M.M.E., M.C.E., M.E.E., or Ph.D., whose training has not included work in a foreign language equivalent to three units of entrance in one language or two in each of two languages.

### Graduate Students not Candidates for Degrees

It is expected that ordinarily only such students shall be admitted to the Graduate School as have the qualifications as stated above, requisite to enter upon candidacy for advanced degrees. In special cases and for special reasons an applicant may be admitted to the Graduate School without becoming a candidate for an advanced degree. The work of such a "non-candidate" shall be in charge of one or more advisers selected by the student. Each non-

candidate shall present to the Dean not later than two weeks after registration a detailed statement of studies selected, approved by the adviser and by each of the several members of the faculty under whom the work is to be taken.

### Admission for Graduate Study in Law

One who meets the requirements for admission to the Cornell Law School, and who has received the degree of Bachelor of Laws or an equivalent degree from an approved law school, may be admitted to the Graduate School as a candidate for the degree Master of Laws (LL.M.), or the degree Doctor of the Science of Law (J.S.D.), by the vote of the Division of Law. Foreign students may be admitted as candidates for these degrees if, in the opinion of the Division of Law, they have had a training substantially equivalent to the requirements set forth in this paragraph.

Application for admission should contain a statement of the applicant's academic training, the means available to him for financing his graduate work, the objective for which he desires graduate work, and also the particular fields of study in which he is interested.

## REGISTRATION

The rules of the university provide that: "All students taking work in the graduate School and/or work leading to, or in contemplation of an advanced degree, shall at the beginning of each term or session, register both in the Graduate School and with the Registrar of the University."

Such registration shall be made on the regular registration days of each term, unless special permission for later registration has been granted by the Dean.

Graduate students who have completed requirements of residence for the degrees for which they are candidates, and who remain in residence working on their theses or toward or in contemplation of a degree must register each term in which they are thus engaged. Any student whose residence requirement has been met and who completes his thesis elsewhere must register for the term in which he presents himself for his degree.

## A CERTIFICATE OF VACCINATION REQUIRED BEFORE MATRICULATION

Every student matriculating in the University for graduate study, whether in the Summer Session or during the regular terms, is required to present to the Registrar a satisfactory certificate of vaccination against smallpox. This certificate is considered satisfactory

only if it certifies to a successful vaccination within the last five years or certifies that at least three unsuccessful attempts at vaccination have been made within that period.

## RESIDENCE

No student will be awarded any degree by Cornell University unless the student has spent at least one full academic year, or the equivalent, in residence and study at the University.

Residence credit toward an advanced degree is granted to regularly enrolled students only upon the satisfactory completion of a term or other period of work, attested by the members of the student's Special Committee.

### Credit for Work Done in Cornell University

Residence credit for work *in the University* may be acquired in four ways:

(1) By the satisfactory completion of a term or portion of a term of work during the regular sessions of the University.

(2) By the satisfactory completion of work done in the Summer Session of Cornell University, in the Summer School of Agriculture, or in the Summer School of Biology.

Residence credit for such summer work may be counted toward the Master's degrees on recommendation of the student's Special Committee, in partial fulfillment of the requirements for the degree of Doctor of Philosophy for which a maximum residence credit of one year may be acquired in summer sessions; one term of residence may be acquired by two summer sessions, and one year (or two terms) of residence by four summer sessions. All students pursuing graduate studies during one of the Summer Sessions are required to enroll both in the office of the Registrar of the University and in that of the Dean of the Graduate School before beginning work. Candidates for these degrees who are in residence during Summer Sessions only are required also to continue their studies during the year under the direction of the Chairman of the Special Committee in charge of their work. It should be noted that in some departments no graduate work is offered in the Summer Session. A statement of the graduate work offered will be found in the Announcements of the various Summer Sessions, which will be sent upon application to the Secretary of the University.

(3) By the satisfactory completion of a period of work during the summer under the personal direction of a member of the Faculty of the Graduate School.

The general library and many of the laboratories and special libraries of the University are open during this period, and certain members of the instructing staff who remain in residence during the summer are willing to assume responsibility for the supervision of the work of students who are qualified to carry on investigations. It is impossible to make any announcement in advance as to what opportunities for graduate work may be found at any definite time in a particular subject; but such information may be obtained by correspondence.

Residence credit towards an advanced degree for work carried on under personal direction during the summer will be granted only if the following conditions are complied with: (a) The student must ordinarily have already completed at least a full year of graduate work as a candidate for an advanced degree, either in this University or in some institution whose graduate work is acceptable. In all cases graduate students are required to register both in the office of the Registrar of the University and in that of the Dean of the Graduate School. No candidate for the Doctor's degree may receive credit for more than two terms of residence during any twelve consecutive months. (b) The student must present to the Dean of the Graduate School a statement from the member of the Faculty under whose direction the work is to be done, signifying his readiness to undertake such direction and also stating the number of weeks during which he will be prepared to supervise this work.

(4) By the satisfactory completion of graduate work in law done during the summer in accordance with the Rules of the Division of Law.

Upon petition, the Division of Law may grant a candidate permission to carry on specific graduate work in law during the summer and determine the residence credit to be granted therefor, but a student may not acquire more than one term's credit in the aggregate by summer attendance. It is not possible to make any announcement in advance as to what opportunities for graduate work may be found at any definite time in a particular subject, but such information may be obtained by correspondence. All students pursuing graduate studies in law during the summer are required to enroll both in the office of the Registrar of the University and in that of the Dean of the Graduate School before beginning work.

A graduate student who holds an appointment as instructor or as a teaching or research assistant in Cornell University may receive a maximum of three-fourths residence credit for graduate work carried on during the period of such appointment. On recommendation of his Special Committee, he may obtain full graduate residence for the year by carrying on his studies during the summer provided he devotes his whole time during this period to graduate study and does not hold a teaching appointment. An instructor or assistant who has completed at least one term of satisfactory graduate work at another university may, however, upon the recommendation of his Special Committee, satisfy the residence requirement for the master's degree by one academic year at Cornell.

No student may obtain more than two terms of residence in a calendar year.

## Credit for Work Done Elsewhere

For the Master's degree no credit may be obtained for work done elsewhere.

For the Doctor's degree residence credit for work done elsewhere may be granted in the following cases:

(1) Residence as a graduate student in another university may, on recommendation of the student's Special Committee, be accepted toward residence credit for the Doctor's degree at Cornell University in such amount as the Special Committee may determine. No general statement can be made regarding the conditions under which this permission will be granted; each case will be decided on its merits. The last year of required residence must be in regular sessions at Cornell University.

(2) There are certain cases in which, in order to give the work of the Graduate School the greatest possible breadth, it is desirable, from the point of view both of the student and of the University, to take advantage of opportunities for study and research not found in university centers.

The conditions under which a candidate for the degree of Doctor of Philosophy may be allowed residence toward his degree for time spent in study away from the University have been stated in the following form by the legislation of the Faculty: (a) Applicants for this privilege must be regularly registered in the Graduate School as candidates for the Doctorate, and while not in residence shall receive no compensation except from the University. (b) They shall have spent at least two terms in Cornell University in study towards the Doctor's degree. (c) Permission to count such time as residence may be given by the Dean of the Graduate School for a period not to exceed one term, when the application is unanimously approved by the members of the student's Special Committee. When a longer period of outside study is required, applications for an extension of time should be made to the General Committee, which may, at its discretion, extend the period to two terms. In no event, however, shall a student acquire a total of more than two terms' residence under these provisions. (d) A student who avails himself of this privilege shall continue to work under the general direction of his Special Committee. Whenever possible, however, the work should be carried on under the immediate supervision of a competent director, acting for the Special Committee and to be designated by that Committee. (e) Reports regarding the progress of the work shall be made as directed by the Special Committee at intervals not in excess of one month.

(3) Under conditions to be ascertained from the Dean, instructors in Cornell University who are also registered in the Graduate School may receive credit for work done without compensation during the summer months away from the University

Students, who because of work outside of their graduate studies obtain only partial credit for each term of residence, may, on recommendation of their special committees, obtain additional residence credit by carrying on their studies for a period of not less than eight weeks during the summer, provided they devote their whole time during this period to graduate study. Such students may obtain a maximum of one-half term's residence credit for such summer work.

## Residence Credit Convertible

Residence, whether at Cornell University or elsewhere, in pursuance of work for a Master's degree, may be credited toward the

residence required for the degree of Doctor of Philosophy provided the Special Committee in charge of the work for the latter degree approves, certifying the work done as forming an integral part of the work required for the Doctor's degree.

## DEGREES

The requirements for advanced degrees, with the exception of the professional degrees in Law and in Education, are based, not upon courses or credits, but upon the completion of a definite period of residence, the presentation of a satisfactory thesis or essay, and the passing of an examination.

## THE MASTER'S DEGREES

Cornell University confers the degrees of Master of Arts, Master of Science, Master of Architecture, Master of Civil Engineering, Master of Mechanical Engineering, Master of Electrical Engineering, Master in Forestry, Master in Landscape Architecture, Master of Chemistry, Master of Science in Agriculture, Master of Laws, Master of Fine Arts, Master of Arts in Education, and Master of Science in Education.

The Master's degree is conferred upon a candidate who, after completing at least one year of residence devoted to the study of a field comprising a Major Subject and one Minor Subject, presents a satisfactory thesis, or essay, as the chairman of the candidate's Special Committee may decide, and passes an examination on his special field.

The degree of Master of Laws is conferred upon a candidate who has completed at least one year of residence and has obtained at least twenty credit hours or their equivalent with high merit in courses of special work chosen with the approval of Group H of the Faculty of the Graduate School. A comprehensive examination on the work of the year may be required.

### THE THESIS

The thesis, or essay, must not only demonstrate the candidate's ability to do independent work, but must be acceptable in literary style and composition.

A statement of the general subject of the thesis, or essay, with the written approval of the chairman of the Special Committee in charge of the candidate's work, must be filed in the office of the Dean at least six months before the candidate expects to present himself for examination.

The completed thesis, or essay, approved by the Special Committee, must be presented at the office of the Dean at least five days before the examination for the degree, and must remain on file

until the day preceding the examination. When the Major Subject for the degree of Master of Architecture or the degree of Master in Landscape Architecture is in Design, the candidate is required to deposit in place of the thesis, either the original drawings or a photographic reproduction of them.

Each candidate for a Master's degree is required to furnish two bound typewritten copies of this thesis, or essay, for the use of the University Library, and these copies are to be delivered to the office of the Dean not less than five days before the examination for the degree, and must remain on file until the day preceding the examination. One of these copies may be a carbon copy.

The paper on which the thesis is typewritten must be a durable rag bond; the size of the page of the typewritten thesis should be 8 by 10½ inches; the margin on the left should be at least an inch and a quarter. The title page of the thesis should be set up according to the following form:

[TITLE OF THESIS]
A Thesis
Presented to the Faculty of the Graduate School of Cornell University for the degree of
[————————]
By
[Author's Name in Full]
[Date on which degree is to be conferred.]

Immediately following the title-page there shall be a biographical sketch of the author, the length of which shall not exceed 150 words. These two copies of the thesis become the permanent property of the Library.

### EXAMINATIONS

After the thesis, or essay, has been accepted by the Special Committee, and duly filed in the office of the Graduate School, the candidate is required to present himself for examination on his Major and Minor Subjects and on the subject matter of his thesis.

Examinations for a Master's degree may be written or oral, or both, at the option of the examining committee, and are open to all members of the Faculty. The examination for the degree of Master of Architecture may be waived by the General Committee of the Graduate School in any case where, in the opinion of the student's Special Committee, the Major and Minor Subjects are of such a nature as to make an examination impossible or inexpedient.

## THE DEGREE OF DOCTOR OF PHILOSOPHY

The degree of Doctor of Philosophy is conferred upon a candidate who, after completing not less than three years of resident graduate work devoted to the study of a field of work comprising a Major Subject and two Minor Subjects, presents a satisfactory thesis, and passes an examination on his chosen field and on the subject matter of his thesis.

The Doctor's degree is intended to represent, not a specified amount of work, covering a specified time, but the attainment, through long study, of independent and comprehensive scholarship in a special field.

A candidate for the Doctor's degree will ordinarily be expected to have a working knowledge of French and German before beginning graduate work. In no case may more than three terms of residence credit be earned before satisfying this language requirement. To meet the language requirement for the Doctor's degree, the student shall, for each language, satisfy a member of the Language Examination Board that he possesses an adequate reading knowledge of that language. Additional requirements in foreign language may be made at the discretion of the student's special committee.

### QUALIFYING EXAMINATIONS

Candidates for the degree of Doctor of Philosophy are required to pass a Qualifying Examination, to be held normally not later than the close of the second year of residence. The legislation of the Faculty on this subject is given in the following paragraphs:

(1) The qualifying examination or examinations required of a candidate for the degree of Doctor of Philosophy shall be held at such time as his Special Committee may determine, normally not later than the close of the second year of residence. No candidate may proceed to his final examination until two terms of residence have been acquired after he has passed the qualifying examination.

(2) The Special Committee shall pass upon the results of this examination as a whole, and shall report to the Dean whether the candidate has made satisfactory progress and is qualified to proceed in due order to complete the requirements for the degree.

(3) The Special Committee, in the case of any candidate, may waive the qualifying examination in whole or in part; but the Committee shall nevertheless report to the Dean whether the candidate has made satisfactory progress and is qualified to proceed in due order to complete the requirements for the degree.

(4) If a candidate fails to pass the qualifying examination, no re-examination shall be allowed except on the recommendation of the Special Committee.

### THESIS

The thesis for the Doctor's degree must not only give evidence of the candidate's power to carry on independent investigation but must be satisfactory in style and composition. A statement of the

general subject of the thesis, with the written approval of the chairman of the Special Committee in charge of the candidate's work, must be filed in the office of the Dean at least six months before the candidate expects to present himself for examination. The thesis of a candidate intending to take his degree at the June commencement should normally be completed by May 1, in order that ample time may be afforded for the inspection of the thesis by all members of the Special Committee. Two bound typewritten copies (one of which may be a carbon copy) of the completed thesis, approved by the Special Committee, are to be presented at the office of the Graduate School at least five days before the examination for the degree, and must remain on file until the day preceding the examination, after which they become the property of the University Library.

The paper on which the thesis is typewritten must be a durable rag bond; the size of the page of the typewritten thesis should be 8 x 10½ inches; the margin on the left should be at least an inch and a quarter. The title-page of the thesis should be set up according to the following form.

[TITLE OF THESIS]
A Thesis
Presented to the Faculty of the Graduate School
of Cornell University for the degree of
[————————]
By
[Author's Name in Full]
[Date on which degree is to be conferred.]

Immediately following the title page there shall be a biographical sketch of the author, the length of which shall not exceed 150 words.

Each candidate for the Doctor's degree must, before the degree is conferred, meet one of the following requirements:

(1) He must deposit in the office of the Dean of the Graduate School one hundred printed copies of his thesis for the purposes of the University Library;

(2) He must present with the two bound typewritten copies mentioned above, 100 printed copies of an abstract or description of his thesis, which abstract must be approved by his Special Committee; or

(3) He must present with the two bound typewritten copies mentioned above a typewritten copy of the abstract, not exceeding 1500 words in length, and the sum of $25 to defray the expenses of printing the abstract.

It is recommended that each student publish his thesis in full.

### PUBLICATION OF THE THESIS

The candidate should consult with the Secretary regarding the form of publication of the thesis. The thesis shall have both a cover and a title-page. The title-page shall include the printed statement that the thesis is presented to the Faculty of the Graduate School of Cornell University for the degree of Doctor of Philosophy, and shall give the date of the conferring of the degree. If the thesis is a reprint, the place and date of the original publication must be given.

### FINAL EXAMINATIONS

The final examinations for the doctor's degree may be either oral or written, or both, at the option of the examining committee, and are open to all members of the Faculty. The Faculty has, however, expressed the opinion that a written examination should be required for the doctorate at some time during the student's candidacy. In the event of failure in final examination, no re-examination may be held until a period of three months has elapsed.

It is not the policy of the Graduate School to divide the final examination for advanced degrees into parts, or to accept piecemeal fulfillment of the requirements for these degrees. In ordinary cases, examinations for advanced degrees are not held until after the candidate has completed the minimum period of residence and has presented a thesis duly approved by the members of his Special Committee. But on recommendation of the Special Committee the examination on the Major and the Minor Subjects may be held not earlier than two weeks before the end of the fourth term of residence. If this examination be passed, it must be followed by an examination on the subject matter of the thesis when the completed thesis is presented.

## THE DEGREE OF DOCTOR OF THE SCIENCE OF LAW

To receive the degree of Doctor of the Science of Law, the candidate shall be in residence not less than one year; shall pursue with distinction such program and investigation as shall be approved by his special committee and shall be acceptable to the Division of Law, the results of such investigation to be embodied in a thesis which shall be a creditable contribution to legal scholarship. It is desirable that candidates for this degree shall have had some practical or teaching experience after obtaining a first degree in law. For further information see page 55, infra, and also the current Law School Announcement.

## DATES FOR CONFERRING DEGREES

Advanced degrees are conferred in February, June, and September.

In February, degrees will be conferred on students who have made application for the degree on or before the first day of instruction after the Christmas recess, and who have completed the requirements not later than the last day of the term.

In June, degrees will be conferred on students who have made application for the degree not later than May 15, and who have completed the requirements not later than the last day of the final term examinations.

In September, degrees will be conferred on students who have made application for the degree not later than September 1, and who have completed the requirements not later than the day preceding the first day of instruction of the first term.

## TUITION AND OTHER FEES

*A Tuition Fee* of $150 for the academic year is to be paid by all students registered in the Graduate School. It is payable in installments of $75 at the beginning of each term.

Certain classes of students are exempt from the payment of the tuition fee. They are:

(1) Graduate students holding certain appointments as University Fellows or Graduate Scholars, and holders of certain temporary fellowships and scholarships.

(2) Resident Doctors, i.e., students in the Graduate School who have the Doctor's degree and are not candidates for a degree.

(3) Graduate students holding appointments as assistants and instructors and having their major studies in the college or line of work in which they are instructing, are exempt from the payment of tuition fees and laboratory and shop fees in the department in which they are employed to give instruction during the regular first and second terms only; members of the instrucing staff who take work for which they must pay tuition are required to pay in proportion to the amount of work for which they are registered.

*An Administration Fee* of $25 is to be paid by all students registered in the Graduate School except Honorary Fellows and Resident Doctors. It is payable in installments of $12.50 at the beginning of each term.

*A Matriculation Fee* of $10 is required of every student upon his first entrance into the University. It must be paid at the time of registration and is not refundable.

*A Health and Infirmary Fee** of $6 a term is required of all students (except Honorary Fellows and Resident Doctors and students

*Teachers and others not on the University teaching staff taking four hours of work or less, whose tuition payments have been regularly prorated, and who reside and regularly commute to the University from without the area of the city and town of Ithaca, shall be exempt from the payment of the Infirmary fee upon the understanding that if they should be admitted to the Infirmary they will pay the regular daily rate. To such students, membership in Willard Straight Hall is optional.

registered in the Medical College in New York City) at the beginning of each term. For a statement of the privileges given in return for this fee, see the General Information Number.

*A Graduation Fee* of $20 is required, at least ten days before the degree is to be conferred, of every candidate for an advanced degree. The fee will be returned if the degree is not conferred.

*Laboratory Fees.* Every person taking laboratory work in courses in which a fee is charged must pay to the Treasurer of the University the required fee or the required deposit for the materials *et cetera* that are to be used in the work.

*A Willard Straight Hall Membership Fee** of $5 a term is required of all graduate students except those who are members of the instructing staff, for whom membership is optional. The use of the hall is restricted to those who have paid this fee.

*Fees for the Summer Session.* Students taking work in any of the summer courses must register both in the Graduate School and in such summer course or courses, and must pay an administration fee of $6.25 and a tuition fee of $30 for each Summer Session; with the exception that any student undertaking graduate work for the first time at Cornell in a summer session, shall pay a summer session tuition fee of $60 for such first summer's work and of $30 for each subsequent summer session.

*Personal Direction.* Students carrying on studies during the summer as candidates for advanced degrees under Personal Direction are required to register with the Registrar as well as in the Graduate School and to pay an administration fee of $6.25.

Students registered under personal direction during the summer who desire residence credit for their work, must pay tuition for the credit desired pro rata at the rate charged for the regular academic year, such payment to admit them to the current summer session classes without additional tuition payments; provided that the amount of tuition paid is at least equal to that charged students registered in the Summer Session. Students registered under personal direction during the summer, not for credit, are exempt from the payment of tuition, but may not attend either as visitors or for subsequent credit, any of the classes or exercises of the summer session.

Tuition and other fees become due when the student registers. The University allows twenty days of grace in each term, five days in the Summer Session. The last day of grace is generally printed on the registration coupon which the student is required to present at the Treasurer's office. Any student who fails to pay his tuition charges, other fees, and other indebtedness to the University, or who, if entitled to free tuition, fails to claim it at the Treasurer's office and to pay his fees and other indebtedness, within the prescribed period of grace, is thereby dropped from the University unless

*See foot-note on the preceding page.

the Treasurer has granted him an extension of time to complete payment. The Treasurer is permitted to grant such an extension when, in his judgment, the circumstances of a particular case warrant his doing so. For any such extension the student is assessed a fee of $5 for the first week and $2 additional for each subsequent week in which the whole or any part of the debt remains unpaid, but the assessment in any case is not more than $15. The assessment may be waived in any instance for reasons satisfactory to the Comptroller and the Registrar, when such reasons are set forth in a written statement.

Students registering at any time during the last ten weeks of either the first or the second term are required to pay tuition at the rate of ten per cent of the regular tuition of the term for each week or fraction of a week between the day of registration and the last examination day of the term. Students registering at any time during the last four weeks in the short summer courses are required to pay tuition at the rate of twenty-five per cent of the term's tuition for each week or fraction of a week between the day of registration and the last examination day of the term.

A tuition fee or other fee may be changed by the Trustees at any time without previous notice.

## LIVING EXPENSES IN ITHACA

The minimum cost of living in Ithaca during the school year from September till June is $700, exclusive of tuition or other fees due the University. Board and room for that period cost about $550, and $150 is not more than a safe allowance for other personal expenses. If the student is to live in Ithaca throughout the calendar year he had better estimate his living expenses at the rate of twenty dollars a week.

Prospective graduate students who must depend on employment partially to meet living expenses are advised that opportunities for such employment are relatively limited in Ithaca.

Women students should arrange for living accommodations through the Dean of Women.

## FELLOWSHIPS, SCHOLARSHIPS, PRIZES

### Honorary Fellowships

Holders of the Doctor's degree or other persons of recognized standing as scholars who wish to continue work in a field in which they have already achieved distinction may, in the discretion of the Faculty, be appointed to honorary fellowships. These fellowships cover all fees except laboratory charges. Actual residence at the University and regular registration in the Graduate School are required of incumbents.

### Resident Doctors

Persons having the Doctor's degree or of equivalent standing may register in the Graduate School as Resident Doctors and, on recommendation of the Dean, are exempt from the payment of all fees except laboratory charges.

## Fellowships

The following twenty-seven fellowships are annually offered in the Graduate School:

1. The Cornell Fellowship in English.
2. The McGraw Fellowship in Civil Engineering.
3. The Sage Fellowship in Chemistry.
4. The Schuyler Fellowship in Animal Biology.
5. The Sibley Fellowship in Mechanical and Electrical Engineering.
6. The Goldwin Smith Fellowship in Botany, Geology, or Physical Geography.
7. The President White Fellowship in Physics.
8. The Erastus Brooks Fellowship in Mathematics.
9. The University Fellowship in Architecture or Landscape Architecture.
10. The University Fellowship in Romance Languages.
11. The University Fellowship in German.
12. The University Fellowship in Agriculture.
13. The Charles Bull Earle Memorial Fellowship in Mechanical and Electrical Engineering.
14. The President White Fellowship in Modern History.
15. The President White Fellowship in Political and Social Science.

16, 17. The Susan Linn Sage Fellowships in Philosophy.

18. The Susan Linn Sage Fellowship in Psychology.

19, 20. The Fellowships in Political Economy.

21, 22. The Fellowships in Greek and Latin.

23. The Fellowship in American History.
24. The Edgar J. Meyer Memorial Fellowship in Engineering Research.
25. The George C. Boldt Fellowship in History.
26. The Anna Cora Smith Fellowship in Home Economics.
27. The Clinton DeWitt Smith Fellowship in Agriculture.

The Cornell-Brookings Fellowship: A stipend of $500, made available by the Brookings Institution of Washington, D. C., may be combined with the stipend of either the President White Fellowship in Political and Social Science or one of the Fellowships in Political Economy to make a Cornell-Brookings Fellowship, the stipend of which may vary from $900 to $1150. The Cornell-Brookings Fellowship will usually be granted only to a student of economics or government in his third year of graduate study, and will be held in residence at the Brookings Institution. The holder of the Fellowship must be regularly registered in the Graduate School of Cornell University.

The President White Fellowships in Modern History and in Political and Social Science, the Anna Cora Smith Fellowship in Home Economics, and the Clinton DeWitt Smith Fellowship in Agriculture have an annual value of $500 each; the George C. Boldt Fellowship in History has an annual value of $1,000; the others have an annual value of $400 each. Some of the Fellows are also exempt from tuition. It is possible that, during the year 1933–34, some modifications may be made in the lists of fellowships and graduate scholarships and in certain cases the stipends attaching to them may be considerably increased. In cases where any such change is made applicants will be informed by correspondence.

The President White Fellowships in Modern History and in Political and Social Science may at the discretion of the Faculty of the Graduate School, be made traveling fellowships. The holders of these fellowships are by the terms of the gift called upon to be in attendance for a certain period each

day in the President White Library, where they will ordinarily do a large part of their study. In the case of a student of very exceptional ability and promise in the fields of either of these fellowships, the two fellowships may in the discretion of the Faculty, be combined for a single year into one.

The two fellowships in Political Economy may similarly be combined into one fellowship in any single year.

### Special Temporary Fellowships.

In addition to the fellowships enumerated above, the income of the Susanna Phelps Gage Fund for research in physics may, by the decision of the professors in the Department of Physics, be devoted to the support of fellowships in Physics.

At the present time the following special fellowships are also awarded by the Faculty of the Graduate School:

American Creosoting Fellowship in Chemistry.

American Rose Society Fellowship in Plant Pathology.

Calumet Baking Powder Fellowship in Chemistry.

Charles Lathrop Pack Fellowships in Nature Education and Forestry.

Eli Lilly Research Fellowship in Chemistry.

General Seafoods Corporation Fellowship in Animal Husbandry.

Genesee-Orleans Vegetable Growers Association Fellowship in Plant Pathology.

Lily Disease Investigation Fellowship in Plant Pathology.

Morgenthau Fellowship in Home Economics.

Nassau Farm Bureau Fellowship in Plant Pathology.

New York Florists' Club Fellowship for the study of diseases of Cyclamens and other Potted Plants.

New York Florists' Club Fellowship for the Investigation of Diseases of Roses Grown under Glass.

Niagara Sprayer and Chemical Company Fellowship.

Oswego Farm Bureau Vegetable Growers Fellowship in Plant Pathology.

du Pont Fellowship in Chemistry.

du Pont Fellowship in Mechanical Engineering.

Sylvania Industrial Corporation Fellowship in Animal Husbandry.

Williamson Co-operative Vegetable Association Fellowship.

It is impossible at the present time to announce these fellowships as annually awarded to applicants. Information in regard to them may at any time be obtained by correspondence with the respective departments.

## Graduate Scholarships

The following eighteen graduate scholarships are offered annually in the graduate school:

1–5. The Susan Linn Sage Graduate Scholarships in Philosophy.
6. The Susan Linn Sage Graduate Scholarship in Psychology.
7. The Graduate Scholarship in Mathematics.
8. The Graduate Scholarship in Chemistry.
9. The Graduate Scholarship in Physics.
10. The Graduate Scholarship in Civil Engineering.
11. The Graduate Scholarship in Latin and Greek.
12. The Graduate Scholarship in Archaeology and Comparative Philology.
13. The Graduate Scholarship in Animal Biology.
14. The Graduate Scholarship in Botany, Geology, or Physical Geography.
15. The Graduate Scholarship in English.
16. The Graduate Scholarship in History.
17. The Graduate Scholarship in Architecture.
18. The Graduate Scholarship in Veterinary Medicine.

The graduate scholarships, with the exception of the Scholarship in Architecture, have an annual value of $200 each. Some of the holders of graduate scholarships are also exempt from tuition. The Graduate Scholarship in Architecture grants only free tuition.

The Faculty of the Graduate School has the authority to award fellowships and scholarships in the following ways:

(1) to fill all fellowships and scholarships at the stipends now established;

(2) to combine the stipends of two or more scholarships or fellowships in order to increase the stipend of a single scholarship or fellowship;

(3) to leave the scholarships and fellowships, or any of them, unfilled during one or more years in order to reserve such unused funds for increasing the stipends of such scholarships and fellowships as may be filled during a subsequent year.

## Award and Tenure

Appointments to fellowships and scholarships for the ensuing year are made by the Faculty, upon recommendation of the professors concerned, on April 1 of each year.

Official forms for making application for fellowships and graduate scholarships may be obtained from the Office of the Graduate School. All applications shall be filed ordinarily in the office of the Dean on or before March 15 of the academic year preceding the one for which application is made. Before this application is filed, the applicant should have convinced himself by correspondence that he is eligible for admission to the Graduate School of this University as a candidate for an advanced degree in his chosen field, since appointments are given only to those who are eligible for admission to candidacy for an advanced degree.

*Prospective graduate students who wish also to apply for positions as teaching or research assistants should address applications for such positions directly to the Department or College concerned, and not to the Office of the Graduate School.*

All other information, papers, and testimonials should be submitted on or before March 15 to the Office of the Graduate School. Applicants are advised to submit any published or unpublished papers or reports showing the result of their study or research which might serve to indicate the extent of their knowledge of the subject, their command of the methods and tools of research, and their capacity generally for clear written expression. Candidates who are graduates of other colleges or universities should submit recommendations from the instructors best acquainted with their ability and attainments. It should be borne in mind that information cannot be too exact or detailed in the case of students not personally known to the appointing body.

The term of each fellowship and graduate scholarship is one academic year, but the term may under exceptional circumstances be extended to two academic years.

Students holding fellowships or graduate scholarships are not free to accept other appointments, but will be expected to devote their time uninterruptedly to the prosecution of their studies.

The moneys due on fellowships and graduate scholarships are paid at the office of the Treasurer of the University in six equal payments on October 15, December 1, January 15, February 15, April 1, and June 1.

### The John McMullen Research Scholarships

The John McMullen Research Scholarships: Open to graduates in Civil, Mechanical, or Electrical Engineering. These scholarships were founded by a bequest of John McMullen, of Norwalk, Conn., to Cornell University "for the purpose of creating and maintaining free scholarship or scholarships for the education of young men as engineers, the details as to the amounts of said scholarships and the qualifications of the beneficiaries to be left to said institution to determine, said scholarships to be known as the John McMullen Scholarships." With the avails of this bequest the Board of Trustees has established several research scholarships of an annual value varying from $1,500 to $2,400. The scholarships have not been assigned to any particular school of the College, but will be awarded as conditions dictate. Applications should be sent to the Dean of the College of Engineering.

### The Eleanor Tatum Long Graduate Scholarship

The Eleanor Tatum Long Graduate Scholarship in Structural Geology is open to graduate students who are majoring in the branch of Geology named. Application for the scholarship should be made to the Department of Geology. The stipend is approximately $1000 a year, and does not carry free tuition.

### Tuition Scholarships

The Board of Trustees of Cornell University has established twenty tuition scholarships to be awarded by the General Committee of the Graduate School. Twelve of these scholarships are for work in the endowed colleges and eight for work in the state-supported colleges. These scholarships entitle the holder to exemption from payment of tuition fees, but not other fees, for the duration of the appointment. These scholarships are awarded from nominations made by the professor or professors in whose field the nominee is working.

### The Graduate Prize in Philosophy

The Graduate Prize in Philosophy has an annual value of about twenty-five dollars, and is open for competition to all students registered in the Graduate School of Cornell University.

The prize will be awarded to the graduate student who submits the best paper embodying the results of research in the field of philosophy. To be acceptable, the paper must show independent scholarship and research in dealing with philosophical ideas. The subject of the paper may be either historical or critical and constructive in character. It may be concerned either with problems of pure philosophy or with the philosophical bearing of the concepts and methods employed in mathematics or in any of the natural or humanistic sciences.

Papers submitted in competition must be deposited in the office of the Dean of the Graduate School on or before the first of May. Each paper is to be typewritten, and must bear a fictitious signature and be accompanied by the name of the writer in a sealed envelope.

The prize will be awarded by a committee appointed by the President of the University. A copy of the successful paper is to be deposited in the University Library by the Dean of the Graduate School.

## THE UNIVERSITY LIBRARIES

Otto Kinkeldey, *Librarian;* E. R. B. Willis, *Associate Librarian;* G. L. Burr, *Librarian Emeritus of the President White Library;* Haldór Hermannson, *Curator of the Icelandic Collection;* G. L. Hamilton, *Curator of the Dante and Petrarch Collections;* E. E. Willever, *Librarian of the Law Library;* W. W. Ellis, *Librarian of the Agricultural College Library.*

The University Libraries comprise the General Library of the University, the Seminary Libraries in the General Library Building, the Architectural Library, the Chemical Library, the Sibley Engineering Library, the Civil Engineering Library, the Law Library, the Flower Veterinary Library, the Barnes Hall Library, the Goldwin Smith Hall Library, the Van Cleef Memorial Medical Library, the Library of the New York State College of Agriculture, and the Library of the New York State Agricultural Experiment Station at Geneva. The total number of bound volumes in them

is now about eight hundred and seventy thousand. The number of periodicals, transactions, and other serials currently received, is over two thousand, and of most of these complete sets are on the shelves.

In addition to the general store of books which a University Library of this size may be expected to contain, there are many special collections, assembled by scholars or with scholarly intent, of which a list in some detail may be found in the Register of the University. Among the more noteworthy are:

THE PRESIDENT WHITE LIBRARY, received in 1891 as a gift from the first President of the University and largely increased by subsequent gifts and purchases. It includes special collections on the History of Superstition, the Age of the Reformation, and the French Revolution.

THE DANTE, PETRARCH, AND ICELANDIC COLLECTIONS, for which separate catalogues have been printed, were gathered by the first Librarian, Willard Fiske, who gave them to the University and bequeathed funds for their upkeep.

THE MAY COLLECTION relating to the history of slavery had as its nucleus the Library of the late Rev. Samuel J. May, long secretary of the American Anti-slavery Society.

THE WASON COLLECTION of books dealing with China and the Chinese was bequeathed to the Library by Charles William Wason, '76, with provision for its increase.

For the study of English, of the classical languages, of the Germanic and Romance languages, of philosophy, of politics and economics, of American and of European history, there have been provided in the library building seven seminary rooms, each equipped with a carefully chosen body of reference books, to which advanced students in these fields have access. In connection with the scientific and technical laboratories similar collections have been formed and well supplied with reference books, standard works, and sets of periodicals, conveniently arranged for study and research.

Cards of admission to the shelves in the stackrooms and to the White Historical Library will be issued to graduate students for the purpose of consultation and research. The privilege of taking books for home use is granted to all students who comply with the library regulations.

LECTURES IN BIBLIOGRAPHY. As a part of the work of the General Library, Mr. Willis, associate librarian, offers a series of informal talks to graduate students in the second term on the resources and facilities of the Library and on the employment as aids to research of the general bibliographical helps.

# FIELDS OF INSTRUCTION

In the following pages are outlined the opportunities for graduate study in the various subjects taught in the University. The subjects are grouped in broad fields. An asterisk (*) preceding the title of a special field of study indicates that this is a field which may be chosen as a Major or Minor Subject. Under each subject there is usually given a statement of (1) the special facilities and encouragements for work in that subject, (2) the general prerequisites for advanced work in the subject, (3) courses of instruction for graduates and undergraduates or primarily for graduates, and opportunities offered for the direction of individual investigation in the subject.

NOTE: The titles of undergraduate courses are printed in italics; the titles of graduate courses in bold-faced type.

## THE FINE ARTS

### THE HISTORY AND PRACTICE OF THE FINE ARTS

*Professors* O. M. BRAUNER, CHRISTIAN MIDJO, H. P. CAMDEN, D. L. FINLAYSON, A. C. PHELPS.

*Committee:* O. M. BRAUNER, OTTO KINKELDEY, GEORGE YOUNG, jr., and R. M. OGDEN.

Graduate work is offered in historical, theoretical, or creative work in the field of the fine arts.

Candidates for the degree of Master of Fine Arts must be holders of a baccalaureate degree and must spend at least one year in residence following the granting of such degree.

The History and Theory of the Fine Arts, Drawing, Painting or Sculpture may be selected as major subjects. Minor subjects may be selected as approved.

**Drawing and Painting.** Professors BRAUNER and MIDJO.
**Sculpture.** Professor CAMDEN.
**History of Art.** Professor FINLAYSON.
**History of Architecture.** Professor PHELPS.
Other members of the staff will cooperate as necessary.

### ARCHITECTURE

*Professors* F. H. BOSWORTH, A. C. PHELPS, GEORGE YOUNG, jr., L. P. BURNHAM, H. E. BAXTER, and A. D. SEYMOUR, jr.

Graduate work is offered in architectural design, in the history of architecture, and in advanced construction.

Candidates for the degree of Master of Architecture must have had preliminary training in the subjects elected for graduate work equivalent to that required in like subjects in this University for the degree of Bachelor of Architecture. Architectural Design, History of Architecture, and Architectural Construction are offered as major subjects for the Master's degree; Landscape Design, Drawing, Painting, Modeling, and approved courses in other departments of the University may be elected as minor subjects.

The facilities for graduate work in architecture are excellent. Large, well lighted drafting-rooms and studios are provided and a special architectural library, comprising several thousand books, photographs, lantern slides, and numerous original drawings, is situated in White Hall where it is easily accessible to the student.

Instruction is given by means of lectures, seminary discussions, and especially by direct personal criticism and advice.

***Architectural Design.** Professors BURNHAM and SEYMOUR.

***History of Architecture.** Professor PHELPS.

***Architectural Construction.** Professors YOUNG and BAXTER.

## LANDSCAPE ARCHITECTURE

*Professors* E. D. MONTILLON, EDWARD LAWSON and R. W. CURTIS, and the Faculty of Architecture.

Graduate work in Landscape Architecture is offered in design, history, and planting design.

Candidates for the degree of Master of Landscape Architecture must have had preliminary training in the subjects elected for graduate work equivalent to that required in like subjects in this University for the degree of Bachelor of Landscape Architecture. Any one of these subjects may be selected as the major study for the degree of Bachelor of Landscape Architecture. The minor subject may be one of the other two, Architectural Design, Drawing, Modeling or approved work in any department of the University.

***Landscape Design.** Professors MONTILLON and LAWSON.

***History of Landscape Architecture.** Professors MONTILLON and LAWSON.

***Planting Design.** Professors LAWSON and CURTIS.

## *MUSIC

*Professors* P. J. WEAVER, OTTO KINKELDEY, H. D. SMITH, A. C. HAIGH, and GILBERT ROSS.

*Primarily for Undergraduates*

*The Art of Music.* Professor WEAVER. (*Music* 5, M W F 11).

*History of Music.* Professor WEAVER. (*Music* 10, T Th 10).

*Historical Survey of Piano Music.* Assistant Professor HAIGH. (*Music* 12, M W F 10).

*Historical Survey of Orchestral Music.* Assistant Professor ROSS. (*Music* 13, M W F 2).

*Harmonic Analysis and Musical Form.* Assistant Professor SMITH. (*Music* 22 and 23, M W F 10).

*Counterpoint.* Assistant Professor SMITH. (*Music* 24, T Th 9).

*Double Counterpoint, Canon and Fugue.* Assistant Professor SMITH. (*Music* 25, M W F 8).

*Elementary Orchestration.* Assistant Professor ROSS. (*Music* 31, T Th 11).

*Elementary Composition.* Assistant Professor HAIGH. (*Music* 40, T Th S 11).

*Advanced Composition.* Assistant Professor HAIGH. (*Music* 41, T Th S 9).

*Applied Music (organ, piano, violin).* Assistant Professors SMITH, HAIGH, and ROSS. (*Music* 60 and 61, hours to be arranged).

*Primarily for Graduates*

**Seminary in Musicology.** Professor KINKELDEY. ( **Music** 100). Primarily for graduates (and, by permission, for seniors) who have the requisite reading knowledge of one or more of the important foreign languages, a fair knowledge of musical theory, and some skill in practical music. The work is intended to make the student acquainted with the accomplishments of the past and with modern methods and aims in all fields, scientific, aesthetic, and historical, of musical research and investigation. Special topics or fields of study will be selected for each term after consultation with the class.

# LANGUAGES AND LITERATURES

## THE CLASSICS

*Professors* C. L. DURHAM, E. P. ANDREWS, H. L. JONES, HARRY CAPLAN, and JAMES HUTTON.

Admission to graduate study in a subject included in the group of the Classics, except in archaeology, assumes a knowledge of the field selected equivalent in general to that expected of a student who has pursued the subject concerned throughout four years of undergraduate study in a college of recognized standing.

Graduate work in the Classics is conducted in the main by the seminary system, the object of which is training in the methods, the principles, and the performance of independent research and criticism, and the work is therefore as far as possible put into the hands of the students themselves. Subjects other than those investigated in one of the seminaries of the year are ordinarily presented by courses of lectures.

Two seminary rooms in the Library Building are reserved for the exclusive use of graduate students in the Classics. In addition to the various complete sets of philological and of archaeological journals and standard works of reference in these rooms, the general University Library is at the disposal of the graduate students; stack permits are available when required, and special collections of books can be transferred from the general library to the seminary rooms when needed.

Two fellowships in Greek and Latin; a scholarship in Greek and Latin; and a scholarship in Archaeology and Comparative Philology are awarded annually.

The Charles Edwin Bennett Fund for Research in the Classical Languages yields an annual income of three hundred dollars which may be used each year in the way best suited to promote the object for which the fund was established.

Good doctoral dissertations will be accepted for publication in the *Cornell Studies in Classical Philology.*

### *GREEK

1a. *Greek for Beginners.* Introduction to Homer's Iliad. Three hours a week, both terms.

1b. *Homer's Iliad.* Continuation of Greek 1a. Three hours a week, both terms.

2a. *Attic Greek. Plato, Selected Dialogues.* Three hours a week, both terms.

2b. *Euripides, Iphigenia in Tauris* and *Alcestis; New Testament, Selections.* Three hours a week, both terms.

5. *Greek Composition.* One hour a week throughout the year.

7. *Greek Myths.* Illustrated lectures. First term, two hours a week.

8. *Lectures on Ancient Greece and Greek Life.* Second term, two hours a week.

17. **Aristophanes: Clouds; Sophocles: Oedipus Rex, Antigone.** Throughout the year. Prerequisite, Greek 2b. Professor JONES. T Th S 12. Goldwin Smith 120.

[20. **Lyric Poetry: Aeschylus: Prometheus Vinctus; Theocritus; Demosthenes: Philippics.** Throughout the year. Prerequisite, Greek 17. Not given in 1933–34.]

[22. **Plato: the Republic; Pindar: Selected Odes; Thucydides.** Throughout the year. Prerequisite, Greek 20. For graduates and qualified undergraduates. Not given in 1933–34.]

25. **Advanced Greek Composition.** Second term. Prerequisite, Greek 5. Assistant Professor HUTTON. Th 2. Goldwin Smith 124.

[33. **Classical and Mediaeval Rhetoric.** Professor CAPLAN. Not given in 1933–34.]

34. **Readings in the Attic Orators.** First term. Professor JONES. M W F 11. Goldwin Smith 120.

[41. **Seminary. Strabo; or Homeric Geography.** Professor JONES. Not given in 1933–34.]

[44. **Seminary. Greek Anthology.** Assistant Professor HUTTON. Not given in 1933–34.]

See also readings in GREEK PHILOSOPHY (under **PHILOSOPHY**), INDO-EUROPEAN PHILOLOGY (under **LATIN**), METHODS OF LITERARY AND LINGUISTIC STUDY, AND PRINCIPLES OF LITERARY CRITICISM (under **COMPARATIVE STUDY OF LITERATURE**), and ANCIENT HISTORY (under **HISTORY**).

## *LATIN

1a. *Freshman Course: For Students Offering Three Units of Entrance Latin.* Ovid; Virgil; Horace, Odes and Epodes. Three hours a week both terms.

1. *Freshman Course: For Students Offering Four Units of Entrance Latin.* Cicero, De Senectute; Martial, Epigrams; Horace, Odes and Epodes. Three hours a week both terms.

3. *Sight Translation.* One hour a week throughout the year.

8. *Terence; Catullus; Horace, Satires and Epistles; Tacitus, Agricola; Livy; Seneca, Epistles.* Three hours a week throughout the year.

[11. *Survey of Roman Poetry,* with interpretation of representative selections. Not given in 1933–34.]

12. *Epic Poetry: Ennius; Virgil: Georgics, The Last Six Books of the Aeneid.* First term, two hours a week.

[16. *The Greater Republican Writers.* Throughout the year. Prerequisites, Latin 8, 11, or 12. Plautus; Cicero; Lucretius. Not given in 1933–34.]

17. *Literature and History of the Early Empire.* Throughout the year. Prerequisites, Latin 8, 11, or 12. Tacitus, Annals; Juvenal; Pliny's Letters; Suetonius. Assistant Professor HUTTON. M W F 11. Goldwin Smith 128.

21. *Latin Writing, Elementary Course.* One hour a week throughout the year.

[26. *Teacher's Training Course.* Given in alternate years, not given in 1933–34.]

[27. *Topography and Architectural Remains of Rome.* Not given in 1933–34.]

30. *History of Roman Literature; Lectures and Readings.* Cicero, Life and Philosophical Works. Second term. Assistant Professor HUTTON. T Th 11. Goldwin Smith 128.

41. **Seminary. Studies in the History of Latin Literature.** Professor CAPLAN. Throughout the year. T 2:30. Library, Classical Seminary Room.

[42. **Seminary.** The MS. tradition of Cicero's oratorical works; or Plautus; or problems in Latin pronunciation and versification; or Catullus and Alexandrianism. Professor DURHAM. Not given in 1933–34.]

45. **Latin Writing, Advanced Course.** Throughout the year. First term: Professor DURHAM. F 12. Goldwin Smith 128. Second term: Assistant Professor HUTTON. Goldwin Smith 124. For graduates, and for undergraduates who have taken Latin 21.

47. **Historical Latin Syntax.** For graduate students. Two hours a week, first term. Professor DURHAM.

[48. **Vulgar Latin: Petronius, Cena Trimalchionis; Vulgar Latin Inscriptions, including Christian Inscriptions.** Professor DURHAM. Not given in 1933–34.]

[49. **Indo-European Philology; Sounds and Flexions of Latin; Italic Dialects.** Professor DURHAM. Primarily for graduate students. Not given in 1933–34.]

## *GREEK ART AND ANTIQUITIES

*Professor* E. P. ANDREWS.

1. *History of Greek Sculpture.* Three hours a week, either term.
3. *Greek Antiquities.* Three hours a week, either term.
4a. *Greek Coins.* Two hours a week, first term.
4b. *Greek Architecture.* Two hours a week, second term.

The following graduate courses presuppose facility in reading Greek and a working knowledge of Greek History. Not more than one course will be given each term. The choice of subject and the hours will be by arrangement, suiting the needs and ability of students seeking such courses. The courses will be given in Goldwin Smith 35 by Professor ANDREWS.

100. **Greek Epigraphy.** The Greek alphabets and illustrative inscriptions, chiefly in Attic, working from squeezes.

101. **Pausanias and the Topography of Greece with especial reference to Athens.**

102. **Modern Greek, Written and Colloquial.** Given in preparation for resident study in Athens.

## *ENGLISH LANGUAGE AND LITERATURE

*Professors* WILLIAM STRUNK, jr., F. C. PRESCOTT, C. S. NORTHUP, J. W. HEBEL, B. S. MONROE, L. N. BROUGHTON, F. M. SMITH, W. H. FRENCH, and EDWIN NUNGEZER, and *Doctors* MILTON MARX, H. J. MULLER, F. O. BISSELL, jr., and BRICE HARRIS.

Among the books available to the student are complete sets of the publications of the Early English Text, Chaucer, Scottish Text, Percy, English Dialect, Shakespeare, New Shakespere, Spenser, Philological, Malone, and other societies; of the Arber, Bullen, Grosart, and Farmer reprints; and of all the important periodicals dealing with the English language and literature. Most of the American and foreign dissertations on English subjects, standard and other editions of individual authors, English and American, and several special collections are also in the Library, which is exceptionally rich in the field of Old and Middle English and in the Elizabethan and Victorian periods. The Hart Memorial Library, founded by the late Professor James Morgan Hart, contains about four thousand seven hundred and fifty volumes, including valuable collections in the bibliography of English philology. This library, in Goldwin Smith Hall, is for the use of graduate students and members of the Faculty. The Department has also a seminary room in the University Library. *Cornell Studies in English,* a series of monographs issued by the Department, affords some opportunity for the publication of work accomplished by graduates as well as by members of the staff. Twenty-four numbers have appeared.

Candidates for an advanced degree may take their major subject in literature or in language. In general, thirty-six hours of college English are required before a student may enter upon candidacy for an advanced degree. Work in philosophy, history, and languages, ancient and modern, may, at the discretion of the candidate's special committee, be counted against a shortage in undergraduate English. Training in the Greek and Latin literatures is especially desirable as preparation for graduate work in English. All candidates must have a reasonable familiarity with Old and Middle English; must have a general knowledge of English literature and English history; and must accomplish satisfactory work in research. Candidates for the Master's degree must have sufficient knowledge of French or German to make use of scholarly work in one of those languages, and candidates for the Doctor's degree must have a similar knowledge of both French and German, and a reading knowledge of Latin.

One fellowship of the annual value of $400 and one scholarship of the annual value of $200 are awarded annually to graduate students in English. Holders of fellowships and scholarships are also exempt from the payment of tuition.

The fellowship and scholarship are ordinarily awarded only to applicants who have had one year or more of graduate study.

22. *Nineteenth Century Poetry.* Three hours a week, throughout the year.
32. *Old English.* Three hours a week, throughout the year.
37. *Chaucer.* Three hours a week, first term.
38. *Middle English Metrical Romances.* Two hours a week, second term.
42. *The English Drama to 1642.* Three hours a week, throughout the year.
44. *Sixteenth Century Literature.* Three hours a week, throughout the year.
46. *Shakespeare.* Three hours a week, throughout the year.
50. *Seventeenth Century Literature.* Three hours a week, first term.
52. *Milton.* Three hours a week, second term.
54. *Eighteenth Century Poetry.* Two hours a week, throughout the year.
56. *Eighteenth Century Prose.* Three hours a week, throughout the year.
58. *Biography.* Two hours a week, throughout the year.
64. *Byron and Shelley.* Two hours a week, first term.
68, 69. *Victorian Literature.* Three hours a week, throughout the year.
70, 72. *American Literature.* Three hours a week, throughout the year.
74. *The English Language.* Two hours a week, first term.
76. *English Usage and Style.* Three hours a week, throughout the year.
78. *Johnson and His Circle.* Three hours a week, throughout the year.
84. *English Poetry.* Two hours a week, throughout the year.
90. *Dramatic Structure.* Three hours a week, throughout the year.
98. *Teachers' Course.* Two hours a week, second term.

101. **Old English Literature.** Professor MONROE. Either term. T Th 3, or other hours to be arranged. Goldwin Smith 162.

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

104. **Restoration Drama.** Dr. MARX. Throughout the year. Room and hour to be arranged.

Dryden, Davenant, Etherege, Shadwell, Otway, Wycherley, Congreve, Vanbrugh, Farquhar, and others. First term. Restoration tragedy and the heroic play. Second term. Restoration comedy.

108. **Elizabethan Seminary.** Assistant Professor NUNGEZER. Throughout the year. Room and hour to be arranged.

Studies in representative non-dramatic literature of the second half of the sixteenth century, with emphasis on significant problems.

110. **The Seventeenth Century.** Professor HEBEL. Throughout the year. Room and hour to be arranged.

This course is supplementary to English 50, *Seventeenth Century Literature*, and is intended for students in the first year of their graduate study. A brief survey of Continental and English literature of the early Renaissance, followed by a detailed study of English literature from 1590 to 1660.

111. **Problems and Methods in the Study of the Seventeenth Century.** Professor HEBEL. Throughout the year. Room and hour to be arranged.

Intended for students in the second and third years of their graduate study, and designed to introduce them to various modes of literary investigation. In alternate years the course will be (a) an introduction to methods of research based on recent Shakespearean scholarship, or (b) a general survey of literary criticism and aesthetics.

115. **Eighteenth Century Literature.** Professor BROUGHTON. Throughout the year. W 2–4. Goldwin Smith 338.

A study of the influences, tendencies, literary criticism, thought, and life of the eighteenth century.

116. **Wordsworth and His Contemporaries.** Professor BROUGHTON. Throughout the year. M 4–6. Goldwin Smith 338.

First term: a detailed study of the works of Wordsworth and their influence

on contemporary English thought and literature. Second term: the contemporaries of Wordsworth.

[117. **Pastoral Poetry.** Professor BROUGHTON.

A study of the sources and development of the appreciation of rustic life and landscape in poetry from Theocritus to recent writers. Not given 1933–34.]

135. **Nineteenth Century Fiction.** Professor NORTHUP. Throughout the year. Th 4–6. Goldwin Smith 338.

Studies in the development of the novel from Scott to Thomas Hardy.

137. **Middle English Literature.** Professor NORTHUP. Throughout the year. M W 10. Goldwin Smith 338.

Studies of important poetry and prose from the Conquest to Malory and of leading problems needing research.

138. **The American Short Story.** Professor SMITH. Second term. Room and hour to be arranged.

A study of the short story as reflecting the social background of America.

140. **American Literature.** Professor PRESCOTT. First term. Room and hour to be arranged.

Emerson, Thoreau, and Whitman, and their relation to New England Transcendentalism.

141. **The English Language.** Professor MONROE. Throughout the year. W 3, or other hours to be arranged. Goldwin Smith 162.

A study of selected topics either independently or in connection with other courses in language and literature.

146. **Shelley.** Professor PRESCOTT. Second term. Room and hour to be arranged.

A study of Shelley's poetical and prose works in relation to his life and time.

150. **Dramatic Literature.** Professor STRUNK. Throughout the year. T 7:30. Goldwin Smith 338.

A study of dramatic history and theory, with reading of representative plays. This course is supplementary to English 90, Dramatic Structure, which should precede or accompany it.

## *COMPARATIVE STUDY OF LITERATURE

*Professor* LANE COOPER (*Professor of the English Language and Literature*); and *Assistant Professor* JAMES HUTTON (*of the Department of Classics*).

Once the usual demands for entrance into the Graduate School are satisfied, no particular requirement but special fitness is made of candidates for an advanced degree who desire entrance into this field of work, which is closely related to English Philology in the broad sense of the term. Philology is here taken to mean the conjoint study of language and literature. The candidate must evince some special fitness for either the literary or the linguistic side of the work, but in any case must not be deficient in literary appreciation. He will have opportunity to prove his worth in the first year of graduate study. In general, one year of satisfactory graduate work is enough for the degree of Master of Arts. Students who are permitted to advance toward the doctoral degree commonly expect to receive it after two years more—but the attainment of the doctorate in three years must not be regarded as a fixed rule. The work for both degrees will be adapted to the needs and purposes of the individual candidate; great care will be taken to find a suitable subject for the "thesis." The work is in the main designed to develop good scholars and effective teachers for colleges and universities.

Apart from a broad culture, however attained, the best foundation for this work is undergraduate study of the classics. Those who wish to be candidates should use every opportunity to improve their acquaintance with Greek and Latin

literature, whether in the original or through translations, and with mediaeval literature—for example, in Old and Middle English, which had best be begun before the first year of graduate work. The graduate student must bring a love of good literature with him, and not expect to acquire it at a late date, for his special studies now presuppose that love. In general, a good candidate is one who has been drawn to read the best books, and has read them, from the age of eight or ten years on, and who has had a broad and sound course of study as an undergraduate. This course should have included one satisfactory year of French, at least two years of German, and a fair amount of Latin. For those who have not had Greek in the preparatory school, it is desirable to begin it as early as the Sophomore year in college; but it may be begun later; and candidates who have not studied the Greek language will not be rejected on that account. A student who has had a broad general culture, and has done very well in classics, history, biology, or mathematics, may expect to succeed in the comparative study of literature.

Good doctoral dissertations will be accepted for publication in the *Cornell Studies in English.*

1. *Modern Writers on Art.* Throughout the year, three hours a term.

2. *English Translations of Greek and Latin Classics.* Throughout the year, three hours a term.

3. **Old and Middle English.** Professor Cooper. Throughout the year. M W F 10. Goldwin Smith 127.

A study of the foundations of the English language and literature. The work of the second term deals partly with Chaucer. Students may be admitted at the beginning of either term. The course will be of service to prospective teachers in the secondary schools.

4. **Principles of Literary Criticism.** Professor Cooper. Throughout the year. W 11–12:50. Goldwin Smith 127.

A study of the chief theories of poetry, and chief kinds of literature, with illustrations drawn from writers both ancient and modern. This and the following courses are mainly designed for prospective college and university teachers.

5. **Dante in English.** Professor Cooper. Throughout the year. M 11–12:50. Goldwin Smith 127. Given in alternate years.

Reading for the sake of literary and historical perspective, followed by a more intensive study of select cantos of the *Commedia.* A knowledge of Italian is not required.

[6. **Methods of Literary and Linguistic Study.** Professor Cooper. Throughout the year. Given in alternate years, not given in 1933–34.]

Reading in the *Encyklopädie* of August Boeckh, followed by a study of more recent treatises with special reference to the ancient classics and English.]

7. **Chaucer Seminary.** Professor Cooper. Throughout the year. Tuesday, 7:30 p. m. English Seminary Room.

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

## *RHETORIC AND PUBLIC SPEAKING: DRAMATIC PRODUCTION

*Professors* A. M. Drummond, G. B. Muchmore, H. A. Wichelns, Harry Caplan, W. H. Stainton, R. H. Wagner, and C. K. Thomas.

The chief aim of graduate work in rhetoric and in dramatic production is to develop competent investigators and teachers for colleges and universities.

Candidates should have the background of a thorough undergraduate course centering in literature, history, and philosophy; should be able to speak and write good English; should have reasonable proficiency in public

speaking and reading; and should be conversant with the literature of their chosen field. Candidates for the Master's degree should have a reading knowledge of French or of German; candidates for the Doctor's degree must, before admittance to candidacy, demonstrate their ability to make use of French and of German. Applicants are advised to enter into correspondence as to their qualifications well in advance of the date at which they propose to begin residence.

All candidates must attain a reasonable knowledge of speech training and phonetics; must acquire a specialist's knowledge of the literature and history of their chosen field, and must accomplish satisfactory work in research. In most cases, the work will require more than the minimum periods of residence. For the Doctor's degree, residence in this University during two academic years will be necessary.

Properly qualified students may select Speech Training and Phonetics as a minor subject.

Candidates for the Doctor's degree whose major interest is in Rhetoric, that is, in the principles, history, and criticism of public address, will be advised to make English Literature one of their minor subjects.

Candidates for the Doctor's degree whose major interest is in Drama and the Theatre will be required to take Dramatic Literature as a minor subject, unless they have already pursued systematic study in this field. Candidates for the Master's degree in Dramatic Production will require at least one academic year and one summer session of residence, and may attain the doctorate in Drama and the Theatre only after two additional years and an additional summer. Opportunities for theatre practice of which students will be expected to avail themselves are afforded by various branches of the University Theatre, especially by the Laboratory Theatre and the Summer Theatre.

[15. **Advanced Public Speaking.** Assistant Professor MUCHMORE. Not given in 1933–34.]

16. **Forms of Address.** Second term. Assistant Professor MUCHMORE. M W F 10. Goldwin Smith.

[21. **History of Rhetoric and Oratory.** Professor WICHELNS. Not given in 1933–34.]

23. **Classical Rhetoric.** First term. Professor WICHELNS. T 2–4. Goldwin Smith 236.

A study, in English translation, of ancient theories of public address, with special reference to Aristotle, Cicero, and Quintilian.

24. **Public Opinion and the Method of Argument.** Second term. Professor WICHELNS. T 11; Th 11–1. Goldwin Smith 248.

Public opinion and its formation studied with reference to the modern theory and practice of public address.

25. **British Orators.** First term. Assistant Professor WAGNER. T 11; Th 11–1. Goldwin Smith 248.

[27. **American Orators.** Professor WICHELNS. Not given in 1933–34.]

30. *Phonetics and Speech Training.* Three hours a week, first term.

31. **Advanced Phonetics and Speech Training.** Second term. Assistant Professor THOMAS. T Th S 10. Goldwin Smith 26.

Principles of general phonetics; regional variations and historical changes in standards of speech; methods of improving normal and defective speech.

41. **Dramatic Interpretation.** First term. Assistant Professor STAINTON. M W F 12. Morse, Stage Laboratory.

Dramatic interpretation and the related principles of stage direction and production.

42. **Advanced Dramatic Interpretation.** Throughout the year. Professor DRUMMOND. Th 4–6. Morse, Stage Laboratory.

A practice course in direction, rehearsal, and acting, leading to public presentations in the Laboratory Theatre; special attention to oral interpretation.

45. **Dramatic Production: Stagecraft.** Second term. Assistant Professor STAINTON. M W 12. Laboratory, T 1:40–4 or as arranged. Morse, Stage Laboratory.

The theory and practice of stage production.

[48. **History of the Theatre.** Professor DRUMMOND. Not given in 1933–34.]

49. **Playwriting.** Throughout the year. Professor DRUMMOND. T Th 12. Goldwin Smith 242.

51. **Problems and Methods.** First term. Professor DRUMMOND. W 2–4. Goldwin Smith 242.

A survey of fundamental ideas on the practice and pedagogy of public speaking, speech training, and dramatic production.

**Classical and Medieval Rhetoric.** Professor CAPLAN. See Greek 33.

**Dramatic Literature.** See especially English 90 and 150. Professor STRUNK.

*Seminary Courses*

[60. **Rhetorical Criticism.** Professor WICHELNS. Not given in 1933–34.]

61. **English and American Theories of Public Address.** W 2–4. Goldwin Smith 235.

[62. **Philosophy of Rhetoric.** Professor WICHELNS. Not given in 1933–34.]

63. **Speech Training.** Assistant Professor THOMAS. W 2–4. Goldwin Smith 23.

General phonetics: methods of speech improvement; theory of voice and speech.

66. **Dramatic Production.** Second term. Professor DRUMMOND. W 2–4. Goldwin Smith 242.

A study of the chief theories of dramatic production in relation to aesthetic principles.

[67. **Dramatic Art.** Professor DRUMMOND. Not given in 1933–34.]

68. **Modern Theories of Stage Presentation.** Assistant Professor STAINTON. Th 2–4. Morse, Stage Laboratory.

## GERMANIC LANGUAGES AND LITERATURES

### *GERMAN

*Professors* A. B. FAUST, A. W. BOESCHE, P. R. POPE, and A. L. ANDREWS.

In the advanced courses in this subject the work is twofold, literary and philological. The history of German literature from the earliest period to the present day is sketched in outline lecture courses with collateral reading. Special topics are selected for detailed study such as the epic and lyric poetry of the Middle High German period, the literature of the Reformation, the classical period, the drama of the nineteenth century, and contemporary literature. The courses offered in philology include the study of Gothic and of Old and Middle High German. They also afford an introduction to the science of language.

The seminaries in German literature and philology aim to impart the principles and methods of investigation. A teacher's course deals with classroom methods and theories of instruction in the modern languages.

All the work in German is greatly facilitated by an exceptional library equipment. The nucleus was formed by the acquisition of the Zarncke library, one of the largest collections of rare books for the study of German literature and philology ever brought to America. With constant enlargements the library has become one of the most serviceable in the country. The German seminary room in the University Library contains books for ready reference, including philological journals and reviews.

Candidates for advanced degrees in German are expected to have an adequate knowledge of French and Latin. A fellowship in German is awarded annually.

*For Graduates and Undergraduates*

[11. *Schiller's Dramas.* Professor ANDREWS. Three hours a week, first term. Not given in 1933–34.]

12. *Schiller's Poems.* Professor BOESCHE. Three hours a week, second term.

13. *Goethe's Life and Works.* Professor BOESCHE. Three hours a week, first term.

14. *Goethe's Faust.* Professor FAUST. Three hours a week, second term.

15. *Survey of German Literature.* Professor FAUST. Three hours a week, both terms.

[17. *Nineteenth Century Drama.* Professor POPE. Three hours a week, both terms. Not given in 1933–34.]

18. *Lessing's Life and Works.* Professor POPE. Three hours a week, first term.

[19. *Heine's Life and Works.* Professor BOESCHE. Three hours a week, second term. Not given in 1933–34.]

20. *Introduction to German Folklore.* Dr. HIEBLE. Three hours a week, second term.

21. *Deutsche Kulturkunde.* Dr. KUBLER. Three hours a week, second term.

[25. *Wagner's Life and Works.* Professor POPE. Three hours a week, second term. Not given in 1933–34.]

35. *Historical German Syntax.* Professor BOESCHE. Two hours a week, second term.

[40. *Teacher's Course in Methods.* Professor FAUST. Three hours a week, first term. Not given in 1933–34.]

*Primarily for Graduates*

16. **Contemporary German Literature.** Prerequisite, German 1–5, or the equivalent. Professor FAUST. Throughout the year. Credit three hours a term. M W F 10. Goldwin Smith 181.

A study of the literature of Modern Germany since 1880, including foreign influences. Lectures in German, collateral readings, reports, and investigations.

[30. **Der deutsche Einschlag in der Bevölkerung der Vereinigten Staaten. Geschichtliche Entwickelung und Bedeutung im Aufbau des amerikanischen Volkes. Kulturelle und literarische Beziehungen.** Prerequisite, German 15, or the equivalent. Professor FAUST. First term. Three hours a week.

Lectures in German; collateral reading in German. Alternating with course 16 in successive years. Not given in 1933–34.]

37. **Middle High German.** Prerequisites, German 10 and six hours of literature. Professor POPE. Three hours a week. Both terms. T Th S 12. Goldwin Smith 182.

42. **Gothic.** Professor BOESCHE. Three hours a week. First term. Streitberg's *Gotisches Elementarbuch: Die Gotische Bibel,* ed. by Streitberg. This course will serve as a general introduction to Germanic philology.

43. **Old High German.** Prerequisite, German 37. Professor BOESCHE. Three hours a week. Second term. Braune's *Althochdeutsche Grammatik* and *Althochdeutsches Lesebuch.* A study, mainly linguistic, of the oldest German texts. It should be preceded by the course in Gothic.

[47. **Germanic Antiquities.** Prerequisite, Gothic. Professor ANDREWS. Second term. One hour a week. A consideration of the sources of knowledge of the Germanic people up to and including the migrations. Not given in 1933–34.]

[48. **Principles of Germanic Philology.** Professor ANDREWS. Two hours a week. Second term. A discussion of the fundamental principles of linguistic

relationships within the old Germanic dialects. Lectures and illustrative problems. This course should be preceded by those in Gothic and Old High German. Not given in 1933–34.]

49-50. **Seminary in German Literature.** Two hours a week, Thursday 3–5. First term, Professor FAUST; second term, Professor POPE. Goldwin Smith 181. A study of special literary problems, as: Der junge Goethe; Goethe's *Faust* II; Lessing's *Hamburgische Dramaturgie;* the Modern "Sturm und Drang" Period; German-American Literature; Problems in German Literature since 1880.

52. **Seminary in German Philology.** Professor BOESCHE. A detailed study of early German texts such as the smaller Old High German poems, or of questions in Historical German Syntax. F 3–5. Goldwin Smith 188.

## *SCANDINAVIAN LANGUAGES AND LITERATURES

*Professor* HALLDÓR HERMANNSSON.

The Fiske Icelandic Collection of the University Library, comprising about 20,000 books and pamphlets, offers excellent facilities for advanced work in Old Norse-Icelandic language and literature, Norse mythology and heroic legends, runology, and early Scandinavian history, as well as in Modern Icelandic language and literature. The library also has a small collection of books on the other modern Scandinavian languages and literatures to which some additions are made annually.

1. **Old Icelandic.** Second term. T Th S 11. Library, Greek and Latin seminary.

2. **Modern Icelandic.** Second term. Three hours a week. Hours to be arranged.

3. **Danish and Dano-Norwegian.** First term. Three hours a week. Given in alternate years.

4. **Swedish.** First term. Three hours a week. Given in alternate years.

5. **Old Norse-Icelandic Literature.** First term. Two hours a week. Given in alternate years.

6. **Modern Scandinavian Literature.** Second term. W F 12. Boardman Hall.

7. **Early Scandinavian Civilization and History.** Second term. Two hours a week. Given in alternate years.

Lectures dealing especially with Old Norse mythology and the Viking Age.

## ROMANCE LANGUAGES AND LITERATURES

*Professors* J. F. MASON, G. L. HAMILTON, LAURENCE PUMPELLY, G. I. DALE, and M. G. BISHOP.

The collection of French and Spanish books in the University Library is very large, and offers excellent facilities for advanced work. Objects of special pride are the unrivalled Dante and Petrarch collections, the gift of the late Willard Fiske, who likewise presented to the University a unique collection of Rhaeto-Romance works. Smaller collections of Portuguese, Provençal, and Catalan books are also to be found in the University Library. The seminary library contains several thousand volumes including many sets of bound periodicals. A university fellowship in Romance languages (of the value of $400 and free tuition) is annually awarded. This fellowship is ordinarily awarded only to an applicant who has had one year or more of graduate study.

The courses of study in this department are divided into three categories: those intended primarily for undergraduates, those intended alike for undergraduates and graduates, and those intended primarily for graduates. All candidates for advanced degrees in this department must possess a thorough reading knowledge of Latin, French, and German, before announcing their candidacy.

A graduate student in Romance languages should have completed some formal course of study in the language and literature of the language which he intends to select as his major subject, and should have a reading knowledge at least of the languages which he selects as his minor subjects.

A candidate for the degree of Master of Arts whose major subject is in Romance languages is expected to present for the approval of the chairman of the Special Committee, within two weeks after registration day, an outline of the work planned for the year. The thesis must, before May 1, be submitted for the criticism of the chairman of the candidate's Special Committee. If not already taken, a course in the philology of the language which constitutes their major subject is required of graduate students in their first year of study.

Candidates for the degree of Doctor of Philosophy are expected to follow advanced courses given in the field in which their major subject lies and to take up such work as will give a comprehensive view of the fields in which their minor subjects lie. It is intended that the last year of preparation for this degree shall be spent chiefly upon the thesis. Further information may be obtained from the professors in this department.

## *FRENCH

*Professors* MASON, HAMILTON, PUMPELLY, and BISHOP.

16. *History of French Literature.* Throughout the year. Professor MASON. M W F 11. Goldwin Smith B.

Lectures on French Literature since the Middle Ages.

17. *Literature of the Seventeenth Century.* Throughout the year. Assistant Professor BISHOP. M W F 11. Goldwin Smith 281.

[18. *Literature of the Eighteenth Century.* Throughout the year. Professor ————. M W F 11. Goldwin Smith 281. Not given in 1933–34.]

19. *The Romantic Movement in French Literature.* Throughout the year. Professor MASON. M W F 9. Goldwin Smith 290.

23. **French Historical Grammar.** First term. Professor PUMPELLY. T Th 10. Goldwin Smith 277.

Lectures on the historical development of French from its origins to the present. Primarily for students intending to teach French.

[24. **French Philology.** Throughout the year. College entrance Latin or its equivalent is a prerequisite. Professor PUMPELLY. T 10, Th 2. Goldwin Smith 277.

Lectures on the historical development of the French language, with a detailed phonological and morphological study of the *Chanson de Roland.* Not given in 1933–34.]

[31. *Literature of the Sixteenth Century.* Throughout the year. Assistant Professor BISHOP. T Th 12. Goldwin Smith 283. Not given in 1933–34.]

[41. **Old French Texts.** First term. Hours and room to be arranged. Professor HAMILTON. Not given in 1933–34.]

43. **Old Provençal Philology and Literature.** Second term. Hours and room to be arranged. Professor HAMILTON.

47. **Modern French Seminary.** Throughout the year. Professor MASON. T 2:30. Library, French Seminary.

## *ITALIAN

*Professor* HAMILTON.

14. *Italian Poetry.* Throughout the year. Professor HAMILTON. T Th 11. Goldwin Smith 281.

Dante, *Divina Commedia;* Leopardi, *Rime;* Carducci, *Poesie,* will be read in class. Readings and reports for extra-class work.

15. *The Literature of the Italian Renaissance.* Second term. Professor HAMILTON. Hours and room to be arranged.

Petrarch, *Rime;* Machiavelli, *Principe;* Ariosto, *Orlando Furioso.* Outside readings and reports.

### *SPANISH

*Professor* DALE

10. *History of Spanish Literature.* Throughout the year. Professor DALE. M W F 12. Goldwin Smith 283.

15. *Drama of the Golden Age.* First term. Professor DALE. T Th S 11. Goldwin Smith 277.

17. *Cervantes.* Second term. Professor DALE. T Th S 11. Goldwin Smith 277.

[41. **Old Spanish.** Throughout the year. Professor DALE. Not given in 1933–34.]

[42. **Calderón and Alarcón.** Throughout the year. Professor DALE. Not given in 1933–34.]

43. **The Picaresque Novel.** Throughout the year. Professor DALE. Th 2:15. Library, Spanish Seminary.

## HISTORY; AND POLITICAL, ECONOMIC, AND SOCIAL SCIENCE

The subjects of history, economics and government have been united since 1887 in the President White School of History and Political Science, which bears the name of the first president of the University in especial recognition of the gift of this valuable collection of historical literature to the University Library.

The aims of the President White School are threefold: first, the advancement of knowledge by investigation and publication in the fields of history, economics, politics, jurisprudence, and social science; second, the training of scholars and teachers in these departments of study; third, the training of men and women for the public service, for business, and for professions such as law, journalism, and philanthropy.

### HISTORY

*Professors* J. P. BRETZ, CARL BECKER, PRESERVED SMITH, M. L. W. LAISTNER, A. P. WHITAKER, CARL STEPHENSON, and F. G. MARCHAM.

A graduate student in history should have a sufficient knowledge of general history and of geography. He should be able to speak and write good English. He should have a reading knowledge of French, of German, and of any other language necessary for the thorough study of his special subject. For work in Medieval History he would need a knowledge of Latin, and for Ancient History both Latin and Greek. It is highly desirable that he should have had the necessary linguistic training as an undergraduate; but deficiencies in this respect may sometimes be made up after entering upon graduate work.

The University Library contains ninety or a hundred thousand volumes dealing with history. In large part these are to be found in the room known as the White Historical Library to which graduate students have immediate access. The historical seminary rooms in the library building are furnished with atlases, dictionaries, bibliographies, and other works of reference, and afford access to the shelves of the Library proper.

It has been from the outset the policy of the University, while providing adequately for the symmetrical growth of the Library, to acquire private collections of books which eminent scholars have through a lifetime of study built up as their tools of research. Thus, for the study of Oriental History, Cornell has been endowed with the EISENLOHR COLLECTION on the history of Egypt,

with the WASON COLLECTION on the history and the civilization of China, and with that of President White on the history of Palestine. For the study of the Graeco-Roman world, it acquired that of Charles Anthon. For the Middle Ages, it has notable bodies of books on the birth of the Papal state, on the rise of the Carolingian empire, and in general on the relations of Church and State. For the Renaissance, it can boast the unrivaled FISKE COLLECTIONS on Dante and Petrarch and the world of their time. For the age of the Reformation, for the history of superstition and persecution (notably for Inquisition and Index, for the story of witchcraft, for the beginnings of the sciences, for the rise of tolerance), it is equipped with the riches of the PRESIDENT WHITE LIBRARY; and for the study of the French Revolution that library has no equal on this side of the Atlantic, if anywhere outside of France. For the history of America, the University possesses the library of the historian Jared Sparks, with the MAY COLLECTION on American slavery and the SCAIFE COLLECTION on the Civil War. Professor GOLDWIN SMITH enriched it with his working library of English history; it obtained that of Professor Tuttle on Prussia; from Professor Fiske came one singularly complete on Iceland. In a multitude of other fields it has been found possible to gather for the special student materials for exhaustive research. Many of these collections are endowed with special funds for their increase; and all have been steadily built up with an eye to the needs of the mature student of history.

Three fellowships and a scholarship are annually awarded to graduate students of history. The President White Fellowship in Modern European History has a value of $500. It may be granted as a travelling fellowship. The fellowship in American History amounts to $400. The stipend of the George C. Boldt Fellowship in History is $1,000. The Graduate Scholarship in History amounts to $200. Holders of fellowships and graduate scholarships are exempt from the payment of tuition. There are several assistantships in history, which are filled preferably by the appointment of graduate students.

Fellowships are ordinarily awarded only to applicants who have had one year or more of graduate study. It will hardly be worth while for persons who have not had a year of graduate study to apply unless they can submit written work of superior quality.

A seminary is conducted in each of the major fields of history and each professor is willing to direct research in his special field.

General courses, not enumerated here, are offered in oriental, ancient, medieval, modern European and English history and in American history, both political and economic. These are intended for undergraduates, but, if supplemented by individual work, one or another of them may sometimes serve the purposes of a graduate student.

## *ANCIENT HISTORY

*Professor* M. L. W. LAISTNER.

*For Graduates only*

1. (14) **Seminary in Roman Historical Inscriptions.** Throughout the year. M 2–4. University Library, Classical Seminary. A reading knowledge of Latin is essential.

[2. (6) **Seminary in Greek and Roman Historiography.** Throughout the year. M 2–4. Boardman 4. Not given in 1933–34.]

*Courses open to Graduates and Undergraduates*

2. (3) *Greek History, 500–323 B. C.* Second term. M W F 11. Boardman E.

[4. (4) *The Roman Empire, 30 B. C.–180 A. D.* Second term. M W F 11. Not given in 1933–34.]

[5. (5) *The Roman Republic, 133–30 B. C.* First term. M W F 11. Not given in 1933–34.]

6. (7) *The History of Education (Greek, Roman, and Early Mediaeval).* First term. T Th 10. Boardman E.

The theory and practice of education in the Greek and Roman World and in the early Middle Ages in the West to the Carolingian Revival.

NOTE: The figures in parenthesis are the numbers of the courses and seminars in the Announcement of the College of Arts and Sciences.

## *MEDIAEVAL HISTORY

*Professor* CARL STEPHENSON.

*21. *Mediaeval History.* Professor STEPHENSON.

23. **Mediaeval Thought.** Second term. Credit two hours. Prerequisite: History 21 or equivalent. Professor STEPHENSON. T Th 10. Boardman D.

Discussions, lectures, and illustrative reading on the intellectual development of Europe from the 11th to the 14th century.

25. **Seminary in Mediaeval History.** Throughout the year. Credit four hours on completion of the course. Primarily for graduate students. Prerequisite: reading knowledge of Latin; German and French desirable. Professor STEPHENSON. Hours to be arranged.

65a. **History of the English Constitution to 1307.** First term. Credit two hours. Professor STEPHENSON. T Th 10. Goldwin Smith 221. Not open to freshmen.

A study of English institutions, emphasizing the formative period after the Norman Conquest and including a sketch of legal development.

## *ENGLISH HISTORY

*Professor* F. G. MARCHAM.

61. *English History.* Three hours a week, throughout the year.

65b. *History of the English Constitution since 1307.* Second term. T Th 2. Boardman C. Not open to freshmen. A study of English governmental institutions in the modern era and of the political ideas underlying them.

66a and b. *History of England under the Tudors and Stuarts.* Three hours a week, throughout the year. Given in alternate years.

[67 and 68. *History of England from the Eighteenth Century to Present.* Three hours a week, throughout the year. Given in alternate years, not in 1933–34.]

69. **Seminary in Tudor and Stuart History.** Professor MARCHAM. Throughout the year. Study of materials for research in Tudor and Stuart history, and of some of the leading historical problems of the period, centering around a person of general importance.

## *RENAISSANCE AND REFORMATION HISTORY

*Professor* PRESERVED SMITH.

Though Professor Smith offers courses only during the second term of each year, he resides at Ithaca most of the time, and is glad to give conferences and to supervise the preparation of theses even while not teaching.

32. *The Age of the Renaissance and Reformation.*

36. *History of Education (Late Mediaeval and Modern).*

[33. *History of Culture from the Renaissance to the Enlightenment.* Not given in 1933–34.]

[34. **Historical Method.** Second term. Prerequisite, a reading knowledge of either French or German. Not given in 1933–34.]

35. **Church History.** Second term. Prerequisite, a reading knowledge of Latin. European History Seminary Room, Library. S 10–12.

The sources of the modern history of Christianity will be investigated and the most important will be read in the original languages.

## *MODERN EUROPEAN HISTORY

*Professor* CARL BECKER.

*For Undergraduates*

42. *Modern History,* 1600–1930.

*For Graduates and Undergraduates*

**The Napoleonic Era.** A study of the organization of France under Napoleon, the establishment of the empire, and the restoration of Europe in 1814–15.

**The French Revolution.** A study of French society before 1789, and of the Revolution from 1789 to 1795.

*Primarily for Graduates*

**Seminary in Modern European History.** Offers an opportunity to do research in the original sources for the French Revolution or in some closely related field of modern history.

## *AMERICAN HISTORY

*Professors* J. P. BRETZ and A. P. WHITAKER.

82. *American History, 1783–1850.* First term. Three hours a week. Professor WHITAKER.

83. *American History, 1850–1914.* Second term. Three hours a week. Professor WHITAKER.

86. *American History, 1787–1848.* Second term. Three hours a week. Professor BRETZ.

89. **American History, 1750–1848:** The Settlement of the Middle West. Second term. Two hours a week. Prerequisite, History 82, 83, or the equivalent. Upperclassmen and graduates. Professor BRETZ. T Th 9. Boardman E.

93. **Spanish America, 1492–1808.** Throughout the year. Two hours a week. Prerequisite, History 82, 83 or the equivalent. Upperclassmen and graduates. Professor WHITAKER. T Th 11. Boardman E.

99. **Seminary in American History.** Throughout the year. Two hours a week. Professor WHITAKER. Hours to be arranged. Library, American History Room. First meeting, Monday, October 2, 4 p. m.

## *GOVERNMENT

*Professors* R. E. CUSHMAN, G. E. G. CATLIN, and H. W. BRIGGS.

Graduate courses in government afford an opportunity to students to carry on research in that field. As preparation for such work a familiarity with the essentials of American political institutions and of the principal systems of European government is assumed, as well as at least an elementary knowledge of American and English or European history. For 1933–34 research in government will be directed primarily in the fields of American Constitutional Law, Political Theory and International Law and Relations, although topics relating more generally to American or European governmental institutions and political problems may also be selected.

The attention of students desiring to do graduate work in the various fields of public law is directed to the opportunities open to them in the Law School. The courses in that School in Administrative Law, Constitutional Law, International Law, Jurisprudence, Municipal Corporations, Public Service and Carriers, and Trade Regulation, may be elected by graduate students with the con-

sent of the professors in charge. (See Announcement of the Law School.) The members of the faculty of the Law School are willing to cooperate in directing the researches of students in their several fields, and to serve as members of the special committees of such students.

*Primarily for Undergraduates*

1. *American Government.* Three hours a week. Throughout the year.
2. *Comparative Government.* Three hours a week. First term.
8. *History of Political Thought.* Three hours a week. Second term.
9. *Introduction to International Relations.* Three hours a week. First term.

*For Graduates and Undergraduates*

10. **Political Theory.** Second term. Credit three hours. Open to qualified upperclassmen. Consult the instructor before registering. Professor CATLIN. M F 2 and other hour to be arranged. Boardman D.

Nineteenth century and contemporary political theory; the theory of authority, sovereignty, and liberty; toleration and censorship; aristocracy and representative government.

11. **Political Institutions.** Second term. Credit three hours. Professor CATLIN. M W F 11. Boardman A.

A study of the development and structure of certain political institutions, and of their function in modern society.

14. **International Law.** Throughout the year. Credit three hours a term. Completion of first term is prerequisite to second. Open to qualified upperclassmen. Assistant Professor BRIGGS. M W F 12. Boardman D.

The nature and basis of international law; the application of international law in municipal and international courts; the general principles of the law of nations. Cases, readings, and discussions.

15. **International Organization.** Second term. Credit three hours. Open to upperclassmen, and to sophomores who have completed Government 9. Assistant Professor BRIGGS. M W F 9. Boardman A.

International administrative agencies; collective political intervention; internatonal legislation; the organization and working of the League of Nations; the Permanent Court of International Justice.

[16. **Contemporary American Foreign Policy.** Second term. Credit three hours. Open to upperclassmen, and to sophomores who have completed Government 9. Assistant Professor BRIGGS. M W F 9. Boardman A.

The foreign relations of the United States during the 20th century; our Caribbean policy; the limitation of armaments; post-war relations with Europe and the Far East. Not given in 1933–34.]

20. **Constitutional Law: The American Federal System.** First term. Credit three hours. Open to upperclassmen. Prerequisite, both terms of Government 1 or the consent of the instructor. Professor CUSHMAN. T Th S 11. Goldwin Smith 142.

Judicial interpretation of the constitution: the nature of judicial review; separation of governmental powers; relations between state and national government; construction of national powers.

[21. **Constitutional Law: Fundamental Rights and Immunities.** Second term. Credit three hours. Open to upperclassmen. Prerequisite, Government 20 or the consent of the instructor. Professor CUSHMAN. T Th S 11. Goldwin Smith 142.

Privileges and immunities of citizenship; protection of civil and political rights; the obligation of contracts; due process of law and the equal protection of the law. Not given in 1933–34.]

12. **History of Political Theory.** (See Philosophy 10).
25. **Social, Legal, and Political Ethics.** (See Philosophy 7a).
26. **Trade Unionism and Labor Law.** (See Economics 42).

*Primarily for Graduates*

**Seminary in Constitutional Problems.** Professor CUSHMAN. First term only in 1933–34. Problems of current interest in American Constitutional Law will be selected for individual research. Students will be admitted upon consultation with the instructor.

**Seminary in International Law and International Organization.** Assistant Professor BRIGGS. Throughout the year. Students will be admitted upon consultation with the instructor.

**Seminary in Political Theory.** Professor CATLIN. Second term. Discussion of papers on problems of contemporary political theory.

**Seminary in Political Theory.** Professor SABINE. Throughout the year. W 2. Goldwin Smith 220. Topic for the year 1933–34: England in the 17th Century. (See Philosophy 43.)

## ECONOMICS

*Professors* DONALD ENGLISH, P. T. HOMAN, E. A. J. JOHNSON, M. S. KENDRICK, R. E. MONTGOMERY, P. M. O'LEARY, H. L. REED, F. A. SOUTHARD, J. L. WOODWARD.

For purposes of graduate study the work in Economics is divided as follows: Economic Theory and its History; Money, Banking and International Finance; Economic History; Labor and Industrial Relations; Organization and Control of Industry; Public Finance. Any one of these may constitute a major or a minor subject. Every candidate for the Ph.D. or M.A. degree who does not elect "Economic Theory and its History" as a major or a minor subject will be held for certain required work in that subject.

*Requirements for the Degree of Ph.D. in the several fields of study.*

### *ECONOMIC THEORY AND ITS HISTORY

When offered as a major: (1) a good general knowledge of the history of economic thought including the classical school and its critics, the more recent important schools of thought, and the principal contemporary theorists; (2) familiarity with the methods of economic analysis and with controversial areas of thought; (3) a detailed knowledge of some period or school together with necessary historical and intellectual background thereto; (4) a knowledge of social and intellectual history sufficient to form a background for an understanding of the development of economic thought.

When offered as a minor: Parts 1, 2 and 4 of above requirement.

### *MONEY, BANKING, AND INTERNATIONAL FINANCE

When offered as a major: (1) a detailed understanding of the theory and history of money; monetary system of the U. S.; theory and history of banking; present banking system of the U. S.; foreign exchange; monetary aspects of cyclical fluctuations; (2) an understanding of leading monetary systems of the world; modern central banking theory and practice; banking systems of Canada, England, France, and Germany; international movement of capital.

When offered as a minor: Part 1 of above requirement.

### *ECONOMIC HISTORY

When offered as a major: (1) a comprehensive knowledge of the evolution of agriculture, industry and commerce in ancient and mediaeval times together with an understanding of contemporaneous economic ideas; (2) a comprehensive knowledge of economic history of modern times (in Western World) together

with an understanding of intellectual and political movements which have influenced the development of modern economic institutions; (3) a detailed knowledge of at least one special phase of economic history; (4) a knowledge of the bibliography of economic history and ability to appraise the more important generalizations of economic history.

When offered as a minor: Parts 2 and 3 of above requirement.

## *LABOR AND INDUSTRIAL RELATIONS

When offered as a major: A good general knowledge of the following divisions of the field of Labor and Industrial Relations and the literature pertaining to each: (1) trade unionism, collective bargaining and industrial arbitration; (2) history, theory and application of labor law; (3) labor management and personnel problems; (4) the national income, its sources and distribution; (5) labor movements and dissenting or protesting economic thought; (6) social insurance. As a background the candidate should have a grasp of the general field of labor conditions and problems, evolution of the wage system, basic material with respect to wage trends, physical production trends, distribution of wealth and income, and the general field of social legislation, together with demonstrated ability to apply quantitative and theoretical methods to problems in the field of industrial relations.

When offered as a minor: two or three of the divisions listed above.

## *ORGANIZATION AND CONTROL OF INDUSTRY

When offered as a major: (1) a good general knowledge of the organization of industry; (2) an understanding of the problems of control arising in connection with transportation, public utilities and industrial combinations; (3) a detailed knowledge of organization and problems of control in one of the above three general areas of industry; (4) a knowledge of accounting and corporation finance and, in specific cases, of statistics; (5) a knowledge of constitutional law.

When offered as a minor: Part 1 and a knowledge of corporation finance, accounting, and the problems of control in one general area of industry; and a *detailed* knowledge of accounting *or* corporation finance *or* the problems of control in one general area of industry.

## *PUBLIC FINANCE

When offered as a major: (1) a thorough knowledge of the principles and problems of public expenditures and revenues, and of governmental financial policies; (2) an adequate grasp of the facts concerning federal, state, and local public finance in the U. S.; (3) an understanding of these facts in terms of the problems which arise out of them; (4) ability to evaluate ways and means of solving these problems; (5) a broad understanding of the place of public finance in the economic and political order; (6) such specialized knowledge as may be needed for the preparation of a thesis. [Candidates should be grounded in accounting, statistics, finance, and government. Knowledge of the law of taxation, comparative systems of public finance, financial history, and social and political ethics is desirable.]

When offered as a minor: Parts 1 and 5 of the above requirements.

## *Requirements for the Degree of M.A. in the several fields of study.*

Graduate students offering any of the several fields in economics as a major or minor for the M.A. degree should consult with members of the Department of Economics to ascertain the exact requirements. In general, the major requirements for the M.A. degree are substantially the equivalent of the minor requirements for the Ph.D. degree.

Three fellowships are awarded annually to graduate students in Economics and Government. The President White Fellowship in Political and Social Science has a stipend of $500 and each of the other fellowships has a stipend of $400. The two fellowships in Political Economy may be combined into one fellowship in any single year. In addition there are several assistantships, which are open to graduate students.

The Cornell-Brookings Fellowship: A stipend of $500, made available by the Brookings Institution of Washington, D. C., may be combined with the stipend of either the President White Fellowship in Political and Social Science or one of the Fellowships in Political Economy to make a Cornell-Brookings Fellowship, the stipend of which may vary from $950 to $1150. The Cornell-Brookings Fellowship will usually be granted only to a student of economics or government in his third year of graduate study, and will be held in residence at the Brookings Institution. The holder of the Fellowship must be regularly registered in the Graduate School of Cornell University.

1. *Modern Economic Society.* Five hours a week, either term.

2a. *Modern Economic Society.* Three hours a week, first term.

2b. *Modern Economic Society.* Three hours a week, second term.

3. *Introduction to Economics.* For students in Engineering and Chemistry. Three hours a week, either term.

11. *Money and Banking.* Three hours a week, either term.

12. *Financial History of the United States.* Three hours a week, second term.

13. *Corporation and Investment Finance.* Three hours a week, first term.

14. *The Federal Reserve System.* Three hours a week, first term.

15. *Trade Fluctuations.* Three hours a week, second term.

16. **Money and Credit.** Professor REED. Prerequisite, Economics 11, 14, 15. Throughout the year, Th 2–4.

A study of some of the more intricate phases of monetary and banking theory.

21a. *Accounting.* Three hours a week, either term.

21b. *Accounting.* Three hours a week, either term.

25. *Cost Accounting.* Two hours a week, first term.

26. **Accounting Theory and Problems.** Professor ENGLISH. Prerequisite Economics 21b, or its equivalent. Second term. M W F 9.

A critical study of the fundamental principles underlying accounting procedure. The solution of typical problems in corporate consolidation, reorganization, and liquidation, and in other special fields.

31. *Transportation and Communication.* Three hours a week, first term.

33. *Public Utilities.* Three hours a week, first term.

35. *Industrial Combinations.* Three hours a week, second term.

36. *Taxation.* Three hours a week, second term.

41. *Labor Conditions and Problems.* Three hours a week, first term.

42. *Trade Unionism and Collective Bargaining.* Three hours a week, second term.

[44. *Labor Management and Personnel Problems.* Three hours a week, second term. Given in alternate years, not in 1933–34.]

45. *The Economics of Dissent.* Two hours a week, first term.

46. **Legal and Constitutional Aspects of Labor Problems and Welfare Legislation.** Assistant Professor MONTGOMERY. Second term. W 2–4. Given in alternate years.

A study of the legal aspects of trade union objectives and methods and of the theory and practical operation of the more important types of social insurance.

49. **Special Problems in Industrial Relations.** Assistant Professor MONTGOMERY.

Discussion and individual investigation of current and theoretical problems in the field of industrial relations. Among the topics for individual study: collective bargaining in selected industries, the application of quantitative methods to the

study of labor problems, restatements of traditional wage theory, methods in field research, problems in the field of labor law.

50a. *Introduction to Social Science.* Three hours a week, first term.

50b. *Introduction to Social Science.* Three hours a week, second term.

51. *Population Problems.* Three hours a week, first term.

54. *The Family.* Three hours a week, second term.

71. *International Trade.* Three hours a week, first term.

72. *International Finance.* Three hours a week, second term.

81. *Economics of Enterprise.* Three hours a week, first term.

82. *National Wealth and Income.* Three hours a week, second term.

83a. *The Development of Economic Institutions.* Three hours a week, first term.

83b. *The Development of Economic Institutions.* Three hours a week, second term.

[85. **Systematic Economic Theory.** Professor HOMAN. Second term. Hours to be arranged. Given in alternate years. Not given in 1933–34.]

[86. **History and Literature of Economic Thought.** Assistant Professor JOHNSON. Throughout the year. T 2–4. Given in alternate years. Not given in 1933–34.]

87. **Contemporary Economic Thought.** Professor HOMAN. Throughout the year. Given in alternate years.

A survey of recent types of economic theory and methods of analysis.

**Seminary in Economics.** Required of all students registered for a major or minor in economics.

## AGRICULTURAL ECONOMICS AND FARM MANAGEMENT

## PRICES AND STATISTICS, FARM MANAGEMENT, RURAL ECONOMY, BUSINESS MANAGEMENT, AND MARKETING

*Professors* G. F. WARREN, G. N. LAUMAN, J. E. BOYLE, G. P. SCOVILLE, E. G. MISNER, W. I. MYERS, F. A. PEARSON, LELAND SPENCER, V. B. HART, M. P. RASMUSSEN, F. F. HILL, M. S. KENDRICK, J. F. HARRIOTT, M. C. BOND, L. M. VAUGHAN, WHITON POWELL, and M. P. CATHERWOOD.

For graduate work in the various fields here represented, a knowledge of practical agriculture, scientific agriculture, and economics is usually required. For the Doctor's Degree in these fields, a minor in economics is usually required.

All courses except 20 are primarily for graduate students or for graduates and advanced undergraduates.

### *FARM MANAGEMENT

101. **Farm Records and Accounts.** First term. Credit three hours. Lectures, T Th 8, Agricultural Economics Building 125. Laboratory, M or T 1:40–4, Agricultural Economics Building 101. Assistant Professor HARRIOTT.

Farm inventories; income-tax reports; single-enterprise cost accounts; complete farm cost accounts; interpretation of the results of cost accounts and their application in the organization and management of farms. Fee for materials furnished, $2.

102. **Farm Management.** Second term. Credit five hours. Lectures, M W F 10. Agricultural Economics Auditorium. Laboratory for graduates, F 2–4. Agricultural Economics Building 101. Professor W. I. MYERS.

Farming as a business; types of farming; combination of enterprises; size of business; rates of production; farm layout; building arrangement; labor management; machinery; marketing; ways of starting to farm; forms of tenure and leases;

choosing and buying a farm; use of capital and credit; planning, organization, and management of specific farms. Four half-day field trips are taken during April and May to visit farms in near-by regions. Fee for materials furnished, $3.

203. **Business Organization and Management of Successful New York Farms.** First term. Credit three hours. F 1:40–4, S 8–10. Agricultural Economics Building 101. Professor SCOVILLE.

During October and November all-day trips are usually taken on Saturdays. Two 2-day trips are taken, leaving Friday morning and returning Saturday night. Laboratory deposit for expenses of trips, $20.

205. **The Appraisal of Farm Land.** First term. Credit two hours. Lecture, F 9, Agricultural Economics Building 125. Laboratory, Th 1:40–4, Agricultural Economics Building 140. Assistant Professor S. W. WARREN.

A study of factors governing the price of land; and the appraisal of land for use, for sale, for purposes of making loans, and for taxation.

207. **Research Methods in Farm Management.** First term. Credit one hour. T 11. Agricultural Economics Building 101. Professor WARREN.

Attention is given to the more important methods of determining the principles of farm management and the preparation of results for publication.

208. **Research Methods in Farm Management.** Second term. Credit two hours. Th 2–4. Agricultural Economics Building 140. Professor MISNER.

The preparation and use of forms for the collection of data by the survey method. During the spring vacation several days are spent in taking farm-management survey records. The tabulation and the study of such data and preparation of results for publication.

299. **Seminar.** First and second terms. M 4:10–5:15. Agricultural Economics 401. Departmental Staff.

### *AGRICULTURAL PRICES AND STATISTICS

Attention of students is directed to Mathematics 4a, Analytical Geometry and Calculus, and to Mathematics 83, Probability and Statistics.

111. **Agricultural Statistics.** First term. Credit three hours. Lecture, M 8. Agricultural Economics Building 25. Laboratory, M 1:40–4. Agricultural Economics Building 140 and 240. Professor PEARSON.

A study of the principles involved in the collection, tabulation, and interpretation of agricultural and marketing statistics. Analysis of statistical problems with an 80-column tabulating machine. Fee for materials furnished, $3.

112. **Agricultural Statistics.** Second term. Credit three hours. Prerequisite, course 111. Lecture, M 8. Agricultural Economics Building 125. Laboratory, M 1:40–4. Agricultural Economics Building 140. Professor PEARSON.

A study of the application of probable error, sampling, gross, partial, and multiple correlation, curve fitting to problems in this field. Methods of using 80-column tabulating equipment for multiple-correlation analysis. This course is a continuation of course 111. Fee for materials furnished, $3.

115. **Agricultural Prices.** Second term. Credit three hours. Lectures, T Th 9. Agricultural Economics Building 125. Laboratory, W 1:40–4. Agricultural Economics Building 125. Professor PEARSON.

A study of prices of farm products in relation to agricultural and industrial conditions. Fee for materials furnished, $3.

### *BUSINESS MANAGEMENT

20. *Business Organization and Management.* First term. Credit three hours.

121. **Introductory Accounting.** First term. Credit three hours. Lectures, T Th 9. Agricultural Economics Building 225. Practice periods, T or W 1:40–4. Agricultural Economics Building 201. Professor POWELL.

The fundamentals of accounting; the analysis and recording of ordinary business transactions; the preparation of financial statements; the interpretation and use of accounting information. Developed mainly in terms of the merchandising business. Fee for materials furnished, $3.

122. **Advanced Accounting.** Second term. Credit three hours. Prerequisite, course 121 or its equivalent. Lectures, T Th 9. Agricultural Economics Building 225. Practice periods, T or W 1:40–4. Agricultural Economics Building 201. Professor POWELL.

A continuation of course 121. A survey of selected fields of advanced study, including accounting problems of corporations; problems of valuation; and the elements of cost accounting, with special reference to merchandising enterprises. Fee for materials furnished, $2.

127. **Business Law.** First term. Credit two hours. Lectures, T Th 12. Agricultural Economics Building 225. Mr. ALLAN H. TREMAN.

Consideration is given chiefly to legal problems of particular interest to persons who expect to engage in business, including contracts, liens, mortgages, and negotiable instruments; ownership and leasing of property; wills; estates; inheritance taxation; and other practical problems.

131. **Cooperative Marketing.** Second term. Credit three hours. Lectures, M W F 8. Agricultural Economics Building 25. Professor POWELL.

Nature, legal basis, and extent of cooperative marketing. Procedure of organization; internal structure; methods of finance; sales policies; volume of business; membership relations. Fee for materials furnished, $2.

*MARKETING

141. **Marketing.** First term. Credit four hours. Lectures, M W F 8. Agricultural Economics Building 340. Discussion groups one hour a week. Professor BOYLE.

A study of the present organization, functions, and operation of the market structure, with particular reference to agriculture. Cooperative marketing is included. Fee for materials furnished, $2.

142. **Marketing Fruits and Vegetables.** First term. Credit three hours. Lectures, M W 9. Agricultural Economics Building 225. Laboratory, Th 4–6, Agricultural Economics Building 240. Professor RASMUSSEN.

A study of the economic factors involved in the marketing of fruits and vegetables. Regional and seasonal competition; areas of distribution; methods of handling; costs of marketing; types of marketing organizations; sales methods; transportation and carrier services; produce law and methods of credit rating; terminal problems. Fee for materials furnished, $3.

143. **Marketing Dairy Products.** Second term. Credit three hours. Lectures, M W 9. Agricultural Economics Building 225. Laboratory, T 1:40–4. Agricultural Economics Building 240. Professor SPENCER.

Problems involved in the marketing of fluid milk and cream, including variations in consumption and production; adjustment of supply to demand; cooperative organization of producers; price plans and policies; disposal of surplus milk; and costs of distribution. Fee for materials furnished, $3.

146. **The Organized Exchanges and Speculation.** First term. Credit two hours. Recitations, T Th 8. Agricultural Economics Building 331. Professor BOYLE.

[147. **Marketing Trip to New York City.** Second term. Credit one hour. Professor SPENCER in charge. Representatives of other departments will cooperate in the course.] Not given in 1933–34.

The entire time of the class for a week in April is spent in New York City inspecting and studying the marketing of dairy products, of eggs and poultry, of fruits and vegetables, and of livestock and meat.

Registration fee, $7, to cover hire of busses in New York City. Total cost of trip need not exceed $30 in addition to railroad fare.

148. **Research in Marketing.** First and second terms. Credit, to be arranged. Professor BOYLE.

242. **Methods and Results of Research in Marketing.** First term. Credit two hours. W 4–6. Agricultural Economics Building 240. Professor RASMUSSEN.

A critical study of research projects in marketing, and practice in planning market research. The major part of the time is devoted to projects dealing with the marketing of fruits and vegetables.

243. **Methods and Results of Research in Marketing.** Second term. Credit two hours. W 4–6. Agricultural Economics Building 240. Professor SPENCER.

A critical study of research projects in marketing, and practice in planning market research. The major part of the time is devoted to projects dealing with the marketing of dairy products.

246. **Collective Bargaining.** Second term. Credit two hours. Lectures, T Th 8. Agricultural Economics Building 331. Professor BOYLE.

Collective bargaining and its use by labor, capital, and agriculture. The policy of collective bargaining. A study in price determination.

### *RURAL ECONOMY

150. **Taxation.** Second term. Credit three hours. Lectures, M W F 11. Agricultural Economics Building 25. Assistant Professor KENDRICK.

State and local problems connected with rural taxation. The growth of expenditures; the rise of modern tax problems; how various governmental divisions in New York and other States get their tax revenues; the general-property tax and its administration, and the special cases of personal-property, farm, and forest taxation; income, inheritance, and gasoline taxes; grants-in-aid and shared revenues; and the problem of building a system of taxation. Fee for materials furnished, $2.

151. **Public Problems of Agriculture.** Second term. Credit two hours. Lectures, T Th 11. Agricultural Economics Building 125. Professor G. F. WARREN.

A discussion of some of the more important problems of agriculture that involve collective or governmental action. Fee for materials furnished, $1.

161. **Agricultural Economics.** Second term. Credit four hours. Lectures, M W F 8. Agricultural Economics Building 325. Discussion groups one hour a week. Professor BOYLE.

A discussion of the major problems in the field of agricultural economics. A statement of these problems and the various solutions proposed.

262. **Rural Economy, Elementary Course.** First term. Credit three hours. Lectures, M W F 9, and individual conferences. Agricultural Economics Building 325. Professor LAUMAN.

A study of the factors underlying the present conditions in rural communities at home and abroad, and of forces at work in shaping the agriculture of the world, chiefly along economic lines.

263. **Rural Economy, Advanced Course.** Second term. Credit three or four hours. Prerequisite, course 262 or its equivalent. Lectures, M W F 9. Agricultural Economics Building 325. Professor LAUMAN.

A more extended study, primarily theoretical, of the general economic problems of agriculture.

269. **Rural Economy Seminary.** First and second terms. T 2:30. Agricultural Economics Building 316. Professor LAUMAN.

### *HISTORY OF AGRICULTURE

171. **History of Agriculture.** First term. Credit three hours. Lectures, M W F 11. Agricultural Economics Building 325. Professor LAUMAN.

The important phases of the development of agriculture are considered historically. Special stress is laid on the rise of the agricultural classes, on the beginnings of rational agriculture, and on modern agrarian problems.

172. **History of Agriculture in the United States.** Second term. Credit three hours. Lectures, M W F 11. Agricultural Economics Building 325. Professor LAUMAN.

This course deals with the land, its settlement, and its settlers in their economic, social, and political aspects; the technical development of agriculture; the beginnings of permanent agriculture; the rise of marketing problems and of the agrarian movements.

278. **Research in Rural Economy or History of Agriculture.** First and second terms. Credit two or three hours a term. Agricultural Economics Building 316. Professor LAUMAN.

279. **Agricultural History Seminar.** First and second terms. Th 2:30. Agricultural Economics Building 316. Professor LAUMAN.

## *ECONOMICS OF THE HOUSEHOLD

*Professors* HELEN CANON and DAY MONROE.

As a basis for graduate work in economics of the household, elementary courses in the various divisions of home economics and in economics are usually required. For the Doctor's degree a minor in economics is usually required.

26. *The Household Buyer and the Retail Market.* Two hours a week, first or second term.

27. *Household Buying Guides.* One hour a week, second term.

130. *Family Incomes.* Two hours a week, first or second term.

145. *Management of Personal and Family Finances.* Two hours a week, first or second term.

220. **Problems of Household Consumption.** Professor MONROE. First term. Credit two or three hours. F 2 to 4. Martha Van Rensselaer Hall 114.

250. **Economic Problems of the Household.** Professor CANON. Second term. Two hours a week. Hours to be arranged. Martha Van Rensselaer Hall 114.

260. **The Marketing System and the Consumer.** Professor MONROE. Second term. Credit three hours. T Th 8. Martha Van Rensselaer Hall 114. Fee for materials, $2.

## *TEXTILES AND CLOTHING AND HOUSEHOLD ART

*Professors* BEULAH BLACKMORE, MURIEL BRASIE, GRACE MORIN, and DORA W. ERWAY.

Graduate work for the Master's degree is offered in Textiles and Clothing and Household Art. The work in Textiles and Clothing may emphasize either the economic or the applied art aspects of the subject. Candidates should have a background of thorough undergraduate work in this field.

3. *Clothing Selection.* Credit two hours. First or second term.

5. *Clothing Construction.* Textiles and Construction. Credit three hours. First or second term.

10. *Clothing for Children.* Credit two hours. First or second term.

20. *Millinery.* Credit two hours. First or second term.

103. *Clothing Problems and Shop Practice.* Credit three hours. First or second term.

115. *Commercial Clothing Construction.* Credit three, four or five hours. First or second term.

1. *Color and Design.* Credit two hours. First or second term.

31. *Elementary Home Decoration and Furnishing.* Credit two hours. First or second term.

32. *Home Decoration and Furnishing.* Credit two hours. First or second term.

160c. **Special Problems.** Professors BLACKMORE and MORIN and Assistant Professors BRASIE and ERWAY. First or second term. Credit and hours to be arranged. Martha Van Rensselaer Hall.

120. **Seminary in Clothing.** Assistant Professor BRASIE and other members of the Textile and Clothing Staff. Prerequisite, Textiles and Clothing 103, or its equivalent; prerequisite or parallel, Rural Education 135, or its equivalent. Second term. Credit two hours. Martha Van Rensselaer Hall 215.

55. **Purchasing Household Textiles.** Professor BLACKMORE. Prerequisite, Textiles and Clothing 5, or its equivalent. Second term. Credit two hours. Martha Van Rensselaer Hall 213.

15. **Clothing Design and Modeling.** Assistant Professors BRASIE and R. J. SCOTT. Prerequisite, Clothing 3 and 5, and Household Art 1. First or second term. Credit three hours. Martha Van Rensselaer Hall 215 and 217.

6. **Color and Design.** Assistant Professor ERWAY. Prerequisite, Household Art 1 and 31. Second term. Credit two hours. Martha Van Rensselaer Hall 318.

16. **Costume Design.** Assistant Professor ERWAY. Prerequisite, Household Art 15. Second term. Credit two hours. Martha Van Rensselaer Hall 318.

## *HOTEL ADMINISTRATION

*Professors* H. B. MEEK, F. H. RANDOLPH, LOUIS TOTH, A. L. WINSOR, and JOHN COURTNEY.

Graduate work for the Master's degree is offered in Hotel Administration. A foundation knowledge of hotel management is required of graduate students majoring in the field. Such students will choose a minor in a related or underlying field such as accounting, statistics, engineering, or one of the social sciences. Students majoring in the latter fields may find in the problems of the hotel industry a fertile field for research.

Through its contacts with the American Hotel Association and its subsidiary associations and with member hotels the University has possession of and access to a wide range of research material.

81 and 82. *Accounting.* Credit six hours. Throughout the year.

181 and 182. *Hotel Accounting.* Credit three hours. Throughout the year.

183. *Hotel Accounting, Advanced.* Credit three hours. First term.

184. *Food Control.* Credit two hours. Second term.

151. *Hotel Operation.* Credit two hours. First term.

161. *Mechanism of Hotel Machines.* Credit four hours. Second term.†

162a. *Hotel Power Plants, Lectures.* Credit two hours. First term.†

162b. *Hotel Power Plants, Laboratory.* Credit two hours. First term.†

163a. *Hotel Auxiliary Equipment, Lectures.* Credit two hours. First and second terms.†

163b. *Hotel Auxiliary Equipment, Laboratory.* Credit two hours. First and second terms.†

185. **Hotel Accounting Problems.** Second term. Credit two hours. Prerequisite, Hotel Accounting 183 or its equivalent. W 11–1. Dairy Building 412. Assistant Professor TOTH and Mr. COURTNEY.

Incorporating the hotel owning and operating companies. Financing bond issues and discounts. Accounting provisions in hotel leases and management contracts. Installation of hotel accounting systems.

186. **Interpretation of Hotel Financial Statements.** Second term. Credit two hours. Prerequisite, Hotel Accounting 183 or its equivalent. W 1:40–4. Dairy Building 412. Assistant Professor TOTH and Mr. COURTNEY.

†Will be given two out of every three terms.

Study and discussion of hotel balance sheets and profit and loss statements. Typical balance sheets and operating ratios of representative hotels.

189. **Problems in Hotel Analysis.** First or second term. Credit two or three hours, depending on work done. Registration limited. Dairy Building 412. Mr. COURTNEY.

A seminar course for graduate students or seniors in hotel administration. Application of statistical methods to problems in hotel analysis. Each student will solve one or more problems.

153. **Special Hotel Problems.** Second term. Credit two hours. Prerequisite, Hotel Administration 151 or its equivalent. Registration limited. Hours to be arranged. Professor MEEK.

A seminar course for graduate students and seniors in hotel administration. Devoted to the study of problems in the management of hotels or in the relationship of the hotel as an institution to the community it serves.

164. **Hotel Engineering Problems.** Second term. Credit three hours. Open to a limited number of seniors and graduate students with the consent of the instructor. To be taken with or following course 163. Hours to be arranged. Professor RANDOLPH.

Planning the layout for a proposed hotel, emphasizing floor plans and the selection and arrangement of the engineering equipment in the various departments. Determination of different engineering costs and the use of metering devices in promoting efficient operation. Materials fee, $2.

119. **Personnel Administration in Hotels.** Second term. Credit three hours. Open to seniors and graduate students. Prerequisite, Rural Education 114 or its equivalent. M W F 9. Stone 203. Assistant Professor WINSOR.

A study of the worker in relation to his work. Discussion of technics developed for obtaining, hiring, and training employees. The use of general and special ability tests. A study of the organization charts of typical hotels, showing the relationships existing between the various departments, with particular emphasis upon the problems of personnel administration.

## *RURAL SOCIAL ORGANIZATION

*Professors* DWIGHT SANDERSON and W. A. ANDERSON.

Graduate students who desire to register in Rural Social Organization as a major subject should have had a considerable personal experience with rural life and rural institutions, and a general knowledge of sociology, psychology, and economics. Elementary courses in general sociology, rural sociology, and economics are prerequisite to graduate courses.

1. *Introduction to Sociology.* First or second term. Credit three hours. Open to sophomores. Not open to freshmen except those registered in the curriculum for social workers in the College of Home Economics. Lectures and discussions, M W F 8. Agricultural Economics Building 225. Assistant Professor ANDERSON.

This course precedes all others in the department. Its object is to create an understanding of institutions, organizations, and various types of groups that exist in human society; it is an analysis of the human environment in which the individual lives. Both urban and rural society are considered. Fee for materials, $1.50.

12. *Rural Sociology.* First term. Credit three hours. Course 1, or its equivalent, is recommended but not required. Lectures, discussions, and special reports. T Th S 11. Agricultural Economics Building 340. Mr. BEERS.

A study of the groups, institutions, and organizations found in rural society. The structure and functions of rural groups are first analyzed, and attention is then given to the processes of group action and the results. Fee for materials, $1.

111. **Rural Community Organization.** Second term. Credit two hours. Prerequisite, course 1 or 12 or the equivalent. Lectures and discussions, T Th 8. Agricultural Economics Building 310. Mr. POLSON.

A consideration of the aims and methods of the organization of rural communities. Typical communities are studied, their problems are analyzed, and a method of organization is discussed. The county as a unit of social organization also is considered in its relation to community organization.

121. **The Family.** First or second term. Credit three or four hours. Open to juniors, seniors, and graduates; open to sophomores only if registered in the curriculum for social workers in the College of Home Economics. Prerequisite, course 1 or its equivalent. Lectures, discussions, and reports. T Th S 8. Agricultural Economics Building 340. Professor SANDERSON.

Those who register for four hours will engage in intensive studies of special topics as members of groups which will meet one hour a week at a time to be arranged.

This course considers the social problems of the family both on the farm and in the city; the history of the family, particularly during the past century; the differences between family life in the country and in the city; the function of the family in society; marriage and divorce; relations of parents and children; and how the family may be conserved. Fee for materials, $3.

122. **Social Problems and Public Welfare Organization.** Second term. Credit three hours. Lectures and discussions, M W F 11. Agricultural Economics Building 340. Assistant Professor ANDERSON.

A study of social problems such as poverty, delinquency, crime, the physically handicapped, the feeble-minded and mentally diseased, social insurance, public health, mothers' pensions, unemployment, and the like; a consideration of public and private agencies for social work and desirable public policy with regard to their organization and support.

123. *Social-Work Practice.* Throughout the year. Open only to students preparing to become social workers. Individual work at neighborhood houses or in connection with social welfare organizations. Hours and credit to be arranged. Professor SANDERSON.

131. **The Social Psychology of Rural Life.** Second term. Credit three hours. Prerequisite, courses 1 and 12 and one course in psychology. T Th S 11. Agricultural Economics Building 340. Mr. BEERS.

A study of rural attitudes, rural public opinion, personality development in rural environment, and the characteristics of rural group behavior.

[132. **Rural Leadership.** First term. Credit two hours. Prerequisite, permission to register. Professor SANDERSON. Not given in 1933–34.

A seminary course in which a descriptive account of leadership is given from both sociological and psychological points of view. General principles are discussed, with special case references to studies of rural leaders in New York and other states.]

[211. **The Rural Community.** First term. Credit two hours. A seminary course primarily for graduate students. Prerequisite, courses 1 and 12 or their equivalents. Professor SANDERSON. Not given in 1933–34.

A study of the historical development of the rural community; a comparative study of types of rural communities; the rural community as a sociological group, and its place in society; methods of community development and organization.]

213. **Research in Rural Social Organization.** Throughout the year. For graduate students only. Hours and credit to be arranged. Professor SANDERSON and Assistant Professor ANDERSON.

214. **Seminary.** Second term. For graduate students. Th 2–4. Agricultural Economics Building 302. Professor SANDERSON.

The structural characteristics and classification of different types of social groups as related to their functions are studied.

215. **Sociological Theory and Research.** First term. Credit three hours. Prerequisite, permission to register. Hours to be arranged. Agricultural Economics Building 302. Assistant Professor ANDERSON.

A course devoted to the critical analysis of recent and contemporary sociological theory.

216. **Systematic Sociology.** Second term. Credit three hours. Hours to be arranged. Agricultural Economics Building 302. Assistant Professor ANDERSON.

This course is designed to present in a systematic way the whole field of sociology, with special emphasis on sociological theory. The work is divided between discussions concerning the essential aspects of the subject, and reports on special topics.

217. **Seminary.** First term. Credit two hours. For graduate students. Th 2–4. Agricultural Economics Building 302. Professor SANDERSON.

A review of research in rural sociology and an analysis of methods and results.

218. **Seminary on Rural Organization in Foreign Countries.** First term. Credit one hour, or may be taken without credit. For seniors and graduate students from foreign countries. W 4–6. Agricultural Economics Building 302. Professor SANDERSON and Assistant Professor ANDERSON.

The members of the seminary will discuss farmers' organizations and organizations for the improvement of rural life in their own countries and of other selected countries. Membership in the seminary is open to all foreign graduate students who are interested in the problems of rural improvement and a comparison of the organizations and methods used in various countries. The seminary will be held for a minimum of six students.

## *LAW

*Professors* C. K. BURDICK, L. P. WILSON, R. S. STEVENS, G. J. THOMPSON, H. E. WHITESIDE, H. W. EDGERTON, G. H. ROBINSON, H. D. LAUBE, W. H. FARNHAM, J. W. MACDONALD, and LEWIS W. MORSE.

*Division of Law:* C. K. BURDICK, L. P. WILSON, R. S. STEVENS, G. J. THOMPSON, H. E. WHITESIDE, H. W. EDGERTON, G. H. ROBINSON, H. D. LAUBE, W. H. FARNHAM, J. W. MACDONALD, LEWIS W. MORSE, CARL BECKER, G. W. CUNNINGHAM, DONALD ENGLISH, and R. E. CUSHMAN.

Graduate work in law is organized under the direction of the Division of Law of the Graduate School. This division, in which is vested authority to establish and administer rules for admission to candidacy for, and graduation with, the degrees LL.M. and J.S.D., consists of the members of the Faculty of the Law School, representatives of the Departments of Economics, Government, History and Philosophy, in the College of Arts and Sciences, and such other members of the Graduate School faculty as for the time being are serving on the special committees of candidates for the graduate degrees in law.

This method of organizing graduate work in law is considered especially advantageous since it offers to graduate students in law an opportunity to correlate their work in law with work in allied fields in other departments of the University, such as those in philosophy, history, government, business and finance.

Candidates for either of the graduate degrees in law must be in residence not less than one academic year.

The Master's degree is intended primarily for those in practice or intending to enter practice who desire to increase their knowledge of the law by intensive work in special fields.

Work leading to the Doctor's degree is designed to train legal scholars and to stimulate original investigation which shall constitute a contribution to the scien-

tific study of law and to the solution of problems in the fields of history, content, administration, and progress of the law. It is desirable that candidates for the doctor's degree shall have had some practical or teaching experience after obtaining a first degree in law.

A number of furnished offices are provided in the new Law School building, Myron Taylor Hall, for graduate students in law.

For more detailed information regarding graduate work in law see the current Announcement of the Law School.

The Library of the Law School contains 70,000 volumes. In reports of the federal courts, and of the several American State jurisdictions, and in English, Scotch, Irish, Canadian, Australian, and English colonial reports, the law library is practically complete to date. The library also possesses a similarly adequate collection of text books, complete sets of substantially all law periodicals in English, digests, annotations and law encyclopedias, Railroad and Public Service Commission Reports and Bar Association Reports of the various States. It contains a rapidly growing collection of reports, statutes, periodicals, and texts in French, German, and Italian. The Earl J. Bennett collection of Statute Law and the Myron C. Taylor collection of League of Nations Publications are of special value and interest. Several hundred volumes of the records and briefs of cases in the Supreme Court of the United States and in the New York Court of Appeals and accounts of important foreign and domestic trials are also to be found in the library.

The University Library containing over 850,000 volumes (exclusive of the number of volumes in the Law Library) is accessible to law students in the same way as to students in the other colleges.

50. **Jurisprudence.** Professor LAUBE. First term. Two hours. An examination of the nature and end of law, its sources, its forms, its scope, its application and its growth. Assigned reading and selected cases. Required for all graduate students in law and elective to other graduate students and selected third year law students.

50a. **Seminar in Jurisprudence.** Professor LAUBE. Second term. Elective to graduate and selected third year students.

[51. **Administrative Law.** Assistant Professor MACDONALD. First term. Two hours. Given in alternate years, not in 1933–34.]

52. **Round Table in Damages.** Professor WILSON. Second term. A course of informal study covering the general principles of damages at law and contrasting these with other forms of relief which may be available in certain typical situations. Ten periods of one and one-half hours each will be devoted to informal discussion. Elective to graduate students and to ten third year students with permission of the professor in charge.

53. **Seminar in Criminal Law and Administration.** Professor EDGERTON. Time to be arranged. Elective to graduate students and selected third year students.

54. **Seminar in Corporations.** Professor STEVENS. Prerequisite: Satisfactory completion of a course in Private Corporations. Second term. Supervised study of particular problems, preparation of reports, and group conferences. Elective to graduate and to selected third year students with the consent of the instructor.

55. **Seminar in Legal History.** Professors WHITESIDE, LAUBE, and FARNHAM. (Omitted in 1933–34.) Time to be arranged. Elective to graduate and selected third year students.

56. **Seminar in International Law and International Relations.** Professor BURDICK. Time to be arranged. Elective to graduate and selected third year students.

57. **Seminar in Modern Movements in Procedure.** Professors MACDONALD and WILSON. Time to be arranged. Elective to graduate and selected third year students.

59. **Seminar in Trade Regulation.** Professor EDGERTON. Time to be arranged. Elective to graduate and selected third year students.

# GRADUATE SCHOOL OF EDUCATION

## EDUCATION AND RURAL EDUCATION

*Professors* BAYNE, BINZEL, BUTTERWORTH, EATON, FERRISS, FREEMAN, JORDAN, KRUSE, LAISTNER, MOORE, OGDEN, PALMER, SMITH, STEWART, WINSOR.

The development of standards for public school service during the last several years promises soon to place upon the graduate level much of the professional work that has hitherto been secured through undergraduate training. Hence, those looking forward to a city superintendency, to a principalship of a city elementary or high school, to a principalship or superintendency of a village school, to high school teaching, to a supervisorship, and the like, will find it desirable, if not essential, to have training beyond a first degree. It is to give this needed professional service that the Graduate School of Education has been established. Although the emphasis will be upon the graduate work, Cornell University will, through this teacher-training organization, continue to offer those facilities that have been available to the undergraduates of the various colleges.

A separate Announcement listing the offerings in Education may be secured by writing to the Director.

*There are two types of advanced degrees for students of education, as follows:*

1. The degrees of *Master of Arts, Master of Science,* and *Doctor of Philosophy* are administered directly by the Graduate School of Cornell University.

2. The degrees of *Master of Arts in Education* and *Master of Science in Education* are administered directly by the Graduate School of Education, subject to the regulations of the Graduate School of Cornell University.

A graduate student in the field of Education may become a candidate for a degree in either of these categories.

### *Admission*

1. Qualified students may be admitted to candidacy for the degrees of Master of Arts, Master of Science, or for the Degree of Doctor of Philosophy with a major or minor or both in some phase of Education. A graduate of any college in which requirements for the first degree are substantially equivalent to those for the first degree at Cornell may be admitted to resident study in the Graduate School. It should be noted that these requirements include three years of study in foreign language. He may at once enter upon candidacy for an advanced degree if he can show that he is qualified to carry on study in the field in which he proposes to work.

In order to avoid delay at the beginning of the academic year, those who desire to enter the Graduate School are advised to make application for admission, either in person or by letter, in the preceding spring or summer. They should address the Dean of the Graduate School, Cornell University, Ithaca, N. Y. Students who wish to work under the direction of a particular professor should communicate with him also.

2. Qualified students may be admitted to candidacy for the degree of Master of Arts in Education under the same conditions as above stated.

Qualified students may be admitted to candidacy for the degree, Master of Science in Education, under the same conditions, except that the requirement in foreign language is omitted.

In order to avoid delays at the beginning of the academic year, those who desire to enter the Graduate School of Education are advised to make application for admission, either in person or by letter, in the preceding spring or summer. They should address both the Dean of the Graduate School, Cornell University, Ithaca, N. Y., and the Director of the Graduate School of Education.

## *The Master's Degrees in Education*

A degree of Master of Arts in Education or of Master of Science in Education is conferred upon a candidate who, after completing not less than one year of residence devoted to study in a field in which Education constitutes the major portion, has given satisfactory evidence of ability to carry graduate work, and has met such other requirements as his Special Committee with the approval of the Graduate School of Education may have established. Every candidate must have passed a final comprehensive examination.

These degrees are designed for school executive officers and teachers who wish to enter upon a course of professional study involving neither close restriction nor intensive research. This course of study is both comprehensive and critical. It has, however, a distinctly professional emphasis. The amount of prescribed work will be adjusted to the particular preparation and experience of the candidate. In general these candidates are expected to fall into one of three classes:

Class I. Men and women, graduates of standard colleges, of approved experience in educational positions, who are seeking professional preparation on the graduate level.

Class II. Men and women, graduates of standard colleges, who wish to qualify as school principals or as supervisors in special fields in accord with professional requirements of various states.

Class III. Men and women, graduates of standard colleges, qualified for graduate work, but who have not included in their undergraduate programs courses in the field of Education sufficient for certification as teachers.

1. With the approval of the Director of the Graduate School of Education the candidate shall choose three members of the graduate faculty to serve as a special committee to direct his work. At least two of these shall be from the staff in Education, one of the two being selected by the candidate to act as chairman. This committee is empowered to determine the special qualifications of the candidate to undertake a program proper to his particular professional interest. An approved program must have unity, in terms both of purpose and of sequential development. Within an approved program are included such courses, seminars, projects, investigations, and examinations as the committee may require. These provisions may have the consequence of extending the residence requirements for students of Class III beyond the minimum of one year.

2. The office of the Director of the Graduate School of Education acts as an office of record, and the candidate for one of these degrees shall, within ten days of his registration, file in writing a statement approved by his committee, showing his plan of work and course of study.

3. Upon the satisfactory completion of the work outlined by the Special Committee and the passing of a final comprehensive examination, the Faculty of the Graduate School of Education will recommend to the Faculty of the Graduate School that the candidate be granted the appropriate degree. The maximal period allowed for completion of all requirements conforms to the regulations of the Graduate School of Cornell University.

4. Prior to scheduling the final examination, all members of the staff under whom the candidate has carried his course work or who have acted in an advisory or similar capacity with him will be informed of his proposed examination and will be asked to express an opinion regarding his fitness for such examination, and invited to be present and take part in the examination.

The courses expected of the candidate will usually fall into four groups designated as A, B, C, and D. There will be no sharp line of demarcation between these groups, but the following statement may serve as a guide in differentiating them:

Group A. Courses of a special nature, such as a group of courses in English, the languages, history or science which are essential to a well-trained high school teacher of these several fields.

Group B. Courses directly preliminary and introductory to advanced studies in Education.

Group C. Advanced courses in theory or science of education presupposing studies of an introductory type.

Note: For example, courses in curriculum theory, philosophy of education, history of education, educational psychology, mental measurements. To undertake a course in Class C, the student must have completed an acceptable preliminary course in Class B, or an equivalent study in the field of the advanced course.

Group D. Advanced special courses in the field of educational practice, which presuppose a professional background.

Note: Courses in educational administration, supervision, teacher-training, and the like, would fall, presumably, in Group D. To qualify for such a course, the candidate must give evidence of professional study and experience represented minimally, say, by certification to teach, and one year of successful service in employment as teacher, principal, supervisor, or the like. Such preparation may be gained either before or after entrance upon candidacy, but it is prerequisite to recognition or satisfactory completion of courses in Group D.

For detailed information regarding these degrees write to the Director of the Graduate School of Education.

COURSES OF INSTRUCTION. In the statement of courses given below the term "Education 1," "Education 6," etc., given in parenthesis following the name of the course, indicates that the course is offered by the Department of Education. "Rural Education 111," "Rural Education 114," etc., means that the course is offered by the Department of Rural Education.

All courses offered by the Department of Education require Psychology 1 as a prerequisite. In the Department of Rural Education courses numbered under 100 are intended primarily for underclassmen; those from 101 to 200 are primarily for upperclassmen or graduate students; while those numbered 201 and over are primarily for graduate students. It should be noted that courses carrying the same name are not necessarily equivalents. All courses offered by the Graduate School of Education are listed below. The undergraduate courses are included as suggestive to graduate students, who do not have all the requirements for graduate study, of the nature of the work that may be expected of them in meeting deficiencies.

## GENERAL COURSES

*Introduction to Problems of Public Education.* (Rural Education 1). First term. Credit two hours. Not open to freshmen. Designed for students not preparing to teach. Not credited toward the certificate requirements in education. T Th 10. Agricultural Economics 125. Professor MOORE.

**Seminary in Education** (Education 20). First term. Credit two hours. Primarily for graduate students; open to upperclassmen by permission. M 4–6. Goldwin Smith 248. Assistant Professor FREEMAN.

Topics relevant to educational theory.

**Seminary in Education** (Education 21). Second term. Credit two hours. Admission by permission of the instructor. M 4–6. Goldwin Smith 248. Professor JORDAN.

Topics developing from historical and current problems of educational practice, especially as related to administration and conduct of the public school system and of the university. Primarily for graduate students.

**Seminary** (Rural Education 234). First term. Credit one hour. M 2–3:30. Stone 203. Professor BUTTERWORTH.

A consideration of scientific method in education with particular reference to thesis writing.

## *EDUCATIONAL PSYCHOLOGY

Psychology 1 is prerequisite to all courses in Education.

*Educational Psychology* (Education 1). Either term. Credit three hours. Lectures and recitations. First term, Assistant Professor FREEMAN. M W F 11. Goldwin Smith 234. Second term. Professor OGDEN, Section I, T Th S 11, Goldwin Smith 134; Assistant Professor FREEMAN, Section II, M W F 10, Goldwin Smith 234.

*Psychology: an Introductory Course* (Rural Education 110). Either term. Credit three hours. Open to students above the freshman year. M W F 10. Stone 102. Assistant Professor WINSOR.

*Psychology for Students of Education* (Rural Education 111). Either term. Credit four hours. Open to juniors and seniors. Assistant Professor BAYNE and Dr. GARDNER.

*First term:* Section 1: lectures, M W F 11; laboratory, T 1:40–4; Stone 203. Section 2: lectures M W F 9; laboratory, Th 1:40–4; Stone 203.

*Second term:* Section 1: *lectures,* M W F 11; laboratory,T 1:40–4; Stone 203.

*Psychology for Students of Education* (Rural Education 112). First or second term. Credit three hours. Prerequisite, Rural Education 110, Psychology 1, or equivalent. Open to second term sophomores, juniors, and seniors. First term. M W F 9. East Roberts 222. Second term. M W F 9. Caldwell 143. Professor KRUSE.

*Psychology for Students of Hotel Administration* (Rural Education 114). First term. Credit four hours. Open to juniors and seniors. Lectures, M W F 8, Stone 102. Laboratory, W 1:40–4, Stone 203. Assistant Professor WINSOR.

*Psychology for Students of Child Training* (Rural Education 116). Either term. Credit two hours. Open only to students who have course 111 or its equivalent. Lectures, T Th 11. Stone 102. Dr. GARDNER.

*Personnel Administration* (Rural Education 119). Second term. Credit three hours. Prerequisite, course 114 or its equivalent. Lectures, M W F 9. Stone 102. Assistant Professor WINSOR.

**Psychology for Students of Education** (Rural Education 211a). First term. Credit four hours. For mature students with teaching experience. Lectures, M W F, 11–12:20. Stone 309. Professor KRUSE.

[**Psychology of Learning** (Rural Education 212). Second term. Credit two hours. Th 4:15–6. Stone 309. Professor KRUSE. Not given in 1933–34.]

**Seminary in Educational Psychology** (Rural Education 218). Second term. Credit two hours. Th 4:15–6. Stone 309. Professor KRUSE.

**Seminary in Personnel Administration** (Rural Education 219). Second term. Credit two hours. Open to qualified seniors and graduates. Th 4:15–6. Stone 203. Assistant Professor WINSOR.

**Experimental Education** (Education 8). Either term. Credit and hours to be arranged. Consent of the instructor is required. Education 7 or its equivalent should normally precede this course. Assistant Professor FREEMAN. Goldwin Smith 248.

Problems of experimental education; the application of psychological and statistical methods to problems in educational psychology; chief results and bearings.

**Mental Development** (Education 17). First term. Credit two hours. Prerequisite, Education 1 or its equivalent. W 2–4. Professor FREEMAN.

A course in child psychology, dealing with the facts of mental growth and their interpretation.

[**Individual Differences** (Education 18). First term. Credit two hours. Prerequisite, Education 1 or its equivalent. It is desirable, though not required, that Education 7 precede this course. Assistant Professor FREEMAN. W 2–4. Goldwin Smith 248.

Given in alternate years, not in 1933–34.]

## *METHOD

*Method and Procedure in Secondary School Teaching* (Rural Education 121). First term. Credit three hours. Prerequisite course 111 or its equivalent. Open to juniors and seniors. Lectures, M W F 11. Stone 102. Professor FERRISS.

*Method and Procedure in High School Teaching* (Education 4). First term. Credit three hours. For seniors only. Professor JORDAN. M W F 11. Goldwin Smith 264. M W F 3. Goldwin Smith 256.

*Observation and Practice in High School Method* (Education 4a). First term. Credit one hour. For seniors only. Professor JORDAN, Mr. HULSE, and Miss BESIG. M 4. Goldwin Smith 256.

Planned to be taken coincidently with course 4, required of students desiring to meet the New York State requirements for the provisional professional certificate.

*Practice in High School Method* (Education 4b). Either term. Credit two or three hours. For seniors only. Mr. HULSE and Miss BESIG. M 4. Goldwin Smith 256.

*The Teaching of Science in the Secondary School* (Rural Education 126). Second term. Credit two or three hours. Prerequisite, course 121 or its equivalent and at least 30 hours in science. Lectures, M W 10. Fernow 8. Professor PALMER and Miss GORDON.

*Introduction to the Teaching of Agriculture in the Public Schools* (Rural Education 131). First term. Credit two hours. Open by permission only to upperclass students preparing to teach agriculture, whose progress in the prescribed courses in technical agriculture is adequate. Lecture, T 10, Stone 203. One laboratory period a week, M 1:40–4. Professor STEWART and Dr. HOSKINS. Laboratory fee, $5.

*The Teaching of Agriculture in the Secondary Schools* (Rural Education 132). Either term. Credit three hours a term. Open to students who have completed course 111 or its equivalent and have completed the farm-practice requirements, and whose progress in the prescribed courses in technical agriculture is adequate. Course 131 should precede or accompany. T Th 9. Stone 203. One laboratory a week in directed teaching is required. Dr. HOSKINS and Mr. ————. Laboratory fee, $5.

*Directed Agricultural Teaching* (Rural Education 133). Either term. Credit one or two hours. Registration by permission. Dr. HOSKINS and Mr. ————. Laboratory fee, $5.

*The Teaching of Home Economics in the Secondary School* (Rural Education 135). Second term. Credit three hours. Prerequisite, course 111 or its equivalent. Required of juniors preparing to teach. Lectures, T Th 10. Laboratory, T or Th 1:40–4. Stone 102. Professor BINZEL and Miss JACOBSON. Laboratory fee, $2.

*Directed Teaching of Home Economics in the Secondary School* (Rural Education 136). Either term. Credit two or three hours. Prerequisite, course 135.

Students planning to take this course should arrange with the department during the junior year. General conferences, S 8–10. Stone 203. Professor BINZEL and Misses BULL, HASTIE, and JACOBSON. Laboratory fee, $10.

**Principles of Method** (Rural Education 222). Second term. Credit three hours. Prerequisite, course 211a or its equivalent and teaching or comparable experience in agriculture, home economics, or science. Given in alternate years. T Th S 10. Stone 203. Professor STEWART. [Not given in 1934–35.]

A critical study of procedures and techniques of teaching based upon the experience of teaching and an analysis of educational literature.

**Research in Science Teaching** (Rural Education 226). Either term. Credit one or two hours. M or W 9. Fernow 8. Professor PALMER.

Special problems in science teaching.

[**Seminary in Elementary Education** (Rural Education 227). Second term. Credit two hours. Professor MOORE. Not given in 1933–34.]

**Seminary in Child Guidance** (Rural Education 228). Second term. For graduate students who have had some work in child guidance. F 4–6. Nursery School. Professor WARING.

[*The Teaching of Agriculture in the Secondary School* (Rural Education 232, Second term. Credit three hours. Open to graduate students with approved qualifications. Given in alternate years. M W F 9. Stone 203. Dr. HOSKINS. Not given in 1933–34.]

**Cooperative Extension Work** (Rural Education 240). First term. Credit three hours. Open to graduate students qualified in agriculture or home economics. M W F 10. Stone 309. Professor EATON.

A study of the educational aims, content and methods of the cooperative extension work in agriculture and home economics.

**Problems in College Teaching** (Rural Education 243). Second term. Credit three hours. Open to graduate students who teach or intend to teach in colleges. T Th 10. Stone 309. Professor EATON.

## *PREPARATION OF TEACHERS FOR NORMAL SCHOOLS AND COLLEGES

[**The Preparation of Teachers for Normal Schools and Colleges** (Rural Education 241). Second term. Credit three hours. M W F 10. Professor BUTTERWORTH. Not given in 1933–34.]

**The College Preparation of Teachers of Agriculture for the Secondary School** (Rural Education 245). Second term. Credit three hours. Open to graduate students of approved qualifications. Prerequisite course 211a. M W F 9. Stone 309. Professor STEWART. [Not given in 1934–35.]

[**The Preparation of Teachers of Home Economics** (Rural Education 248). First term. Credit three hours. Given in alternate years. Open to students of approved qualifications. Time to be arranged. Professor BINZEL. Not given in 1933–34.]

**Seminary in Home Economics Education** (Rural Education 249). First term. Credit two hours. Open to graduate students. Time to be arranged. Professor BINZEL.

Course content to be adapted to personnel of class.

**Seminary in Agricultural Education** (Rural Education 250). First term. Credit two hours. Th 4–6. Stone 309. Professor STEWART.

A consideration of the relationships of federal and state authorities in administering the programs of vocational agriculture.

## *MEASUREMENT AND STATISTICS

**Mental and Educational Measurements** (Education 7). First term. Credit three hours. Prerequisite, Education 1 or equivalent. Assistant Professor FREEMAN. T Th S 9. Goldwin Smith 225.

The nature of intelligence. History of the development of individual and group tests of intelligence; principles underlying their formation and application; the use of tests of intelligence in school problems and in fields outside the school. The theory, construction, and use of educational tests. Demonstration in administering tests.

[**Mental and Educational Measurements** (Rural Education 251). Second term. Credit three hours. Prerequisite, permission to register. Primarily for graduate students. Assistant Professor BAYNE. Not given in 1933–34.]

**Statistics for Students of Education** (Rural Education 253). First term. Credit two hours. Primarily for graduate students in education. Open to a limited number of other students upon approval of the instructor. W 2–4. Stone 309. Assistant Professor BAYNE.

A study of common statistical procedures in relation to critical reading of technical studies, research, and writing reports of studies. As far as possible the work is related to the problems of the individual student.

## *ADMINISTRATION AND SUPERVISION

**City School Administration and Supervision** (Education 10). Throughout the year. Credit two hours a term. Prerequisite, Education 1. Professor JORDAN. M W 9. Goldwin Smith 248.

Principles of administration and supervision of state and city school systems, involving problems of evaluation and improvement of teaching, and of the subject matter in the public schools. The course will be adapted to the particular needs of the class.

**High School Administration** (Education 11). Second term. Credit two hours. For seniors, graduates, and other qualified students. Professor JORDAN. W F 3. Goldwin Smith.

Principles relevant to administration of the senior and junior high school; classification of pupils; program making; curriculum problems; the principal as supervisor; pupil guidance; duties of the principal in both large and small high schools.

[**The Junior High School** (Education 12). Throughout the year. Credit two hours a term. For seniors, graduates and other qualified students. W 4–6. Goldwin Smith 234. Professor JORDAN. Not given in 1933–34.]

[**Principles of School Administration and Supervision** (Rural Education 161). First term. Credit three hours. Open to juniors and seniors who have had courses 111 and 121 or 181. Open also to graduate students without administrative experience who have had the foregoing courses or their equivalent. M W F 9. Professor BUTTERWORTH. Not given in 1933–34.]

[**The Principalship of the Centralized and Village School** (Rural Education 175). Second term. Credit two hours. Open to graduate students by special permission. T Th 11. Stone 203. Professor FERRISS. Not given in 1933–34.]

**The Administration of Rural Schools** (Rural Education 261). First term. Credit three hours. T Th 11–12:20. Stone 203. Professor BUTTERWORTH.

A course for students of experience dealing with the problems of organizing and administering education in the elementary and secondary schools in country and village districts.

**Special Problems in School Administration** (Rural Education 262). This course is divided into units in such a manner as to include the major problems of the school administrator. Professor BUTTERWORTH.

[A. **School Finance.** Second term. Credit two hours. Not given in 1933–34.]

B. **The School Population.** Second term. Credit two hours. S 10–11:45. Stone 309. The school census, attendance, grading and promotion, retardation, elimination, and similar problems.

[C. **The School Plant.** Second term. Credit two hours. S 10–11:45. Stone 309. Not given in 1933–34.]

**Procedures and Techniques in Supervision** (Rural Education 263). Credit three hours. First term. M W F 10. Stone 309. Professor MOORE.

Designed for students, supervisors and principals. Students who have not had experience in these fields will be admitted only upon permission of the instructor. A consideration of the nature and purpose of supervision; the improvement of the learning-teaching process; skill in observation; analysis of methods; relationships between general and specific objectives; selection; analysis and organization of subject matter; measuring and testing results; assisting teachers in professional growth. The experience and needs of the class will determine the emphasis and nature of treatment of these various aspects.

**Seminary in Rural School Administration** (Rural Education 264). Second term. Credit two hours. M 4–5:30. Stone 309. Professor BUTTERWORTH.

Designed for those desiring to make an intensive study of administrative problems in rural elementary and secondary schools. Topic to be announced.

**The Supervision of the Elementary School Subjects** (Rural Education 266). Second term. Credit three hours. M W F 10. Stone 309. Professor MOORE.

A course designed for supervisors, elementary school principals, and superintendents. It includes a consideration of important research studies which have a direct bearing upon the teaching and supervision of the elementary school subjects.

[**Administration and Supervision of Agricultural Education** (Rural Education 267). Second term. Credit three hours. Open to graduate students of approved qualifications. Given in alternate years. M W F 9. Professor STEWART. Not given in 1933–34.]

[**The Administration and Supervision of Home Economics Education** (Rural Education 269). First term. Credit three hours. Given in alternate years. Open to graduate students of approved qualifications. The course includes directed observation of and participation in supervision. Professor BINZEL. Not given in 1933–34.]

**Principles of Curriculum Building** (Rural Education 276). Second term. Credit three hours. For graduate students only. T Th 2–3:20. Stone 309. Professor FERRISS.

A consideration of the major problems, principles, and techniques in determining educational objectives, and curriculum content and organization.

[**Seminary in Rural Secondary Education** (Rural Education 278). Second term. Credit two hours. Given in alternate years. M 4–5:30. Stone 203. Professor FERRISS. Not given in 1933–34.]

## *HISTORY OF EDUCATION

*History of Education* (Education 3). (a) (Greek, Roman, and Early Mediaeval). First term. Credit two hours. Open to upperclassmen and graduates only. T Th 10. Professor LAISTNER. (See History 7.) (b) Late Mediaeval and Modern). Second term. Credit two hours. Open to upperclassmen and graduates only. T Th 10. Professor SMITH. (See History 36.)

*History of American Education* (Education 13). First term. Repeated second term. Credit three hours. Prerequisite, Education 1, or its equivalent. Mr. HULSE. T Th S 10. Goldwin Smith 142.

## *EDUCATIONAL THEORY

*Principles of Secondary Education* (Education 2). Second term. Credit three hours. Prerequisite, Education 1. Section 1, M W F 2. Professor JORDAN. Goldwin Smith 234. Section 2, T Th S 9. Assistant Professor FREEMAN. Goldwin Smith 234.

*Principles of Education* (Rural Education 181). Second term. Credit three hours. Prerequisite, Rural Education 111. Open to juniors and seniors. Students preparing to teach home economics should take this course. Section 1, M W F 11. Stone 102. Section 2, M W F 9. Stone 203. Professor MOORE.

**The Junior High School and the Rural Community** (Rural Education 187). Second term. Credit two hours. T Th 11. Stone 203. Professor FERRISS. Open to seniors who have had courses in educational psychology and methods, and to graduate students.

A consideration of the junior high school idea with particular reference to its adaptation to smaller communities. Treats of such topics as aims and essential features, types of administrative and curriculum organization, pupil activities, the work of the teacher, and so forth.

**Education and Vocations** (Rural Education 194). First term. Credit three hours. Open to seniors and graduate students qualified in educational psychology, and economics or sociology. T Th S 10. Stone 203. Professor EATON.

A study of the theory of vocational education in the large.

**Rural Secondary Education** (Rural Education 281). First term. Credit four hours. Primarily for graduate students. M W F 9, and conference periods to be arranged. Stone 309. Professor FERRISS.

A course to consider some of the more basic problems in the nature, organization, curriculum, and extension of secondary education in its adaptation to rural needs and conditions.

**Philosophy of Education** (Rural Education 294). Second term. Credit three hours. Open to graduate students whose studies in education are well advanced. M W F 11. Stone 309. Professor EATON.

An examination of the concepts of education and of the bearing of several major theories of life upon education.

**Theory of Behavior** (Education 5). Second term. Credit two hours. Primarily for graduate students; open to upperclassmen by permission. W 2–4. Goldwin Smith 248. Professor OGDEN.

The nature of behavior; learning, insight, personality and character; educational applications.

## *NATURE STUDY

*The Teaching of Nature Study and Elementary School Science* (Rural Education 107). Second term. Credit three hours. Open to those who have taken or are taking course 121 or its equivalent and at least 30 hours in science. Lecture, M 12. Fernow 8. Practical exercises, T Th 1:40–4. Professor PALMER and Miss GORDON.

[**Nature Literature** (Rural Education 202). First term. Credit two hours. Prerequisite courses 111 and 121. Professor PALMER and Miss GORDON. Not given in 1933–34.]

**The Nature Movement and its Makers** (Rural Education 209). First term. Credit two hours. Prerequisite, courses 111 and 121. M W 10. Fernow 8. Professor PALMER and Miss GORDON.

Discussion of the history of the nature movement with special consideration of its influence on and relation to the teaching of science in elementary schools. Studies are made of the present and past status of nature and science education.

## *CHILD DEVELOPMENT AND PARENT EDUCATION

*Professors* ETHEL B. WARING and MARIE B. FOWLER.

Graduate work in Child Development and Parent Education involves course work to supplement and extend the student's undergraduate experience; field work with families in their homes; conference and discussion groups; and research.

The laboratory is the Nursery School located in Martha Van Rensselaer Hall. The following are prerequisite for graduate work in Child Development and Parent Education.

### FAMILY LIFE

[111. *The Family: Its Modern Social and Economic Problems.* Two hours a week, either term. Not given in 1933–34.]

100. *Orientation in Child Development.* Two hours a week, either term.

101. *Principles in Behavior and Guidance, Elementary Course.* Three hours credit, either term.

107. *Home and School Environment for Young Children.* Three hours credit, first term.

125. *Infant and Child Hygiene, Elementary Course.* Two hours a week, second term.

126. *Home Nursing and Child Hygiene.* Three hours credit, first term.

127. *Infant and Child Hygiene, Advanced Course.* Two hours a week, second term. Open to students specializing in Child Development and Parent Education. [Not given in 1933–34.]

200. **Orientation in Child Development and Parent Education.** Open to graduate and senior students with adequate training in child development and parent education. Professor FOWLER. Three hours credit, either term. T Th 8. Martha Van Rensselaer Hall 117.

Planned to give graduate and advanced students some experience with less mature students in developing a simple organization of subject matter in the field. Laboratory fee, $5.

205. **Principles in Behavior and Guidance, Advanced Course.** Prerequisite, Family Life 101. Professor WARING. Second term. M W F 8. Martha Van Rensselaer Hall 117. Lectures and discussion. Two hours of observation weekly in the laboratory. Programs to be checked with instructor during registration. Laboratory to be arranged after the first lecture period.

This course undertakes to direct students to observe what situations young children meet, how they meet them, and what adults do to help or to hinder the children in meeting them in desirable ways. It undertakes to study a child's behavior, to see what it may involve in performance, in attitude, and in meaning, to discover in which of these aspects, if any, his experience is undesirable, to see what elements in the situation most influence his behavior, how he usually responds to them, how adults may change the situations and thereby improve his behavior. Laboratory fee, $7.50.

215. **Studies in Child Development and Parent Education.** Prerequisite, Family Life 205. Professor WARING. First and second terms, credit four or more hours. Open to graduate students only. Martha Van Rensselaer Hall G 62. At least four hours each term for students majoring in the department for a major or minoring for a doctorate.

The course undertakes to direct the student in the intensive study of children and their families in all the phases of child development and parent education available in the department, including laboratory study, home visitation, parent conferences of various sorts, and some experience in small group discussion and large group leadership. Laboratory fee, $7.50.

220. **Participation in Nursery School.** Prerequisite, Family Life 101 and 107. Professor FOWLER and Miss REEVES. Credit three or four hours, first or second term. A total of thirty hours of supervised participation with the children in the Nursery School for each hour of credit and one hour in conference with the teaching staff each week. Open only to a limited number of seniors and graduate students with adequate personal and professional qualifications. Laboratory and conference hours to be arranged. Laboratory fee, $7.50.

**Seminary in Child Guidance.** See Rural Education 228.

## SUSAN LINN SAGE SCHOOL OF PHILOSOPHY

*Professors* FRANK THILLY, G. WATTS CUNNINGHAM, G. H. SABINE, E. A. BURTT, HAROLD R. SMART, RICHARD ROBINSON, RALPH W. CHURCH; *Doctor* E. T. PAINE.

The Susan Linn Sage School of Philosophy owes its existence to the generosity of the late Henry W. Sage. In addition to endowing the Susan Linn Sage Professorship, he made a further gift of $200,000 for the purpose of providing permanently at Cornell University for philosophical instruction and investigation. For the encouragement of higher studies and research in every field represented, there have been established in this School two fellowships of the annual value of $400 each and five scholarships of the annual value of $200 each. Holders of these fellowships and scholarships are also exempt from the

payment of tuition. Fellowships are ordinarily awarded only to applicants who have had at least one year of graduate study.

The more important philosophical and psychological journals, both American and foreign, are received by the University Library, which is also adequately equipped with philosophical and psychological works, and is particularly rich in literature relating to Plato, Spinoza, and Kant. The seminary room in the Library is provided with complete sets of the leading philosophical journals, lexicons, and other books of reference and the more important recent works in the several branches of philosophy. The current numbers of the philosophical journals are also to be found in the room. Liberal provision is made for the constant growth of this special library.

*The Philosophical Review,* established by the University and issued under the auspices of the Sage School, is a bi-monthly journal devoted to the interests of philosophy, embracing under that title logic, metaphysics, ethics, aesthetics, history of philosophy, and philosophy of religion. Although supported by private endowment, it is not the organ of any institution or of any special school, but by the terms of the subsidy is an absolutely free organ of philsophical scholarship.

Under the title of *Cornell Studies in Philosophy,* a series of monograph studies is published from time to time as representative of the work done by graduate students in philosophy. These monographs are issued under the editorial supervision of the professors of the Sage School, and consist mainly of studies undertaken originally as dissertations for the doctorate. The series furnishes also a channel for the publication of research other than that of the thesis. Seventeen monographs have been issued in the series.

A large part of the work of the Sage School is adapted to the needs of graduates of this and other institutions, who are preparing themselves to be teachers or investigators in philosophy and in allied fields of study. The courses of instruction represent the chief branches and problems of philosophy. In all divisions, particular stress is laid upon the historical study of philosophical ideas as the best means of securing a comprehensive grasp of fundamental problems and values. While any of the courses offered may be utilized by graduates, attendance on lectures is to be regarded only as an aid to the independent development on the part of the student of critical scholarship and methods of investigation. The seminars are designed to offer opportunity for detailed study of selected problems, and are exclusively for graduate students.

## *Philosophy

A. *Elementary Study of Philosophical Classics.* Three hours a week, both terms.

1. *Problems of Philosophy.* Three hours a week, first term.
2. *Logic.* Three hours a week, either term.
3. *Types of Logical Theory.* Three hours a week, both terms.

4a. *Aesthetics.* Three hours a week, first term.

4b. *Aesthetics.* Three hours a week, second term.

5. *History of Philosophy.* Three hours a week, both terms.
6. *Moral Ideas and Practice.* Three hours a week, second term.
7. *Ethics.* Three hours a week, first term.

7a. *Social, Legal, and Political Ethics.* Three hours a week, second term.

8. *Plato and Aristotle.* Three hours a week, both terms.

[9. *The Romantic Revolution in Modern Thought.* Two hours a week, first term. Not given in 1933–34.]

10. *History of Political Theory.* Three hours a week, both terms.

[11. *Contemporary Philosophy: British and Continental.* Two hours a week, both terms. Not given in 1933–34.]

[12. *American Philosophy.* Two hours a week, second term. Not given in 1933–34.]

13. *Introduction to the Philosophy of Religion.* Three hours a week, first term.

[14. *The Nature of Religion.* Three hours a week, second term. Not given in 1933–34.]

14a. *History of Religions.* Three hours a week, second term.

15. *The Philosophy of the Natural Sciences.* Three hours a week, first term.

[16. *French Philosophy.* Three hours a week, first term. Not given in 1933–34.]

[17. *Philosophy and Science from Copernicus to Kant.* Three hours a week, second term. Not given in 1933–34.]

18. *Introduction to Hume and Leibniz.* Three hours a week, first term.

18a. *Introduction to Kant.* Three hours a week, second term.

[26. **The Ethics of Modern Utilitarianism.** Professor THILLY. Throughout the year. Th 3–5:30. Goldwin Smith 220. Not given in 1933–34.]

27. **Readings in Greek Philosophy.** Assistant Professor ROBINSON. Throughout the year. Time and place to be arranged.

Reading and interpretation of the Greek text of Plato's *Republic*, or of some other Greek philosophical text.

[28. **Philosophy of Value.** Assistant Professor CHURCH. First term. M W F 10. Goldwin Smith 221. Not given in 1933–34.]

A study in Naturalist, Realist, and Idealist theories of value.

29. **Modern Idealistic Theory of Ethics.** Professor THILLY. Throughout the year, Th 3–5:30. Goldwin Smith 220.

A critical study of the ethics of Kant and Hegel.

30. **Empiricism and Rationalism.** Professor SABINE. Throughout the year. T Th S 11. Goldwin Smith 220.

A critical analysis of the main works of Descartes, Locke, Spinoza, Leibniz, and Hume.

[32. **The Critical Philosophy of Kant.** Professor SABINE. Throughout the year. Hours to be arranged. Goldwin Smith 220. Not given in 1933–34.]

A detailed study of the Critique of Pure Reason.

33. **The Philosophy of Hegel.** Professor CUNNINGHAM. Throughout the year. Hours to be arranged. Goldwin Smith 220.

A critical study of the philosophy of Hegel with special emphasis on the *Phenomenology* and the *Logic*.

34. **The Philosophy of Bradley.** Assistant Professor CHURCH. Throughout the year. Hours to be arranged. Goldwin Smith 220.

A critical analysis of the main works of Bradley, with special emphasis on *Appearance and Reality* and *Essays on Truth and Reality*.

37. **Seminar in Ethics.** Professor THILLY. Throughout the year. Hours to be arranged. Goldwin Smith 220.

Moral philosophy in its relations to economics, politics, and law.

39. **Seminar in Contemporary Philosophy.** Professor CUNNINGHAM. Throughout the year. M 3, or hours to be arranged. Goldwin Smith 220.

Topic for the year 1933–34: Crucial Issues in Contemporary Philosophy.

40. **Seminar in Logic.** Assistant Professor SMART. Throughout the year. F 2, or hours to be arranged. Goldwin Smith 220.

Topic for the year 1933–34: Special Problems in Modern and Contemporary Logic.

42. **Seminar in Ancient and Medieval Philosophy.** Assistant Professor ROBINSON. Throughout the year. W 2–4. Goldwin Smith 220.

Topic for the year 1933–34: Aristotle's *Metaphysics*.

[43. **Seminar in Political Theory.** Professor SABINE. Throughout the year. W 2. Goldwin Smith 220. Not given in 1933–34.]

44. **Seminar in Epistemology.** Professor BURTT. Throughout the year. F 4, or hours to be arranged. Goldwin Smith 220.

Topic for the year 1933–34: Metaphysical Method.

# *PSYCHOLOGY[1]

*Professors* MADISON BENTLEY, H. P. WELD, K. M. DALLENBACH, J. G. JENKINS; *Doctor* SAMUEL FELDMAN.

The research department possesses a separate laboratory in Morrill Hall with rooms for general and individual research, for apparatus, for the library of periodical literature and for meetings of the seminaries.

The resources of the Department have recently been increased by the acquisition of a sound-proof room provided with audio-oscillators and other electrical equipment. This laboratory also includes a workshop for the construction and assemblage of apparatus, and it contains the editorial offices of *The American Journal of Psychology*.

Facilities for graduate studies in animal behavior are provided by the Department of Physiology, with which the Department of Psychology stands in close cooperation.

For the technical training of the student stress is laid upon observational practice, and candidates for advanced degrees are urged to observe in at least three experimental investigations; so far as possible this observational practice is provided in subjects which are remote from the candidate's individual research. No formal list of prerequisites for graduate study in psychology can be laid down. It is assumed, however, that the candidate for an advanced degree will have had, at the least, a good general course in psychology as well as fundamental training in the laboratory.

This department awards one Sage Fellowship and one Sage Scholarship in Psychology. The Fellowship is usually awarded to a candidate who has completed at last two years of graduate study. The Scholarship may be awarded to first-year or second-year graduates.

The Department of Psychology offers the following courses.

1. *Elementary Psychology.* Three hours a week, either term.

2. *General Psychology.* Three hours a week, second term.

3a and 3b. *Introductory Laboratory.* Six hours a week, either term, or both terms.

4. *The Psychophysical and Correlational Methods.* Six hours a week, first term.

5. *Perception.* Three hours a week, first term.

6. *Memory, Skill and Work.* Three hours a week, second term.

7. **Reading of German Psychology.** Dr. FELDMAN. Second term. Hours to be arranged. Seminary Room, Morrill.

The accurate reading and translation of psychological texts and articles. The course presupposes a knowledge of grammar.

8. **Technique of Experimentation.** Professors BENTLEY and DALLENBACH. Second term. T Th 2. Morrill, Psychological Laboratory.

A study of the principles and processes of psychological research.

9. **Experimental, Theoretical, and Historical Problems.** Professors BENTLEY, WELD, and DALLENBACH, and Assistant Professor JENKINS. Morrill, Psychological Laboratory.

10. **Social Psychology.** Prerequisite, consent of the instructor. Professor WELD. Second term. M W F 10. Morrill 41.

11. **Physiological Psychology.** Prerequisite, consent of the instructor. Professor DALLENBACH. First term. M W F 10. Morrill 42.

A systematic review and criticism of the experimental literature of sense psychology. Lectures, discussions, and demonstrations.

12. *Legal Psychology.* Three hours a week, first term.

[1]The Sage Chair in Psychology and the Laboratory of Psychology were established in 1890 under the Foundation of the Susan Linn Sage School of Philosophy, a provision made by the late Henry W. Sage.

13. **History of Psychology.** Prerequisite, consent of the instructor. Professor WELD. First term. M W F 10. Morrill 41.

14. **Contemporary Psychology.** Professor OGDEN. First term. T Th S 11. Seminary Room, Morrill.

A comparative study of current psychological theory; existential psychology, behaviorism, Gestalt psychology, psychoanalysis, and hormic psychology.

15. **Psychology of the Abnormal.** Prerequisite, consent of the instructor. Professor BENTLEY. First term. M W F 10. Morrill 41.

An account of the deficiencies, excesses, and aberrations of the psychological functions. The psychoneuroses and psychological disorders.

16. *Applications of Psychology.* Three hours a week, second term.

17. **Animal Psychology.** Prerequisite, consent of the instructor. Professor BENTLEY. Second term. M W F 10. Morrill 41.

The comparative psychology of vertebrate and invertebrate forms. Lectures, discussions, and demonstrations.

## MATHEMATICS

*Professors* J. I. HUTCHINSON, VIRGIL SNYDER, F. R. SHARPE, ARTHUR RANUM, W. A. HURWITZ, W. B. CARVER, D. C. GILLESPIE, B. W. JONES, and R. P. AGNEW.

The graduate work provides instruction in the principal branches of mathematics and furnishes preparation and material for independent investigation. Only a portion of the whole field can be covered by the courses given in a single year. The courses are changed, therefore, from year to year in order to meet the needs of students.

In addition to the regular instruction, individual guidance and advice are offered to any student who wishes to follow a particular line of inquiry.

Students who take mathematics as a major subject for an advanced degree must have completed previously the equivalent of the elementary course in analytic geometry and calculus, and further study in at least one more advanced subject, as for example, differential equations, advanced calculus, modern algebra, or projective or advanced analytic geometry.

The Oliver Mathematical Club, composed of teachers and advanced students, meets weekly, and has for its object the systematic presentation by the members of some specified mathematical theory of recent development, and of reports on noteworthy articles in current journals and on results of special reading and investigations.

The equipment consists of a collection of about three hundred surfaces, including the various forms of the cyclides, the Kummer surface, the surface of centers, and minimum surfaces; plaster models illustrating positive, negative, and parabolic curvature, and constant measure of curvature; plaster models illustrating the theory of functions, among them models of simply and multiply connected surfaces, and of several forms of Riemann surfaces, and models representing the real parts of algebraic, exponential, logarithmic, and elliptic functions; wooden and glass models of crystals and polyhedra, wire and thread models of twisted curves and ruled surfaces, and skeleton frames for minimum surfaces.

The library has a large collection of books on pure and applied mathematics, including collected works of mathematicians, complete sets of all the important mathematical journals, transactions and other publications of scientific societies, and doctoral theses from the leading American and European universities.

The Erastus Brooks Fellowship of $400 and the Graduate Scholarship of $200 are awarded annually in the field of Mathematics. The fellowship is ordinarily awarded only to applicants who have had one year or more of graduate study.

The following courses are offered. The courses mentioned in brackets will not be given in 1933–34, but are given from time to time.

1. *Solid Geometry.* Three hours a week, either term.
2. *College Algebra.* Three hours a week, either term.
3. *Plane Trigonometry.* Three hours a week, either term.
4, 5. *Analytic Geometry and Calculus.* Five hours a week, either term.
15. *Elementary Course in Higher Mathematics.* Three hours a week, either term.
[20. *Teacher's Course.* Three hours a week, second term. Not given in 1933–34; to be given in 1934–35.]

## *ALGEBRA

21. **Theory of Numbers.** Assistant Professor JONES. Prerequisite, Mathematics 4b or the equivalent. First term. T Th S 8. White 2.
Linear and quadratic congruences, primitive roots, a brief introduction to the theory of quadratic forms and continued fractions.
23. **Modern Algebra.** Professor CARVER. Prerequisite, Mathematics 4b or the equivalent. First term. M W F 10. White 10.
Determinants, matrices, linear dependence, linear transformations.
24. **Theory of Equations.** Assistant Professor JONES. Prerequisite, Mathematics 4b or the equivalent. Second term. T Th S 8. White 2.
DeMoivre's theorem, cubic and quartic equations, Newton's method, determinants and eliminants, symmetric functions.
26. **Theory of Finite Groups.** Professor CARVER. Prerequisite, Mathematics 4b or the equivalent. Second term. M W F 10. White 10.
An elementary course dealing with groups of motions, permutations, and transformations; and treating such abstract group topics as simple and multiple isomorphism, Sylow's theorem, Abelian and prime-power groups.
[**Advanced Theory of Numbers.** Not given in 1933–34.]
[**Introduction to Linear Algebras.** Not given in 1933–34.]
[**Algebraic Invariants.** Not given in 1933–34.]

## *ANALYSIS

41. **Elementary Differential Equations.** Dr. CAMERON. Prerequisite, Mathematics 4b or the equivalent. Repeated in second term. T Th S 11. White 27.
42. **Advanced Calculus.** Professor GILLESPIE. Prerequisite, Mathematics 4b or the equivalent. Throughout the year. M W F 11. White 1.
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.
45. **Theory of Functions of a Complex Variable.** Professor HURWITZ. Prerequisite, Mathematics 4b or the equivalent. Throughout the year. T Th S 9. White 6.
An elementary course in the theory of analytic functions of a complex variable.
46. **Elliptic Integrals.** Professor HUTCHINSON. Prerequisite, Mathematics 4b or the equivalent. First term. S 10. White 25.
The reduction of elliptic integrals to normal forms and their numerical evaluation, with simple applications to geometry and mechanics.
47. **Integral Equations.** Assistant Professor AGNEW. Prerequisite, Mathematics 42 or its equivalent. Throughout the year. M W F 11. White 6.
Differential equations with boundary conditions, linear transformations, orthogonal developments, and related topics.
50. **Entire Functions.** Professor HUTCHINSON. Prerequisite, Mathematics 4b or the equivalent. Second term. S 10. White 25.
A brief outline of the general theory with proofs and illustrations of the most fundamental theorems.

[**Theory of Functions of a Real Variable.** Not given in 1933–34.]
[**Infinite Series.** Not given in 1933–34.]
[**Calculus of Variations.** Not given in 1933–34.]

### *GEOMETRY

61. **Projective Geometry.** Dr. BLACK. Prerequisite, Mathematics 4b or the equivalent. Throughout the year. M W F 9. White B2.
The elements of projected geometry treated synthetically.
62. **Advanced Analytic Geometry.** Professor RANUM. Prerequisite, Mathematics 4b or the equivalent. Throughout the year. T Th S 10. White 9.
Projective geometry of one, two, and three dimensions treated by means of homogeneous coordinates.
64. **Cremona Transformations.** Professor SNYDER. Prerequisite, Mathematics 61. First term. M W F 8. White 24.
The theory of plain Cremona transformations with applications to cubic and quartic curves.
65. **Algebraic Curves.** Professor SNYDER. Prerequisites, Mathematics 61, 62, 64. Second term. M W F 8. White 24.
The geometry on an algebraic curve, canonical series, the Riemann-Roch theorem, birational transformations.
[**Differential Geometry.** Not given in 1933–34.]
[**Non-Euclidean Geometry.** Not given in 1933–34.]
[**Geometry of Hyperspace.** Not given in 1933–34.]

### *APPLIED MATHEMATICS

85. **Vector Analysis.** Professor SHARPE. Prerequisite, Mathematics 4b or the equivalent. First term. M W F 9. White 28.
The algebra and calculus of vectors with applications to mechanics and electrical theory.
87. **Operational Calculus.** Professor SHARPE. Prerequisite, Mathematics 4b or the equivalent. Second term. M W F 9. White 28.
The mathematical foundation of the Heaviside calculus with applications.
[**Differential Equations of Mathematical Physics.** Not given in 1933–34.]
[**Hydrodynamics and Elasticity.** Not given in 1933–34.]
[**Fourier Series and Potential Functions.** Not given in 1933–34.]

## THE ENGINEERING SCIENCES

Graduate work in Engineering will be limited presumably to one field. This may be chosen in any one of the three larger subdivisions or schools of Engineering, i. e., Civil, Mechanical, or Electrical, although further subdivision will always be required. It is, however, always possible to elect work and to pursue research in two or more schools, provided one *field* only is involved, as, for example, in hydro-electric power or in hydro-electric traction.

For better teaching facilities, some duplication exists, both in subject matter and in equipment, and a student should therefore select in such a case the school naturally making the same applications that he himself desires to make. For example, in the School of Mechanical Engineering, hydraulics naturally leads towards, and is developed with a view to, pump design or hydraulic power plants. In Civil Engineering, on the other hand, hydraulics looks forward to water power installations, to canal and harbor construction, to sewerage and waterworks.

In some cases, as for example in studies on cement or steel specifications, further training in chemistry might be found imperative, though that might involve work in still another school. Such additional study is desirable, sometimes essential for successful pursuit of many kinds of graduate work in Engineering.

It is particularly desirable that a thorough knowledge of all fundamental theory be in hand before any attempt is made to carry out its applications into Engineering Design or Construction.

## *MECHANICS

*In Civil Engineering*

*Professors* S. G. George, E. W. Rettger, and E. V. Howell.

An extensive departmental library in Lincoln Hall, in addition to the University Library, affords facilities for advanced work in the field of applied mechanics, especially in applications such as occur in structural engineering.

The prerequisite training for graduate work in this subject should cover the fundamental principles and applications in mathematics, physics, materials, mechanics and structural design required for graduation in civil engineering at Cornell University. Many of the advanced treatises are in French or German, and an ability to read technical works in these languages is extremely valuable.

**Advanced Mechanics.** Linear arches; curved beams; special cases of flexure; problems in the mathematical theory of elasticity; thick hollow cylinders and spheres; plates variously supported; Castigliano's theorem of least work with extensive applications to deflections, beams, arches, and statically indeterminate cases of trusses, beams, frames, and arches.

**Special Research and Seminar Courses in Advanced Mechanics.**

**Topics and Methods of Investigation,** individually arranged.

## *MATERIALS OF CONSTRUCTION

*Professor* H. H. Scofield.

The library of the School of Civil Engineering is well supplied with reference works of various kinds on the subject of structural materials, their properties, specifications, and tests. Especial effort is made to add continually the most recent investigations and researches as the results find their way into print.

The equipment is selected to make all ordinary and many special tests and investigations of the materials of construction. The testing machines range in capacities from 400,000 pounds in tension, compression, and flexure on long span beams to 100,000 pounds. The tests of toughness, abrasion, and wear may be made upon rock, paving brick, and similar materials. Core drills, diamond saws, lap grinders, and other apparatus for the proper preparation of these test pieces are available.

The cement and concrete laboratories are equipped to make all the standard tests upon cement and the various other ingredients entering into concrete. A specialty is made in the tests and investigations of the finished concrete under various conditions, as to proportion, manufacture, and design.

226. *Materials Laboratory.* Either term. Open to graduates who lack fundamental laboratory experience. Professor Scofield and Mr. Vanderlip.

**Engineering Research in Materials.** Either term. Special investigations of an advanced nature of the properties of structural units and the materials of construction. Proper investigational methods are insisted on so that the results shall be of the caliber and scope deemed essential for publication. Professor Scofield.

# HYDRAULICS AND HYDRAULIC ENGINEERING

*In Civil Engineering*

Major work in Experimental Hydraulics, Theoretical Hydraulics, or Hydraulic Engineering may consist in part (subject to the thesis requirement) of advanced courses selected from the subjoined list, or the entire minor

work may consist of such courses accompanied by such special work and reports as may be arranged with the faculty members of the special committee.

A candidate for the degree of Master of Civil Engineering (or of Science), or Doctor of Philosophy who desires to take either a major or a minor subject in these fields of study must ordinarily have completed, preliminary to graduate work, courses in Hydraulics, Municipal Sanitation (including sewer design and construction and sewage disposal), and Water Supply, substantially equivalent to these courses as required of all undergraduates in the School of Civil Engineering. If a graduate student lacks one or more of these preliminary courses or considerable portions of any of them, more than the minimum period of residence may be necessary.

Ordinarily for major work in *Hydraulic Engineering* the thesis requirement of the Graduate School must be satisfied by work involving original designs, estimates, or analyses based on actual engineering data, these to be gathered by the student himself as an essential part of advanced work in this field, and the requirement may not be satisfied by the so-called descriptive type of thesis with only rather vague design based on assumed data.

For major work in *Experimental (or Theoretical) Hydraulics* the thesis requirement may be satisfied by individual experimental (or theoretical) investigation and a thesis based thereon. Ordinarily fully half of the student's total time should be devoted to the thesis investigation. The tendency is to underestimate the time required for preliminary work and that necessary for a thorough digestion of results in preparation of the thesis. Consequently the work should be begun, if possible, early in the first term of residence.

## *HYDRAULICS

*Professor* E. W. SCHODER.

**Hydraulic Measurements.** The experimental work usually includes weirs, Pitot tubes, pipes, current meters, fire hose and nozzles, ordinary water meters, Venturi meters, floats in open channels, actual measurement of river discharge (on a week-end trip) and such occasional tests as opportunity offers in the laboratory or the immediate neighborhood of Ithaca.

**Experimental Hydraulic Investigation.** The subject and scope of the investigation should be selected by conference at the beginning of the term if not previously arranged. It is often permissible and desirable for two students to work together on the same investigation. Written reports are required but the text need not be typewritten in thesis style; these reports are kept by the department. In most cases it is necessary to arrange a definite schedule for work in the laboratory to avoid conflicts.

## *HYDRAULIC ENGINEERING

*In Civil Engineering*

*Professor* F. J. SEERY.

C. E. 231. **Hydraulic Contruction.** The course is devoted largely to a study of water storage and the engineering investigations and design of structures associated with stream regulation for public water supplies, water power, irrigation or navigation. Extensive problems are worked out involving the preliminary investigation of a project, exploration of dam sites, surveys of reservoir sites, the economics of storage, manipulation of storage and pondage, the preparation of an estimate of quantities, costs, plan of progress in construction, etc., for a particular project. The stability of weir dams by graphics, and the analytic design of high masonry dams by Wegmann's method, together with a study of all the factors affecting the stability and form of section of a dam, and the methods of construction are fully covered by text and in problems. Second term. M W F 1:40–4. Lincoln 22.

C. E. 232. **Water-Power Engineering.** Recitations from assigned text and the working of lengthy problems. The course is devoted to a general study of the problems of water power development, the factors affecting the economics of a project, the engineering and commercial feasibility of developing power and the value of a mill site. A detailed study of the characteristics of modern turbine types, the selection of mechanical equipment suited to the conditions of installation and operation, the effects of load factors, pondage, storage and steam auxiliary on the capacity and cost; together with an analysis of the power capacity of a low head mill site, the speed regulation of a plant under medium head fed by a long penstock, and a thorough study of the phenomena of unsteady flow and surging, with and without surge tanks, are covered by the text and incorporated into numerical problems taken from existing plants. First term. M W F 10. Lincoln 34.

*In Mechanical Engineering*

*Professor* F. G. SWITZER.

Arrangements can sometimes be made for experimental work in the University hydro-electric plant. This plant contains a reaction turbine built by the I. P. Morris Department of the Wm. Cramp and Sons Ship and Engine Building Co., rated at 550 h. p., 600 r.p.m. at 142 ft. head. There are also four impulse turbines of the Pelton-Doble type, two of which are rated at 280 h.p., 124 r.p.m. at 135 ft. head, and the other two are rated at 50 h.p., 300 r.p.m. at 135 ft. head. The three large machines are directly connected to 60-cycle alternaters; the two smaller machines are directly connected to d.c. generators. There is also a separate d.c. generator driven by a synchronous motor and the usual switchboard and control apparatus.

The hydraulic laboratory, under the direction of the Department of Experimental Engineering, is also available for the investigation of turbine and draft tube problems, centrifugal pump performance, measurement of water, etc.

The libraries of the University have a very complete collection of treatises relating to mechanics, hydraulics, hydro-electric engineering, and to similar subjects. In addition, these libraries contain the more representative engineering periodicals and the transactions of the leading engineering societies of the world.

[336. *Hydraulic Power Plants.* Professor SWITZER. Two lectures a week throughout the year. Not given in 1933–34.]

338. *Hydraulic Power Plant Problems.* Professor SWITZER. Students who have had preliminary training in hydraulic power plant work may select problems dealing with the design, cost of construction and economic feasibility of such a project, as an isolated plant or as part of a power system which includes auxiliary thermal power plants.

## *MACHINE DESIGN

*Professors* C. D. ALBERT, F. S. ROGERS, C. E. TOWNSEND, E. F. GARNER, and S. J. KOSHKIN.

Under this head is included advanced work in descriptive geometry, kinematics and dynamics, machine design and design methods, and special design problems and investigational work.

There are eight well equipped drawing rooms and a very complete collection of Kinematic models. The Department Library, the Library of the School of Mechanical Engineering, and the University Library have a very complete collection of books on drawing, kinematics, machine design and construction, mechanical technology, structural design, and other books on related subjects.

The department offers the following courses:

120. *Descriptive Geometry.* First term: credit, three hours.

121. *Mechanical Working Drawing.* Second term: credit, three hours.

312. *Kinematics.* First term: credit, three hours.

313. *Empirical Design and Kinematic Drawing.* First term: credit, two hours.

314. *Kinematics.* Credit, two hours first term, and one hour second term.

315. *Empirical Design and Kinematic Drawing.* Credit, two hours each term.

316. *General Machine Design Theory.* First term: credit, two hours.

317. *Machine Design.* Either term: credit, two hours.

318 *a, b. General Machine Design Theory.* Throughout the year: credit, two hours each term.

319. *Machine Design.* Second term: credit, three hours.

320. *Mechanical Technology as Related to Design.* Either term; credit, three hours.

323. *Elements of Structural Work.* Either term: credit, three hours.

326. *Machine Design.* Second term: credit, one hour.

321. **Advanced Kinematics and Kinetics.** Professors ALBERT and ROGERS. Prerequisite courses, 312 and 313, or 314 and 315. Two discussion periods and one three-hour drafting period a week throughout the second term; credit, three hours.

Graphical and semi-graphical treatment of linear and angular velocities and accelerations and of the resulting forces, stresses, and strains due to the form and mass of the moving parts of mechanisms and machines. Vibration and critical speeds and the theoretical basis and use of balancing machines for securing static and running balance of machine parts, will be treated so far as time permits.

322. **Material Handling.** Assistant Professor KOSHKIN. Prerequisite courses 312 and 313, or 314 and 315. Two lectures a week throughout the first term: credit, two hours.

Treatment and analysis of the known methods of handling different kinds of materials and of the principles and considerations involved in a proper choice of the method of handling any given kind of material.

## *HIGHWAY ENGINEERING

*Professors* W. L. CONWELL and R. Y. THATCHER.

The laboratories for testing rocks, aggregates, other non-bituminous highway materials and concrete are in the basement of Lincoln Hall. The laboratories are equipped with a Deval machine, core drill, Page impact machine for the toughness test, ball mill, molding machine for cementation specimens, impact machine for the cementation test, rock saw, grinding lap, Dorry machine, rattler for testing paving brick, and equipment ranging in capacity from 50,000 lbs. to 400,000 lbs. for making tests in tension, compression, etc.

The laboratory for testing bituminous highway materials, bituminous mixtures and subgrade soils is housed in a separate building. This laboratory is equipped with facilities for making the standard tests of specific gravity, consistency, ductility, volatilization, distillation, flash and burning point, softening point, total bitumen, fixed carbon, etc., on bituminous materials, and also with apparatus for the examination of bituminous mixtures and bituminous pavements. Equipment is also available for determining the plastic limit, liquid limit, field moisture equivalent, centrifuge moisture equivalent, shrinkage limit, slaking value, wet and dry mechanical analysis, etc., of subgrade soils.

The other Laboratories of the School of Civil Engineering equipped for the purpose of investigating the properties of engineering materials and the Ceramic Laboratory of the Department of Geology, which is equipped with kilns and a brick machine, are also available for students specializing in highway engineering.

The Library of the School of Civil Engineering and the University Library contain a comprehensive collection of books on highway engineering periodicals, publications of technical societies, etc., while the office of the Department of Railroad and Highway Engineering has on file city and state specifications and re-

ports, government bulletins and reports, reports on highway engineering research, standard plans and plans of highway projects, catalogues of equipment, etc., all of which are available to students.

C. E. 265. *Highway Engineering.* Either term. Credit three hours. Prerequisite courses 260-A and 260-B.

C. E. 266. **Highway Laboratory.** Elective. Seniors and graduate students. Either term. Credit three hours. Prerequisite Course 265, or may be taken concurrently with Course 265. This course includes tests for the lower liquid limit, lower plastic limit, centrifuge moisture equivalent, etc., to examine the properties of subgrade soils; the standard tests of asphalts and tars used for highway construction and maintenance; sampling aggregates and examination of their suitability for non-bituminous and bituminous highways; and trial mixtures and stability tests of sheet asphalt pavements. Professor CONWELL and Assistant Professor THATCHER.

C. E. 267. **Advanced Highway Engineering.** Elective. Seniors and graduate students. Second term. Credit three hours. Prerequisite, Course 265. This course is conducted as a seminar. Meetings are held once each week during an afternoon or evening. The topics for assignment and discussion include the economics of highway engineering, design, construction, and maintenance of highways, the latest research programs and reports, labor and plant organization for various kinds of highway contracts with especial emphasis on the economics of contracting, highway finance, legislation, regulation, etc. Professor CONWELL.

C. E. 268. **Advanced Highway Laboratory.** Elective. Seniors and graduate students. Either term. Credit three hours. Prerequisite, Courses 265 and 266. Testing of non-bituminous and bituminous highway materials and a study of their characteristics; testing of aggregates, soils, bituminous concrete, sheet asphalt, and asphalt paving block mixtures; study of specifications. Special investigations and tests are made to determine the properties of various combinations of materials and the effects of modifications in design. Two laboratory periods a week. Professor CONWELL and Assistant Professor THATCHER.

Occasionally during the year inspection trips are made to investigate drainage and subsoil conditions, condition of highways especially during the latter part of winter and early spring, and during the construction season various highway projects are visited, particular attention being paid to methods and contractor's equipment and organization.

*Note:* For larger highway structures see *STRUCTURAL ENGINEERING.*

## *RAILROAD ENGINEERING

*Professors* F. A. BARNES, J. E. PERRY, and R. Y. THATCHER.

The library of the School of Civil Engineering contains an excellent and up-to-date collection of books, periodicals, and publications of railway and other technical societies on the location, construction, maintenance, and operation of railways and on transportation. Specifications, standard plans, and maps and profiles are available for use in the study of economics of location, railway structures, signaling, yard and terminal design, etc. Instrumental equipment is available for securing additional data for special problems in relocation and in design of structures.

260-A. *Railroad Location.* Juniors. See Course 213. One week during summer vacation, opening date to be announced. Credit one hour.

260-B. *Railroad Surveying and Drawing.* Juniors. Either term. Credit three hours. One recitation and two field or drawing periods a week. Prerequisite courses 213 and 260-A.

261. **Railroad Maintenance of Way.** Elective. Seniors and graduates. First term. Credit three hours. Prerequisite courses 260-A and 260-B. The subjects treated are drainage, track materials, track laying, track maintenance,

separation of grades, and improvement in grades and alinement. Lectures and recitations three hours a week. Professor BARNES and Assistant Professor PERRY.

262. **Railroad Operation and Management.** Elective. Seniors and graduates. Second term. Credit three hours. Prerequisite courses 260-A and 260-B. Under organization the following subjects are treated: general principles underlying organization, principal departments of railway service, and their interrelations. Freight traffic, freight houses, classification yards, car service rules, accounting, etc., are among the topics considered under operation. Signaling and interlocking and train rules are also considered. Lectures and recitations three hours a week. Professor BARNES and Assistant Professor PERRY.

263. **Railroad Location.** Elective. Seniors and graduates. Second term. Credit three hours. A detailed study is made of the economic principles governing the location of new railroads, both steam and electric, and the revision or relocation of existing lines to make them most efficient as transportation machines. Lectures and recitations with problems involving investigations of projects, revisions and comparisons of alternate locations. Three hours a week. Professor BARNES.

264. *Engineering Construction.* Sophomores. Either term. Credit three hours. A course in the fundamentals of construction with special reference to field methods, equipment and tools, plant layouts, and costs. The course includes economic selection of structures, estimates and analyses of costs.

291. **Engineering Design.** Elective. Seniors and graduates. Credit three or more hours. Hours to be arranged.

(e) **Railroad Engineering.** Either term. The problems are those encountered in the location and construction of railroads, and include the following subjects: Economic location of railroads; culverts; bridges; retaining walls; tunnel and subway design; small depot buildings; freight houses; water supply and coaling plants; icing stations; turntables and engine-houses; gravel washing plants; track layouts with details of signals and interlocking; yard and terminal design, etc. Bills of material and estimates of cost are usually required. The field is so broad that the interest of the student is given consideration in assigning problems. Professor BARNES and Assistant Professor PERRY.

297. **Engineering Research.** Elective. Seniors and graduates. Credit three or more hours. Hours to be arranged.

(e) **Railroad Engineering.** Either term. Special problems in the economics of location, construction, maintenance and operation of railroads, comparison of transportation agencies, traffic studies and economics of various systems of transport. Professor BARNES.

In addition to the above courses, the student may take courses in other departments if time permits; such as courses in transportation in the College of Arts and Sciences, or in the applications of electricity to railway work in the School of Electrical Engineering.

*Note:* For the larger railway structures, see *STRUCTURAL ENGINEERING.*

## *SANITARY ENGINEERING

*Professors* H. N. OGDEN and C. L. WALKER.

The courses offered to graduate students may be divided into two classes: those dealing with the design, construction, and operation of sewage-disposal plants, and water purification plants; and those fundamental studies in chemistry, biology, and bacteriology, which the undergraduate student in civil engineering may not have been able to pursue.

A sewage-disposal plant in the city of Ithaca offers opportunity for experimental study of sedimentation, sludge digestion and sludge drying. Within a short distance from Ithaca are five other plants, well adapted for critical examinations of efficiencies. Numerous other opportunities are offered for the study of similar questions.

The laboratories in all the related subjects are open to graduate students in sanitary engineering. The courses in organic chemistry are well adapted to the study of the disposal of trade wastes. The courses in mycology and botany afford excellent opportunity for studying the life history of algae and other water plants which affect both stream pollution and purification. The courses in bacteriology deal not only with water bacteria and the colon types but also with pathogenic forms interesting from the point of view of epidemiology. A well-equipped sanitary laboratory established in the College gives an opportunity for students to acquire not merely laboratory technique in water analysis, but also a practical training in the forms of interpretation. This laboratory is also available for experimental studies of the efficiency of water and sewage plants and of methods of dealing with the refuse from factories. The library is well provided with the literature of the various subjects bearing on municipal sanitation.

The following courses in other subjects in the University may profitably be taken by graduate students in sanitary engineering: Economics 76; Chemistry 305; Chemistry 615, 620; Entomology 52; Veterinary College, Course 43.

In order to take advanced work in this department, the student must have had an equivalent of the following preliminary courses described in the Announcement of the College of Engineering:

Sanitary Biology; Municipal Sanitation; Purification and Control of Water Supplies; Sewage Works.

*Primarily for Graduates*

257. **Purification of Water.** Professor OGDEN. Both terms. Specific problems in water purification; control of watersheds; effect of sedimentation on waters of different compositions; treatment of waters for particular requirements, such as removal of hardness, sediment, bacteria, etc. A report on some existing water system will be required from each student.

258. **Conference on Present Methods of Sewage Disposal.** Professor OGDEN. Both terms. A critical study of the construction and operation of plants now in existence. Inspections and reports.

259. **Laboratory Course.** Professors OGDEN and WALKER. Second term. Devoted to some special problem of sewage or water, such as the operation of a water-filtration plant, a sewage-disposal plant, the purification of trade wastes, the value of disinfection, etc.

## *HEAT-POWER ENGINEERING

*Professors* W. N. BARNARD, F. O. ELLENWOOD, R. E. CLARK, W. H. HOOK, and C. O. MACKEY.

The graduate work conducted under this heading includes original investigations in engineering thermodynamics, problems in power plant economics, the selection and arrangement of the equipment of power plants and the design of such equipment. The library is liberally provided with reference books, periodical literature, and transactions of engineering societies relating to these subjects.

As prerequisites for the graduate work in this field the student should have had the equivalent of the fundamental courses in machine design, experimental engineering, and heat-power engineering that are required of undergraduates in mechanical engineering. These courses are described in the Announcement of the College of Engineering. Those lacking the full equivalent of this training may be required to take one or more of these undergraduate courses or to do specially assigned work to make up the deficiency.

The following courses, which are described in the Announcement of the College of Engineering, are open to both undergraduate and graduate students:

340. *Heat-Power Engineering.* Mainly Thermodynamics. Three hours a week, throughout the year. Assistant Professor MACKEY.

345. *Heat-Power Engineering.* Chiefly Plant Equipment. Three hours a week, throughout the year. Professor ELLENWOOD.

346. *Steam Power Plants.* Two hours a week, throughout the year. Professor BARNARD.

347. *Computing and Design.* Parallels Course 346. Two three-hour periods a week, throughout the year. Professor BARNARD.

350. *Steam Turbines.* Two hours a week, second term. Assistant Professor CLARK.

351. *Internal Combustion Engines.* Two hours a week, first term. Assistant Professor CLARK.

352. *Steam Boilers and Boiler Plants.* Two hours a week, second term. Assistant Professor HOOK.

359. *Design and Special Problems in Heat-Power Engineering.* Advanced students. Either term. Work and credit as arranged. Professors BARNARD and ELLENWOOD.

392. *Graphical Computation and Representation.* Two hours a week, second term. Assistant Professor MACKEY.

## *STRUCTURAL ENGINEERING

*Professors* L. C. URQUHART, E. N. BURROWS, and C. E. O'ROURKE.

In this subject instruction is offered in the determination of loading and stresses and the design of roofs, buildings, bridges, arches, foundations, piers, retaining walls and other structures of timber, steel and concrete.

To qualify for graduate work in structural engineering, a knowledge of theoretical mechanics, of strength of materials, of engineering construction, and elementary courses in stresses and design in timber, steel, and concrete are required.

C.E. 270. *Bridge Stresses.* Four hours a week. Either term.

C.E. 271. *Structural Design.* Three hours a week. Either term.

C.E. 272. **Higher Structures.** Prerequisite, courses 270 and 271 or equivalent. Professors URQUHART or O'ROURKE. Either term. Statically indeterminate structures, continuous beams and trusses, arches and rigid frames. (Required of all graduate students whose major or minor is in Structural Engineering.)

C.E. 273. *Steel Buildings.* Three hours a week. First term.

C.E. 274. *Bridge Design.* Three hours a week. Second term.

C.E. 275. *Investigation of Existing Bridges.* Three hours a week. Second term.

C.E. 280. *Concrete Construction.* Three hours a week. Either term.

C.E. 281. *Foundations.* Three hours a week. Either term.

C.E. 282. *Reinforced Concrete Building Design.* Three hours a week. First term.

C.E. 283. **Reinforced Concrete Arch.** Prerequisite, course 280 or equivalent. Professor URQUHART. First term. Design of railroad or highway Reinforced Concrete Arch Bridge.

C.E. 284. *Concrete Highway Bridge Design.* Three hours a week. Second term.

C.E. 285. **Concrete Design.** Prerequisite course 280 or equivalent. Professor URQUHART or O'ROURKE. Either term. Design of retaining walls, multiple column footings, bins, and reservoirs.

C.E. 286. *Building Construction.* Three hours a week. First term.

C.E. 291. **Engineering Design.** Professor URQUHART. Either term. Special problems of design or investigation not covered in any of the above courses.

# *EXPERIMENTAL ENGINEERING AND MECHANICAL ENGINEERING RESEARCH

*Professors* H. DIEDERICHS, W. M. SAWDON, G. B. UPTON, V. R. GAGE, and A. C. DAVIS.

THE MATERIALS TESTING LABORATORY. This laboratory is equipped for tension and compression tests with an Olsen 300,000,000-lb. machine, a Riehlé 100,000-lb. machine, a 200,000,000-lb. Emery hydraulic machine, an Olsen 150,000-lb. three-screw machine, an Amsler 100,000-lb. hydraulic machine, together with several other machines varying in capacity from 10,000 to 100,000 pounds. For transverse test there is a Riehlé machine of 200,000 pounds capacity and a Fairbanks machine of 10,000 pounds capacity. There are one Thurston autographic torsion machine, one Olsen torsion machine of 200,000 inch-pounds capacity, and two Upton-Lewis fatigue testing machines, an Amsler-Charpy-Izod impact testing machine, and one Olsen Balancing Machine. The equipment includes Brinell and Rockwell Hardness testing machines, Scleroscopes, a Leitz Microphotographic apparatus, extensometers, a cathetometer, gas furnaces, tempering baths, and all other apparatus required for the determination of the physical qualities of engineering materials under tensile, compressive, transverse, and torsional stress, and under different kinds of heat treatment.

THE STEAM LABORATORY. In this laboratory there is a 150-HP triple expansion Allis-Corliss engine so fitted up that it may be operated as a simple, compound or triple expansion engine, condensing or non-condensing. There are also several smaller engines, including a Harris-Corliss, a Payne, a Fitchburg Uniflow, and a Troy steam engine. There are three surface condensers and one jet condenser which may be connected with these engines as desired. There are two 35-kw. horizontal Curtis turbines and a 15-kw. De Laval turbine which drive electric generators and may be run condensing or non-condensing, and a Lee turbine driving a Gould centrifugal pump. A two-stage Worthington air compressor driven by a Uni-flow engine and one airbrake pump, together with meters, nozzles, and other instruments, may be used for routine tests. This part of the laboratory also has several fans that can be arranged and equipped for testing. The apparatus and instruments used for engine testing comprise about eighty indicators of different types, about seventy-five steam gauges, a number of calorimeters for determination of the quality of steam, speed counters, tachometers, planimeters, etc., besides a number of dynamometers of various kinds. The boiler section of this laboratory has one 150-HP Babcock and Wilcox water-tube boiler of the marine type, one 100-HP Babcock and Wilcox water-tube boiler of the standard type both of which are fitted with internal super-heaters, and an 80-HP Heine water-tube boiler. The auxiliary apparatus consists of a Cochrane open heater, a Wainwright closed heater, steam pumps, traps, injectors, etc. A full set of scales, measuring tanks, gauges, flue gas apparatus, separating and throttling calorimeters, pyrometers, etc., complete the boiler equipment.

THE GAS ENGINE LABORATORY. The equipment in this laboratory is chosen with a view to providing a great variety of types as to fuel used, governing, etc. It includes an 8-HP Fairbanks gasoline engine, an 8-HP Olds gasoline engine, a 6-HP Ingeco oil engine, a 6-HP and a 15-HP Hornsby-Akroyd oil engine, a 30-HP Westinghouse gas engine with gas producer, a 25-kw. General Electric Co. gas motor set, and a 45-HP Diesel engine. High speed engines are represented by a variety of auto and airplane engines. The testing equipment includes a full set of indicators and a Midgley indicator. Dynamometers are represented by a 150-HP Sprague Electric, a 60-HP Diehl Electric, a 150-HP General Electric, and two Wheeler hydraulic good for from 100 to 300-HP at 4000 r.p.m.

THE HYDRAULIC LABORATORY. This laboratory contains the following machines and apparatus: a 6-inch single-stage De Laval centrifugal pump; a 2½-inch two-stage Worthington centrifugal pump; a 16-inch Goulds centrifugal

pump direct connected to a variable speed motor; a 12-inch Doble water wheel; a 15-inch S. Morgan Smith turbine with Lombard governor; sets of weir boxes with various types of weirs and nozzles for the determination of coefficients of discharge; various types of water meters and other apparatus for measuring the flow of water, such as Pitot tubes, Venturi meters, current meters, etc.

THE OIL TESTING LABORATORY. This laboratory contains a Cornell oil-testing machine, and a Thurston standard railway-testing machine, and several smaller testing machines. The rest of the equipment consists of several viscosimeters of different types, flash and burning test apparatus, together with the necessary hydrometers and thermometers.

THE REFRIGERATION LABORATORY. For the study of refrigeration the mechanical laboratory possesses a 2-ton York absorption machine and a very complete York refrigerating compression plant having a capacity of 15 tons of ice.

THE CEMENT LABORATORY. This laboratory contains the ordinary apparatus for the testing of cement and concrete.

THE FUEL TESTING LABORATORY. This laboratory contains a complete equipment of fuel calorimeters and other apparatus needed for the determination of the composition and calorific value of fuel, whether gaseous, liquid, or solid.

For the major work in this department the graduate student is required to select a subject in the field of mechanical engineering research. This work is in charge of officers of instruction who devote a considerable portion of their entire time to it and give advice and assistance to graduate students who are carrying on investigations in the various branches of mechanical engineering. Much of the work in this subject is conducted in the several laboratories described under Experimental Engineering. The equipment and resources of all other departments of the Sibley School are likewise available, and in most instances arrangements can be made to use the equipment of the scientific and engineering departments of the other colleges of the University.

In addition to the well-equipped Sibley library containing reference books, periodical literature, bulletins and transactions of bureaus and societies, relating to mechanical engineering and allied branches of learning, the graduate student has access to the University Library and to the special libraries of the other engineering and scientific departments of the University. In the University Library is a large collection of research theses, and the Department of Engineering Research has on file the results of many investigations.

As minor subjects the department offers the following courses open to both graduate and undergraduate students:

**Mechanical Laboratory—Experimental Engineering.** First term. Efficiency tests of gas and gasoline engines, steam injectors, steam turbine, blowing fan, hydraulic turbine, and centrifugal pump. Reports are required to be full and complete; and to include data and results of each test under consideration, and all information necessary to understand completely the machine tested and the methods used.

**Mechanical Laboratory—Experimental Engineering.** Second term. A written report is required on each experiment. Detailed study of methods of testing and methods of computation in the following subjects: testing of engines and boilers, air compressors, ice machines; measurement of flow of water, etc.

**Motor Car Construction.** Professor UPTON.

**Heating and Ventilating.** Professor SAWDON. The methods of design and of construction of various forms of ventilating and heating apparatus.

**Applied Metallography.** Professor UPTON. Covers in historical sequence the development of knowledge of the internal structure of metals, and the relation of structure and properties; the technique of metallographic research, study of application of laws of physical chemistry to interpretation and correlation of results. Study of stable and metastable conditions; heat treatment theory and practice. The practical aim of metallography is constantly emphasized.

**Engineering Research.** The undertaking of specially set problems in engi-

neering research. Primarily for graduate students who have had the equivalent of the training in experimental engineering procedure covered by the first two courses listed above. The work may cover the major work for a thesis in this field.

## *ELECTRICAL ENGINEERING

*Professors* P. M. LINCOLN, V. KARAPETOFF, W. C. BALLARD, R. F. CHAMBERLAIN, B. K. NORTHROP, E. M. STRONG, L. A. BURCKMYER, M. G. MALTI, and TRUE MCLEAN.

THE LECTURE EQUIPMENT. The lecture room is exceptionally well provided with display apparatus and with apparatus especially designed for demonstration purposes.

A HIGH-TENSION LABORATORY is being equipped, with particular reference to the needs of graduate students, the equipment being designed for moderate voltages and accurate measurements.

THE ELECTRICAL LABORATORY. This laboratory is provided with a great variety of standard and special machines for both direct and alternating-current work, along with the necessary meters and control equipment. Among the special pieces of equipment are a street-car truck with motors and also a complete outfit for exhibiting in actual operation the multiple-unit system of electric car control.

The laboratory has been provided with a large number of new machines, including an alternating-current generator which may be connected as a two-phase, three-phase, or six-phase, machine; a modern synchronous converter provided with brush-lifting device; a squirrel-cage and phase-wound induction motor; a sine-wave generating set; also a constant-current transformer and a high voltage testing transformer with a kenotron tube from which 100,000 volts d.c. may be obtained.

THE STANDARDIZING LABORATORY. This laboratory is equipped with the necessary potentiometers, galvanometers and standards for the calibration of instruments, and the testing of materials used in electrical work. An equipment of oscillographs, both G. E. and Westingthouse, is available for work on wave form and other work of a similar nature.

THE COMMUNICATION LABORATORY. This laboratory is provided with representative telegraph and telephone equipment including a complete machine-switching exchange. The radio section includes several transmitters and a number of tube sets operating as telephone and telegraph transmitters. For work with receiving circuits, an assortment of condensers and inductance coils are available in addition to the usual receiving apparatus. Precision measurements are made possible by primary standards of inductance, capacity, and frequency.

ALEXANDER GRAY MEMORIAL LIBRARY. The new library of the School of Electrical Engineering in Franklin Hall has recently been made ready for the use of students and Faculty, in addition to the facilities of the main University Library.

THE UNIVERSITY POWER PLANT. The power for the various laboratories is obtained from the University Hydro-electric Plant, which contains large three-phase alternators, direct-driven by both impulse and reaction water-wheels. This plant is complete in every respect and is used for inspection.

A graduate student working for the M.E.E. degree is expected to have completed a course in Electrical Engineering substantially equivalent to that required for the degree of E.E. at Cornell University.

A considerable amount of advanced theoretical investigations by the members of the faculty is going on at all times, the subjects studied in the past having been: the general properties of electric, magnetic, and electrostatic circuits, theory of machinery and lines, dielectrics, electron theory, relativity, electric waves, etc. Graduate students are not only invited but expected to participate in these researches. Some of the above topics are taken up in the courses mentioned below, especially in the Seminary and Engineering Mathematics.

E. E. 421, 422, 423, 424. *Advanced Electrical Theory.* Seniors and graduates. Five hours a term. Professor KARAPETOFF and Assistant Professor MALTI.

E. E. 433–434. *Advanced Electrical Laboratory.* Seniors and graduates. Professor CHAMBERLAIN and Assistant Professor BURCKMYER.

E. E. 452. *Communication Engineering.* Seniors and graduates. Four hours, second term. Professor BALLARD and Assistant Professor MCLEAN.

E. E. 444. *The Economics of Public Utilities.* Seniors and graduates. Two hours, second term. Professor LINCOLN.

E. E. 481. *Engineering Mathematics.* Seniors and graduates. Two hours, either term. Professor KARAPETOFF.

485. *Applied Mathematics.* Juniors. Professor KARAPETOFF.

Students intending to do experimental research will be given all the available resources and assistance by the faculty and by the college mechanicians. Resources of the other departments of the University are also available when needed. Those intending to study a special topic or phenomenon are advised to communicate with the Director in advance, in order that they may know what facilities are available along those particular lines.

**Theory of Electrical Machinery.** Professor KARAPETOFF and Assistant Professor MALTI.

**Characteristics of Electrical Machinery.** Professor KARAPETOFF and Assistant Professor MALTI.

**Solid Dielectrics.** Assistant Professor MALTI. A study of the anomalous behavior of solid dielectrics under varying conditions of EMF, time, frequency, temperature, pressure, humidity, and ionizing radiations.

**Fundamentals of Electrical Engineering.** Assistant Professor E. M. STRONG.

**Electric Power Plants.** Professor LINCOLN.

**Electrical Design.** Professor LINCOLN.

**Electrical Communication.** Professor BALLARD and Assistant Professor MCLEAN.

**Electrical Laboratory.** Professor CHAMBERLAIN and Assistant Professor BURCKMYER.

**Industrial Applications of Electrical Power.** Professor CHAMBERLAIN.

**Electric Railway Practice.** Professor CHAMBERLAIN.

**Transmission Line Stability.** Professor KARAPETOFF.

**The Graduate Seminary in Electrical Engineering.** Professors LINCOLN and KARAPETOFF. A topic is selected each year to suit the range of interests and the preparation of the students taking it. The primary purpose is to acquaint the students with modern research on the border line between physics and electrical engineering, in topics which are expected to become of practical importance within the next few years.

**Graduate Seminary in Communication Engineering.** Professor BALLARD.

## *INDUSTRIAL ENGINEERING

*Professors* M. A. LEE, D. S. KIMBALL, and D. S. KIMBALL, JR.

The courses offered include a consideration of the organization, administration and selection and location of equipment for industrial enterprises.

No formal graduate courses are offered but equipment is available for original work in micro-motion analysis and in other phases of the field of Industrial Engineering.

To take advanced work in this department the student must have had the equivalent of the undergraduate work listed below:

I-380. *Industrial Organization.* Professor D. S. KIMBALL.

I-382. *Industrial Engineering.* Professor LEE and Assistant Professor D. S. KIMBALL, JR.

I-383. *Industrial Engineering Problems.* Professor LEE and Assistant Professor D. S. KIMBALL, JR.

I-386. *Industrial Relations.* Professor LEE and Assistant Professor D. S. KIMBALL, JR.

I-388. *Cost Accounting.* Professor LEE and Assistant Professor D. S. KIMBALL, JR.

## *TOPOGRAPHIC AND GEODETIC ENGINEERING

*Professors* P. H. UNDERWOOD and L. A. LAWRENCE.

The preliminary work as a qualification for work in this department should include the equivalent of the regular undergraduate course in civil engineering, including work in General and Practical Astronomy. A thorough training in Mathematics and Physics is desirable.

Graduate work for those interested in Topographic and Geodetic Engineering includes courses in Advanced Topographic Surveying, in Geodesy, Least Squares, Geodetic Astronomy, and in Photographic and Aerial Surveying. The Library of the School of Civil Engineering contains an extensive collection of reference books in the subjects mentioned. The surveying equipment of the School is also available for practice work.

110. *Elementary Surveying.* Credit three hours. Either term.

211. *Advanced Surveying.* Credit three hours. First term. Prerequisite, Surveying 110.

212. *Advanced Surveying.* Credit two hours. Second term.

213. *Summer Survey; Topographic, Hydrographic, and Geodetic Survey; Camp.* Credit four hours, five weeks during last of summer preceding first term. Prerequisites, Surveying 212 and Astronomy 182.

214. *Mapping.* Credit two hours. First term. Prerequisite, Surveying 213.

215. *Problems in Adjustment of Observations.* Credit one hour. Second term. Prerequisite, Surveying 213.

C.E. 216. **Least Squares: Adjustment of Observations.** Second term. Credit two hours. Prerequisites, calculus and physics. Lectures and recitations. Applications are made to problems in physics, astronomy, mechanics, hydraulics, surveying, etc., with some attention given to the derivation of empirical formulae. Professor UNDERWOOD.

C.E. 217. **Advanced Topographic Surveying.** Second term. Prerequisite, Course 213. Economics of surveying methods; surveys for special purposes; for storage and distribution of water for irrigation; for earthwork on a large scale; for lines of communication, etc. Photographic surveying, lectures, recitations, assigned readings. Professor UNDERWOOD.

C.E. 219. **Photographic and Aerial Surveying.** Second term. Credit three hours. Prerequisite, Advanced Surveying, Course 212 or Course 211-A. The principles of photographic surveying; surveys with camera stations on the ground; stereoscopic methods and apparatus; aerial surveys. Recitations, lectures, and collateral reading. Professor UNDERWOOD.

## *AGRICULTURAL ENGINEERING

*Professors* H. W. RILEY, B. B. ROBB, J. C. MCCURDY, F. H. RANDOLPH, F. L. FAIRBANKS, L. M. ROEHL, and J. E. REYNA.

Students desiring to undertake graduate work in Agricultural Engineering should have, first of all, first-hand knowledge of farm life and of rural conditions generally. Adequate grounding in the engineering fundamentals of the phase studied and ability to perceive the applications of these fundamentals are most essential, since the applications of engineering practices to agriculture, though of great economic importance, are usually successful in proportion as they are direct

and simple. Whether a student's preparation is adequate for any given line of advanced study can be determined only by special consideration of each case. Country life experience, alertness, originality, and interest are important factors for success.

## *Special Facilities*

*Farm Power Machinery.* The laboratory equipment available consists of a 150-HP Froude Hydraulic Absorption Dynamometer, a Szekely Traction Dynamometer, with either disc or strip recording mechanism, tractors of many types, the usual farm power machines, and farm lands affording typical Eastern soils and topography.

*Ventilation of Animal Shelters and Crop Storages.* For this work the department is using a Leeds and Northrup Micro-Max resistance thermometer recorder giving an automatic continuous record of 64 thermometer stations in addition to an L. and N. portable resistance thermometer indicator with hand switch for 24 stations. Poultry houses and cattle, sheep, and hog barns, with natural and electric ventilation, are available.

*Land Drainage.* The University farms, being of rolling topography and of various soil types and formations, afford, in their extensive and well mapped drainage systems, unusual opportunities for advanced study.

1. *Farm Mechanics.* Three hours a week, either term.

101. *Electricity on the Farm.* Three hours a week, second term.

102. *Farm Power Machinery.* Three hours a week, second term.

10. *Household Mechanics.* Three hours a week, either term. For women students.

21. *Farm Engineering.* Three hours a week, either term.

121. *Farm Engineering, Advanced Course.* Two hours a week, second term. Given in alternate years.

[122. *Drainage and Irrigation.* Two hours a week, second term. Given in alternate years, not in 1933–34.]

24. *Farm Concrete.* Two hours a week, first term.

31. *Farm Structures.* Three hours a week, either term.

131. *Farm Structures, Advanced Course.* Two or three hours a week, either term.

40. *Farm Shop Work.* Two hours a week, both terms.

41. *Shop Work for Rural High School Teachers.* Three hours a week, both terms.

46. *Household Carpentry, Furniture Repairing and Refinishing.* Two hours a week, second term. For women students.

47. *Farm Blacksmithing.* One hour a week, either term.

48. *Advanced Farm Blacksmithing.* One or two hours a week, either term.

251. **Research in Agricultural Engineering.** Prerequisite, permission to register. Professors RILEY, ROBB, MCCURDY and RANDOLPH and Assistant Professors FAIRBANKS, REYNA, and ROEHL. Hours as arranged. Investigations for which the student is prepared and for which adequate facilities can be provided.

252. **Seminary.** Required of graduate students and open to advanced seniors. Departmental staff. M 4:30–5:45. Both terms, credit one hour a term. Presentation and discussion of papers on special problems in agricultural engineering.

161. *Mechanism of Hotel Machines.* Four hours a week, either term.

162. *Hotel Power Plants.* Three hours a week, second term.

163. *Hotel Auxiliary Equipment.* Three hours a week, first term.

164. *Hotel Planning.* Three hours a week, second term.

166. *Hotel Maintenance.* One hour a week, first term.

# THE PHYSICAL SCIENCES

## *ASTRONOMY AND GEODESY

*Professor* S. L. BOOTHROYD.

Those electing a major in Astronomy will be required to take courses 184, 185, 186 and 187 and those electing a major in Geodesy will be required to take courses 186 and 188 and Surveying 216. In either case the candidate must present evidence that his training in Mathematics and Physics and in Civil Engineering for majors in Geodesy is sufficiently thorough to warrant undertaking the advanced courses. Those selecting Astronomy or Geodesy as a minor may select such courses as meet their requirements provided the necessary prerequisites are offered.

For work in Practical Astronomy, the Observatory equipment includes a superb 12-inch equatorial; an astronomical transit by Troughton and Simms; an astronomical transit and zenith telescope by Fauth; altazimuths by Troughton and Simms and by Fauth; a Howard Sidereal Clock; chronographs and photographic equipment as well as smaller instruments.

The Geodetic equipment, besides that mentioned above also includes a Mendenhall Half-second Pendulum Apparatus of the pattern used in the United-States Coast and Geodetic Survey; also equipment for the investigation of standards of length.

The Department of Astronomy is not at present prepared to conduct advanced courses in Celestial Mechanics and Theoretical Astronomy or advanced work in Astronomical Spectroscopy other than that mentioned in connection with courses 185 and 187. Study along these lines may be undertaken by students under the direction of the head of the department. Students contemplating an astronomical career are advised to arrange, in consultation with the head of the department, for courses in Mathematics, Physics and Astronomy which will fit them to prepare for fellowships in some of the research observatories which give full opportunities for the development of the student's research abilities.

*For Graduates and Undergraduates*

180. *Introduction to Astronomy.* Three hours a week, either term.

181. *The Solar System.* Three hours a week, second term. Prerequisite, Astronomy 180 (or Physics 3 and 4) or equivalent.

182. *The Elements of Field Astronomy.* Two hours a week, either term. Prerequisites, Astronomy 180, and Mathematics 3 (or Surveying 110).

183. *History of Astronomy.* Three hours a week, first term. Prerequisite, Astronomy 180.

184. *The Sun, Stars, and Nebulae.* Three hours a week, first term. Prerequisites, Astronomy 181; Mathematics 4a and 4b, and Physics 61 and 62.

186. *Geodetic Astronomy.* Credit three hours, either term. Prerequisites, Astronomy 181 and 182, Surveying 212 and Mathematics 4a and 4b, or the equivalent.

*Primarily for Graduates*

[185. **Special Topics in Astrophysics.** Professor BOOTHROYD. Prerequisites, Astronomy 184 and Physics 130. Throughout the year. Credit two hours a term. Hours to be arranged. Given in alternate years, not in 1933–34.]

187. **Spectroscopic Binary Orbits.** Professor BOOTHROYD. Prerequisites, Astronomy 184, or equivalent. Throughout the year. Credit two hours a term. Hours to be arranged. Study of the theory of Spectroscopic Binary Orbits and measurement and reduction of a suitable series of spectograms and computation of the orbital elements from the resulting radial velocities.

188. **Geodesy.** Professor BOOTHROYD. Throughout the year. Credit two hours a term. Hours to be arranged. Prerequisites, Astronomy 186, Sur-

veying 213 and 216 or the equivalent. Laboratory involving the determination of the intensity of gravity, the investigation of the errors of graduated circles and of other geodetic equipment. Assigned reading and discussion of articles in current geophysical literature.

## *PHYSICS

*Professors* ERNEST MERRITT, FREDERICK BEDELL, F. K. RICHTMYER, R. C. GIBBS, E. H. KENNARD, C. C. MURDOCK, J. E. TREVOR, H. E. HOWE, J. R. COLLINS, G. E. GRANTHAM, and L. P. SMITH.

Opportunities are offered for study and investigation by a limited number of students in both theoretical and experimental physics. About forty rooms in Rockefeller Hall are set aside for research. This work is organized separately with its own equipment, stock, and apparatus room, special workshop for the use of graduate students, appliances for the production, handling and liquefaction of air and other gases, X-ray apparatus, spectroscopic apparatus including three vacuum spectographs, a refrigerating plant, and a dynamo laboratory well equipped with various sorts of direct and alternating current apparatus. An instrument maker's shop with three mechanicians and an experienced glass blower are available for the construction and repair of apparatus.

Members of the staff will be especially interested in directing research as follows: Professor BEDELL, in electricity and magnetism, theoretical and experimental, particularly in alternating current phenomena, and in aerodynamics; Professor COLLINS, in spectroscopy, particularly in the infra-red; Professor GIBBS, in atomic and molecular spectroscopy; Professor KENNARD, in theoretical physics, especially in the theory of radiation and in quantum mechanics; Professor MERRITT, in experimental physics, particularly in electricity and magnetism and problems involving luminescence; Professor MURDOCK, in X-rays and crystal structure; Professor RICHTMYER, in X-rays; Professor SMITH in quantum mechanics, and experimental work in ionization of gases and photo-electricity; Professor TREVOR, in the theory of electrodynamics.

Members of the staff who are in residence in Ithaca during the summer often stand ready to consult with investigators.

As a major or minor subject in physics it is usual to name either a particular aspect of physics,—as general, theoretical, experimental or applied physics,—or some particular field—such as mechanics, heat, light, electricity. One aspect or field may be combined with another, or with a subject outside of physics. *Physics* itself may be named as a subject when the other subjects are outside of physics.

**Important Notice.** Since only a limited number of graduate students can be accommodated in physics, arrangement for admission must be made by application to the Dean of the Graduate School before coming to Ithaca.

### GENERAL COURSES

3, 4. *Introductory Experimental Physics.* Three hours a week.

11, 12. *Introductory Experimental Physics.* Three hours a week. For freshmen in Engineering.

21, 22. *General Physics.* Three hours a week. For sophomores in Engineering.

31, 32. *General Physics.* Three hours a week. For sophomore B-Chem. students.

34a, b. *Physical Measurements.* Either term, two hours a week. Laboratory to accompany Physics 31–32.

55. *Introductory Physical Experiments.* Either term, three hours a week. For sophomore pre-medical students.

60. *Physical Experiments.* Both terms, three hours a week. Laboratory to accompany Physics 61-62.

61, 62. *General Physics.* Each term, three hours a week. Follows Physics 3-4 for students in Arts and Sciences.

105. *Advanced Laboratory Practice.* Two laboratory periods and a seminar each week, either term.

*For Graduates and Undergraduates*

106. **Advanced Laboratory Practice.** First and second term. Prerequisites, Physics 60, 61, 62 and such special preparation as may be needed for the experiments which the student wishes to undertake. Admission only after consultation. Professor MURDOCK, other professors cooperating in the direction of the work in certain fields, and Messrs. CUYKENDALL, MINGINS, and SHAW. T W Th F afternoons, Rockefeller 324.

Considerable time is devoted to each of a small number of experiments selected to meet the requirements of the individual student. Single experiments may be selected from other advanced laboratory courses such as 573, 593, 595, 613 and 627. Groups of students will also be organized to perform series of related experiments, in connection with which appropriate class-room instruction will be offered at hours to be arranged. The following groups are planned in 1933–34: Spectroscopy, first term, Mr. SHAW; Electronics and Ionization, first term, Mr. CUYKENDALL; High Temperature Measurements, second term, Assistant Professor COLLINS.

[111. **Mechanics.** First term. Prerequisite, Physics 60 and 62, and Mathematics 4. Professor MURDOCK. M W F 8. Given in alternate years, not in 1933–34.]

[112. **Properties of Matter.** Second term. Prerequisite, Physics 60 and 62. Professor MURDOCK. M W F 8. Given in alternate years, not in 1933–34.]

120. **Electricity and Magnetism.** Throughout the year. Prerequisite, Physics 60, 61, 62, and Mathematics 4. Professor MURDOCK. M W F 8. Rockefeller C. Given in alternate years.

A study of the laws of electrostatic and magnetic fields; electromagnetism and electromagnetic waves; thermal and chemical electromotive forces; metallic, electrolytic and gaseous conduction.

130. **Light.** Second term. Prerequisite, Physics 60 and 62, and Mathematics 4 or the equivalent. Assistant Professor HOWE. T Th S 10. Given in alternate years.

An introductory study of geometrical optics based on Houston's "Light".

160. **Wave Motion and Sound.** First term. Prerequisite, Physics 60 and 62, and Mathematics 4 or the equivalent. Assistant Professor COLLINS. T Th S 10, Rockefeller C. This course is given in alternate years.

The general properties of wave motion; a comparative study of elastic waves, waves on the surface of liquids and sound waves; a detailed study of sound, based on Wood's "Textbook of Sound".

[170. **Introduction to Modern Physical Theories.** Throughout the year. Prerequisite, Physics 120 or 130 or the equivalent. Professor RICHTMYER. T Th S 10. Given in alternate years, not in 1933–34.]

*Primarily for Graduates*

211. **Theoretical Mechanics.** Throughout the year. Prerequisite, Physics 111 or the equivalent. Assistant Professor COLLINS. T Th S 8. Given in alternate years.

The mechanics of systems of particles and of rigid bodies; generalized coördinates; Hamilton's principle; elements of hydrodynamics and elasticity.

[220. **Electromagnetic Theory.** Throughout the year. Prerequisite, Physics 120 or the equivalent. Professor KENNARD. T Th S 8. Given in alternate years, not in 1933–34.

Electric and magnetic fields and electromagnetic waves, omitting developments in special mathematical functions; electrons; connection with Relativity.]

[230. **Theoretical Optics.** Throughout the year. Prerequisite, Physics 130 or the equivalent. Assistant Professor COLLINS. T Th S 9. Given in alternate years, not in 1933–34.]

242. **Thermodynamics and Statistical Mechanics.** Second term. Primarily for graduates. Professor KENNARD. M W F 9.

Includes a discussion of the fundamentals of thermodynamics.

300. **Physics Seminary.** Throughout the year. For seniors and graduates. Professor MERRITT. M 3:15. Rockefeller C.

## SPECIAL TOPIC COURSES

405. **Mathematical Methods in Physics.** Throughout the year. Prerequisite, Mathematics 4a and 4b or the equivalent. Assistant Professor SMITH. T Th S 11.

Lectures and problem work designed to give the student a working knowledge of the principal mathematical methods used in Physics.

415. **Special Topics in Physics.** Reading in any branch of physics under the guidance of some member of the staff.

[460. **Kinetic Theory of Matter.** Professor KENNARD. First term. Not given in 1933–34.]

474. **Quantum Mechanics.** Professor KENNARD. First term. T Th S 10. Primarily for graduates. An introduction to wave mechanics.

475. **Quantum Mechanics of Spectra and Radiation.** Follows Physics 474. Professor KENNARD. Second term. T Th S 10. The theory of many-electron atoms and of radiation phenomena.

[476. **Quantum Mechanics.** First term. Prerequisite, Physics 474. Assistant Professor SMITH. M W F 11. Not given in 1933–34.

The quantum-mechanical theory of statistics and of crystals with particular reference to the electric and magnetic properties of metals; also of collision processes and the formation of molecules and crystals.]

[480. **Advanced Quantum Mechanics.** Second term. Professor KENNARD and Assistant Professor SMITH. Not given in 1933–34.

Lectures on the more theoretical aspects of quantum mechanics, such as the Matrix Mechanics, the relativistic quantum mechanics, the Dirac Transformation Theory, the theory of groups, etc.]

525. **Thermodynamics.** Throughout the year. Prerequisite, Mathematics 41. Mathematics 42 is recommended. Professor TREVOR. Day and hour to be arranged.

571. **Spectroscopy.** Throughout the year. Professor GIBBS. W F 12. Given in alternate years.

A detailed study of the operation of spectroscopic apparatus, of the nature, origin and structure of spectra, and of the laws by which atomic spectra of different elements are related.

573. **Spectroscopy.** Second term. Professor GIBBS and Mr. SHAW. Day and hour to be arranged.

Advanced laboratory work. Registration limited to those who have completed the special group work in spectroscopy given in the first term in Physics 106.

[581. **Atomic Structure.** Professor GIBBS. Second term; given in alternate years, not in 1933–34. M W F 10.

The development of modern atomic theory and its application in the explanation of special series, resonance, ionizing potentials, and fine structure; the structure of the nucleus as revealed by radioactive and isotopic phenomena and the effects of high-speed bombardment.]

591. **X-Rays and the Structure of Matter.** Professor RICHTMYER. First term; given in alternate years. M W F 10. Rockefeller.

Lectures and assigned readings on the production and measurement of X-rays; laws of emission, scattering and absorption; the relation of these laws to atomic structure, quantum theory and similar problems.

[592. **X-Rays and the Structure of Matter.** Second term. Professor MURDOCK. M W F 10. Rockefeller. Not given in 1933–34. See Chemistry 1000.]

593. **X-Rays.** Second term. Prerequisite, first term of Physics 120 or equivalent. Professor RICHTMYER. T Th afternoons. Rockefeller 324.

Laboratory work for a limited number of students. The production and effects of X-rays, methods of study and measurement with particular reference to research.

[595. **Diffraction of X-Rays by Crystals.** Second term. Prerequisite, Physics 34 or 60. Lectures and laboratory for a limited number of students. Professor MURDOCK. Given in alternate years, not in 1933–34.]

611. **Electric Waves and Oscillations.** First term. Prerequisite, Introductory Physics. Professor MERRITT. M 12. Rockefeller B. Experimental lectures. Given in alternate years.

612. **Special Topics in Recent Experimental Physics.** Second term. Prerequisite, Introductory Physics. Professors GIBBS and MURDOCK and Assistant Professor COLLINS. M 12. Rockefeller B. Alternates with Physics 622.

613. **Electric Waves and Oscillations.** Second term. Laboratory. Prerequisite, Physics 60 and 611, or the equivalent. Professor MERRITT and Mr. MINGINS. Day and hour to be arranged.

[621. **Electrical Conduction in Gases.** Prerequisite, Introductory Physics. Professor MERRITT. M 12. Experimental lectures. Given in alternate years, not in 1933–34.]

[622. **Special Topics in Recent Experimental Physics.** Second term. Alternates with Physics 612. Not given in 1933–34.]

[627. **Electrical Conduction in Gases.** First term. Prerequisites, Physics 60, 61 and 62 or the equivalent. Assistant Professor SMITH. Not given in 1933–34.]

633. **Alternating Currents.** First term. Prerequisite, Physics 34 or the equivalent. Professor BEDELL and Dr. RICHARDS. T Th 11. Rockefeller 155.

A study of the underlying principles of alternating currents; the development of graphical methods of analysis as a basis for testing and for the solution of practical problems.

634. **Electrical Laboratory.** Either term, or throughout the year. Prerequisite, Physics 34 or the equivalent. Professor BEDELL and Dr. RICHARDS. Hours as arranged. Rockefeller.

Direct and alternating current measurement, and the investigation of special problems. The character of the work will be varied to meet individual needs.

[636. **Advanced Alternating Currents.** Second term. Prerequisite, Physics 633. Professor BEDELL. T Th 11. Rockefeller 155.

Discussion of the theory and measurement of alternating currents. A seminary for graduates. Not given in 1933–34.]

## GEOLOGY

*Professors* H. RIES, G. D. HARRIS, O. D. VON ENGELN, and C. M. NEVIN, and *Dr.* J. D. BURFOOT.

Under the general title of geology are included dynamic and structural geology, physical geography, geomorphology, glaciology, mineralogy, crystallography, petrography, paleontology and stratigraphic geology, economic geology.

Graduate work in Geology may include, in addition to work done in Ithaca, the opportunity of spending part of the time in investigation under approved direction in the field away from Ithaca.

The University Library has a most extensive collection of private publications, magazines, and geological society transactions, as well as files of North American, European, and other Geological Survey reports. In the Geological Depart-

ment there is the entire library of the late Professor H. S. Williams, and a collection of over 50,000 author's separates.

Special rooms are available for graduate students for carrying on research work.

The department is provided with apparatus for different kinds of photographic work, and for polishing and sectioning ores, minerals, and rocks.

A seismograph station is situated in McGraw Hall.

A. *Elementary Geology.* Throughout the year. Three hours a week.

100. *Introductory Geology.* Three hours a week. Either term.

## *SEDIMENTATION AND STRUCTURAL GEOLOGY

*Professor* NEVIN.

A student taking a major in this branch of geology must first have had at least elementary work in such other branches of geology as the professor in charge may prescribe.

101. *Selected Problems in Geology.* Second term. Three hours a week.

102. **Structural Geology.** First term. Credit three hours. Prerequisite, Geology A or equivalent. Assistant Professor NEVIN. Lectures, T Th 11. Laboratory, T 1:40.

Geologic structures and their causes. A basic course for all students majoring in this branch of geology.

103. **Sedimentation.** First term. Credit three hours. Prerequisite, Geology A. Assistant Professor NEVIN. Lectures, T Th 10. Laboratory, Th 1:40.

The principles involved in the formation of sediments. Laboratory work consists of experimentation with sedimentary processes and field investigations.

107. **Geologic Surveying.** Given in the summer field school. Credit six hours. Assistant Professor NEVIN.

106. **Special Work in Structural Geology and Sedimentation.**

Directed reading and original investigation adapted to the needs of the student. Assistant Professor NEVIN.

## *PHYSICAL GEOGRAPHY

*Professor* VON ENGELN.

The region around Ithaca affords excellent and varied illustrations of physiography and glaciology. For many years the teachers and advanced students of physical geography have been engaged in investigation of the local field problems, and there is further opportunity of this kind. The main laboratory is well equipped with topographic maps and photographs; the collection of relief models is notably complete and there is an experimental laboratory with apparatus and facilities for carrying on a variety of experiments in the development of land forms, etc. The work in this branch also includes introductory courses in economic and regional geography. Such studies in correlation with physical geography and geomorphology may be the preparation for advanced regional study and investigation.

200. **Geomorphology.** Three hours a week, first term. Prerequisite, Geology A.

201. *Physiography of the Lands and Oceanography.* Three hours a week, first term.

203. *Geography of North America.* Three hours a week, first term.

204. *Representation of the Relief of Land Forms.* Three hours a week, second term.

206. *Commercial Geography.* Three hours a week, second term.

205. **Glaciers and Glaciation.** Second term. Credit three hours. Prerequisite, Geology A. Professor VON ENGELN and Mr. RAPPENECKER. Lectures, T Th 10. Laboratory, T 1:40. Physiography Laboratory, McGraw.

Living glaciers and the phenomena of the glacial period. One or more Saturdays devoted to all-day excursions in the spring. Mapping and interpretation of glacial deposits.

208. **Advanced Physiography and Regional Geography.** Prerequisites, an adequate background of course work in geology, especially physiography, and related subjects. Professor VON ENGELN. Both terms. Hours by arrangement. Physiography Laboratory.

Particular problems, especially those of glaciology and the relation of geological structure to topography and physiographic history. In general students with a minor in physiography are expected to undertake work in this course.

209. **Seminar.** Prerequisites as for course 208. Professor VON ENGELN. First or second or both terms. Usually Monday afternoon 4. Physiography Laboratory.

Reviews of current literature or of the original literature on some topic or problem of physiography.

## *MINERALOGY, CRYSTALLOGRAPHY, AND PETROGRAPHY

*Dr.* BURFOOT.

The laboratory equipment is relatively good as regards petrographic microscopes, apparatus for chemical and physical investigations of rocks, and apparatus for special crystallographic determinations. There are also collections of rocks and study collections of minerals, including the Benjamin Silliman, Jr., collection, acquired before the opening of the University in 1868.

Special graduate courses in this division are not offered, but advanced work is adapted to the needs of the individual. Some of the less special courses are, however, so dependent on a rather advanced knowledge of physics or chemistry or of both that they are to be considered as requiring the maturity of graduates, although open also to undergraduates with sufficient preparation.

316. **Metamorphic Geology.** First term. Credit two hours. Prerequisite, Geology A. Dr. BURFOOT. M W 9.

The principles of regional metamorphism and rock alteration. Work with the petrographic microscope will be given to those students who are qualified.

311. *Elementary Mineralogy.* Three hours a week. Either term.

312. *Crystallography.* First term. Credit three hours.

313. **Mineralogy.** Second term. Credit three hours. Should be preceded by Course 312. Dr. BURFOOT. Lectures, T Th 8. Laboratory to be arranged. Mineralogy Laboratory, McGraw.

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

[315. *General Lithology.* Second term. Credit one hour. Not given in 1933–34.]

317. **Optical Determination of Minerals.** First term. Credit three hours. Prerequisite, Geology 311. Dr. MAYO. Lectures, M W 8. Laboratory, to be arranged at time of registration. Petrography Laboratory, McGraw.

318a. **Petrography.** Second term. Credit three hours. Prerequisite, Geology 317. Dr. MAYO. Lectures, M W 8. Laboratory to be arranged at time of registration. Petrography Laboratory, McGraw.

318b. **Advanced Petrography.** Second term. Credit three hours. Prerequisite, Geology 318a. Dr. MAYO. Lectures, M W 9. Laboratory to be arranged.

319. **Sedimentary Petrography.** Second term. Credit three hours. Lectures, M W 9. Prerequisite, Geology 317. Dr. MAYO. Laboratory to be arranged. McGraw.

The methods of investigating the mineral composition, texture, and other physical characteristics of sedimentary rocks; some of the applications of these methods to geological problems.

320. **Advanced or Special Work in Mineralogy, Crystallography, or Petrography.** Throughout the year. Credit variable. Prerequisite, variable. Dr. BURFOOT and Dr. MAYO. Day and hour to be arranged. McGraw.

Adapted to the needs of the individual student.

[321. **Seminar in Mineralogy and Crystallography.** Throughout the year. Credit one hour a term. Dr. BURFOOT and Dr. MAYO. M 4:15. Mineralogy Laboratory. McGraw. Not given in 1933–34.]

## *PALEONTOLOGY AND STRATIGRAPHIC GEOLOGY

*Professor* HARRIS.

The University is so situated that excellent exposures of Devonian formations are at its very door, and the typical sections of New York State which are of fundamental importance in American Paleozoic geology are within short excursion range. The most important of these are the Rochester and Niagara gorges, Trenton Falls and the Helderberg escarpments, the Chemung Valley, and the coal fields of northern Pennsylvania.

Excellent facilities are afforded to those desiring to study the later formations since the department has extensive collections made in the West Indies, Central and South America, as well as different parts of the United States and Europe. There is also the Newcomb collection (10,000 species) of recent shells; and an exceptional wealth of conchological literature in the geological and the general library. *The Bulletins of American Paleontology* and *Palaeontographica Americana* are published in the department.

### *For Graduates and Undergraduates*

400. *Historic Geology.* Three hours a week. Either term.

401. *Ancient Life.* Two hours a week. First term.

402. **Stratigraphic Paleontology.** Professor HARRIS and Dr. CASTER. Prerequisite, Geology 400 or the equivalent and a course in Paleontology or the permission of the instructor. Throughout the year. Lecture, T Th 8. One laboratory by appointment. McGraw 28. Given in alternate years.

A careful study of characteristic fossils of geologic formations. First term: characteristic fossils of the Paleozoic. Second term: characteristic fossils of the Mesozoic and Tertiary.

403. *Introductory Paleontology.* Three hours a week. First term.

404. **Invertebrate Paleontology.** Professor HARRIS. Prerequisite, Introductory Paleontology or the permission of the instructor. Throughout the year. Lectures, M W 8. Laboratory by appointment. McGraw 28.

This course is given every year but the subject matter is repeated only once in every six semesters, 1933–34: first term, Brachiopoda; second term, Cephalopoda.

[405. *Invertebrate Paleontology—Foraminifera.*]

406. **Paleontologic and Stratigraphic Problems.** Professor HARRIS. Prerequisite, permission of the instructor. Throughout the year. Conferences and reports to be arranged. Credit variable. McGraw 28.

An informal study course arranged to fit the needs of the student.

407. **Paleontology and Stratigraphy of South America.** Professor HARRIS. Prerequisite, Geology 400 or the equivalent, and a course in Paleontology. Readings in French or German. Second term. Two lectures a week by arrangement. McGraw 28. Given in alternate years.

A review of the literature on the Paleontology and Stratigraphy of South America and cursory examination of large collections of South American paleontologic material in the geologic museum.

408. *Geologic History of New York State.* Prerequisite, a course in Historic Geology. Dr. CASTER. Second term. Credit three hours.

## *ECONOMIC GEOLOGY

*Professor* RIES.

The work in economic geology is designed to familiarize the student with the origin, occurrence, and distribution of the mineral products of economic value, and also with the practical application of geological principles. The laboratory contains an excellent study collection of economic materials from the United States, Canada, Mexico, Europe, and Africa, including ores, fuels, clays, abrasives, building stones, etc., most of these representing suites of material collected by members of the staff of instruction on geological trips. This collection is supplemented by maps and models.

In addition to the collections, the economic geology laboratory has facilities for general work and research on economic materials; the equipment for metallographic work on ores and for clay investigation is excellent.

The work of graduate instruction consists in part of lectures and in part of special work arranged to suit the needs of the individual student. Students who are registered for a major subject in economic geology are expected to engage in research, which should preferably be based on field work.

Excursions may readily be taken to the anthracite regions of Pennsylvania; to the iron, slate, cement, and talc region near Easton, Pa.; to the magnetite mines of the Adirondacks, etc. Field trips of greater or less length are taken to some of these localities every year.

500. **General Economic Geology.** Throughout the year. Credit three hours a term.

503. *Petroleum Technology.* First term. Credit two hours.

502. *Petroleum Geology.* Second term. Credit three hours.

[510. **Clay Investigation.** Second term. Credit three hours. Prerequisite, Geology A or 501, and Chemistry 101, and permission of the instructor. Professor RIES and Dr. BURFOOT. One lecture and two laboratory periods to be arranged. McGraw. Open only to graduates. Not given in 1933–34.]

511. **Advanced or Special Work in Economic Geology.** Throughout the year. Credit variable. Prerequisite, dependent on the nature of the work. Open to seniors only by special permission. Professor RIES. Day and hour to be arranged. McGraw.

512. **Seminary in Economic Geology.** Throughout the year. Credit two hours a term. Prerequisite, Geology A and 500. Professor RIES. Day and hour to be arranged. McGraw.

**Department Seminar.** Every two weeks throughout the year. All graduate students are expected to attend. Time to be announced.

## *METEOROLOGY

*Professor* R. A. MORDOFF.

A broad field for investigation and research is offered in meteorology. The weather and climatic factors, in their relation to crop distribution and production and to engineering, transportation, economic and social problems, are suitable subjects for graduate study.

A graduate student in meteorology should have completed the elementary courses in meteorology and climatology, physics, mathematics, geology, and preferably elementary statistics.

1. *Elementary Meteorology.* Three hours a week, either term.

2. **Climatology.** Prerequisite, Meteorology 1 or the equivalent. Professor MORDOFF. Second term. M W 9. East Roberts 341. A course covering general climatology and the various climates of the United States with emphasis on those of New York State.

211. **Research.** Prerequisite, Climatology 2, or the equivalent. Professor MORDOFF. First or second term. Hours by appointment. Original investigations in meteorology and climatology.

212. **Seminar.** Prerequisite, Climatology 2, or the equivalent. Professor MORDOFF. First term. Hours to be arranged. East Roberts 341. Preparations and reading of reports on special topics. Abstracts and discussions of papers dealing with the current literature of meteorology and climatology.

## CHEMISTRY

*Professors* W. D. BANCROFT, G. W. CAVANAUGH, E. M. CHAMOT, A. W. BROWNE, F. H. RHODES, T. R. BRIGGS, M. L. NICHOLS, JACOB PAPISH, J. R. JOHNSON, C. W. MASON, and A. W. LAUBENGAYER; *Doctors* R. A. CONNOR, C. W. MORSE, and R. C. TALLMAN.

A graduate student who desires to take either a major or a minor subject in chemistry may select any one of the following seven branches: inorganic chemistry, analytical chemistry, organic chemistry, physical chemistry, optical chemistry, industrial chemistry, agricultural chemistry. Under the present procedure, both the major subject and the one minor subject, required for the degree of Master of Arts, Master of Science, or Master of Chemistry, and both the major subject and the two minor subjects required for the degree of Doctor of Philosophy may be selected from the seven divisions mentioned above, but it is desirable that candidates for the degree of Doctor of Philosophy select at last one minor subject outside of chemistry.

A graduate student who desires to take a minor subject in chemistry with some field other than chemistry as the major subject, will be required to offer introductory courses in inorganic chemistry, qualitative analysis and quantitative analysis as preliminary to his graduate study. The work upon his minor subject in chemistry may be taken in any branch of the subject that he is qualified to pursue, and may comprise advanced courses selected from the subjoined list, with the approval of his special committee.

Candidates for the degree of Master of Arts, Master of Science, or Doctor of Philosophy, with major in Chemistry will be required to offer for admission the equivalent of Introductory Inorganic Chemistry 101 and 105; Qualitative Analysis 205 and 206, or 210; Quantitative Analysis 220 and 221, or 225; Introductory Organic Chemistry 305, and 310 (one term); Introductory Physical Chemistry 405, and 410 (one term); they must also present the equivalent of two units of German.

Before admission to candidacy for the degree of Master of Chemistry, students must have completed the requirements for the degree of Bachelor of Chemistry at Cornell University, or must offer the full equivalent of these requirements if they enter from other institutions.

Candidates for the degree of Doctor of Philosophy with major in Chemistry must have completed, before the beginning of the last year of residence, the equivalent of Advanced Quantitative Analysis 230, Gas and Fuel Analysis 250, Introductory Organic Chemistry Laboratory 310 (second term), Introductory Physical Chemistry Laboratory 410 (second term), Introductory Chemical Spectroscopy 505, and Introductory Chemical Microscopy 530. Graduate students entering from approved universities may take, during their residence for the advanced degree, such of these required courses as they have not already pursued. If a graduate student lacks at entrance several of these preliminary courses, more than the minimum period of residence may be necessary.

Graduate students are required to register with the Department of Chemistry on the registration days at the beginning of each term. Entering students must consult with the chairman of the departmental Graduate Scholarship Committee at this time.

Every candidate is required to pass a Qualifying Examination before he is allowed to begin actual experimental work on his thesis problem. This examination will comprise tests in the following four Divisions of Chemistry: (A) Inorganic and General; (B) Analytical; (C) Organic, and (D) Physical. The individual tests, each consisting of a written examination covering a period of two or three hours, will be given in succession at intervals of one week.

One such Qualifying Examination is given at the beginning of each regular term, and at the end of the second regular term of the University year, on days set by the Committee on Qualifying Examinations. The candidate should present himself for the Qualifying Examination not later than the beginning of the term in which he expects to begin actual laboratory work on his thesis problem. In the light of the candidate's achievement in this examination, his Special Committee may further examine his qualifications for graduate study.

After the candidate has passed the Qualifying Examination, and has completed his minor subjects, he will be required to pass a general examination, both written and oral, on his major and minor subjects. Upon recommendation of the candidate's Special Committee, this examination may be taken toward the end of the term preceding his last year of residence. This procedure makes it possible for the candidate to devote his last year of residence to uninterrupted research on his thesis. At the close of his period of residence, and after the acceptance of his thesis, the candidate will be required to pass a final oral examination on the thesis and on related subjects.

As an alternative procedure, the general examination on major and minor subjects and on the thesis may be taken after the acceptance of the thesis.

For a description of the equipment and facilities for study in the various branches of chemistry, see the Announcement of the Department of Chemistry.

All courses in Chemistry are open to properly qualified graduate or undergraduate students. It may be necessary for a graduate student in chemistry to take one or more of the courses designated by italics as primarily for undergraduates, either as prerequisite to his graduate work or as an essential part of his major and minor studies.

Fellowships and scholarships are ordinarily awarded to students who have had at least a year of graduate study.

All courses listed below are to be given in the Baker Laboratory of Chemistry.

## *INORGANIC CHEMISTRY

101. *Introductory Inorganic Chemistry.* Lectures. Repeated in the second term. Credit three hours.

103. *Introductory Inorganic Chemistry.* Lectures. Throughout the year. Credit three hours, first term, two hours second term.

105. *Introductory Inorganic Chemistry.* Recitations and laboratory practice. Repeated in the second term. Credit three hours.

130. **Advanced Inorganic Chemistry.** Throughout the year. Credit three hours a term. Prerequisite or parallel courses, Chemistry 405 and 410. Assistant Professor LAUBENGAYER. M W F 11. Baker 107.

Lectures. The chemical elements are discussed in the order in which they occur in the Periodic Table of Mendeléeff, with special attention 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.

135. **Advanced Inorganic Chemistry.** Either term. Credit one to six hours. Prerequisite, Chemistry 305 and 310. Professor BROWNE, Assistant Professor LAUBENGAYER, and assistants. Day and hour to be arranged. Baker 178 and 122.

Laboratory practice. The preparation, purification, properties, and reactions of inorganic compounds including those of the rarer elements.

Chemistry 135 is designed to accompany Chemistry 130, but either course may be taken separately.

140. **Selected Topics in Advanced Inorganic Chemistry.** Second term. Credit two hours. Prerequisite, Chemistry 405 and 410, or special permission. Professor BROWNE. W F 9. Baker 107.

[150. **The Chemistry of Glass.** Second term. Credit one hour. Assistant Professor LAUBENGAYER. M 9. Baker 107. Open to students who have had or are taking course 405, and to others by special permission.

A discussion of the development and manufacture of glass and related ceramic ware, such as pottery and porcelain, with special emphasis on the relations between constitution and physical and chemical properties. Inspection trips to nearby ceramic plants will be arranged. Not given in 1933–34.]

195. *Research for Seniors.* Throughout the year. Credit two or more hours a term.

## *ANALYTICAL CHEMISTRY

203. *Introductory Qualitative Analysis.* Second term. Credit five hours.

205. *Introductory Qualitative Analysis.* First term. Credit three hours.

206. *Introductory Qualitative Analysis.* First term. Credit three hours.

210. *Introductory Qualitative Analysis.* Shorter course. Repeated in the second term. Credit three hours.

215. **Advanced Qualitative Analysis.** First term. Credit three hours. Prerequisite, Chemistry 220, 221, 305, and 310. Assistant Professor NICHOLS, Mr. AVENS, and assistants. Day and hour to be arranged. Baker 50.

Laboratory practice. Essentially a continuation of Course 206. The methods for separating and detecting a number of metals and acids not studied in Course 206, including many of the rare elements. The qualitative analysis of a number of solutions, solid mixtures, natural and commercial products will be required.

220. *Introductory Quantitative Analysis.* Repeated in the second term. Credit three hours.

221. *Introductory Quantitative Analysis.* Repeated in the second term. Credit three hours.

225. *Introductory Quantitative Analysis.* Shorter course. Repeated in the second term. Credit three hours.

230. *Advanced Quantitative Analysis.* Repeated in the second term. Credit three hours.

235. **Advanced Quantitative Analysis.** Second term. Credit two hours. Prerequisite, first term of Chemistry 405. Assistant Professor NICHOLS. M W 12. Baker 207.

A theoretical discussion of selected topics in quantitative analysis including sampling, indicators, potentiometric and conductometric titrations, together with the development and present status of various analytical methods.

240. **Electrochemical Analysis.** Repeated in the second term. Credit two hours. Prerequisite, Chemistry 230 and 405. Assistant Professor NICHOLS and Dr. MORSE. Day and hour to be arranged. Baker 292.

Laboratory practice in the electrochemical methods for the determination of silver, lead, copper, tin, nickel, cobalt, zinc, iron, etc.; the analysis of alloys and ores.

250. *Gas and Fuel Analysis.* Repeated in the second term. Credit three hours.

270. **Special Methods of Quantitative Analysis.** Either term. Credit two or more hours. Prerequisite, Chemistry 230 and 235. Assistant Professor NICHOLS, Dr. MORSE, and assistants. Day and hour to be arranged. Baker 277.

Laboratory practice in the application of special methods such as indirect analysis, conductometric and potentiometric titrations, etc., to quantitative analysis and the analysis of special materials. The study of the important methods and special forms of apparatus used in scientific gas analysis.

Within certain limits the work may be selected to suit the requirements of the individual student.

275. **Quantitative Microanalysis.** First term. Credit three or more hours. Prerequisite course 230 and special permission. Assistant Professor NICHOLS. M W 9–5. Baker 277.

Laboratory practice in typical methods of both organic and inorganic quantitative microanalysis.

295. *Research for Seniors.* Throughout the year. Credit two or more hours a term.

## *ORGANIC CHEMISTRY

305. *Introductory Organic Chemistry.* Throughout the year. Credit three hours a term.

310. *Introductory Organic Chemistry.* Throughout the year. Credit three hours a term.

315. **Advanced Organic Chemistry.** Throughout the year. Credit two hours a term. Prerequisite, Chemistry 305 and 310. Professor JOHNSON. T Th 9. Baker 177.

Lectures. A presentation of important chapters of organic chemistry and a discussion of classical researches in this field. Primarily for students specializing in organic chemistry.

Students may register for any term separately.

320. **Advanced Organic Chemistry.** Either term. Credit two to six hours a term. Prerequisite, Chemistry 305 and 310. Dr. TALLMAN, Dr. CONNOR, and assistants. Day and hour to be arranged. Baker 208. Conference, F 12. Baker 206.

Laboratory practice. An advanced course in the preparation of organic compounds. The original literature is consulted, and the student is required to repeat some extended and important piece of work, and to compare his results with those published.

340. **Methods of Organic Analysis.** Either term. Credit four hours. Prerequisite, Chemistry 305 and 310. Dr. CONNOR, and assistants. Lectures and conferences, T Th 10. Baker 206. Laboratory sections, T W Th 1:40–4. Baker 350. Laboratory work based upon Kamm: "Qualitative Organic Analysis."

With the permission of the instructor students may register for three hours credit.

365. *Elementary Organic Chemistry.* Second term. Open only to students in the College of Home Economics. Lectures and laboratory, four hours credit.

375. *Elementary Organic Chemistry.* First term. Lectures and laboratory, six hours credit. For students preparing for the study of medicine.

395. *Research for Seniors.* Throughout the year. Credit two or more hours a term.

## *PHYSICAL CHEMISTRY

405. *Introductory Physical Chemistry.* Throughout the year. Credit three hours a term. Lectures.

It is advisable, but not obligatory that course 410 accompany this course.

410. *Introductory Physical Chemistry.* Throughout the year. Credit three hours a term. Prerequisite or parallel course, Chemistry 405. Laboratory practice.

If one term only is taken, registration for the second term is advised.

[415. **Advanced Physical Chemistry.** Throughout the year. Credit two hours a term. Prerequisite, Chemistry 405. Professor BANCROFT. T Th 11. Baker 7.

An exposition of the law of mass action in its application to chemical equilibrium and reaction velocities. Given in alternate years, not in 1933–34.]

420. **Special Topics in Physical Chemistry.** First term. Credit three hours. Prerequisite, Chemistry 405 and at least one term of 410. Professor BRIGGS and assistants. Lectures: M W 12, Baker 7. Laboratory: T W Th or F 1:40–4, Baker 1-A.

This course is a continuation of courses 405 and 410, and includes such topics as thermodynamics and the Phase Rule, electrochemistry, and photochemistry.

430. **Applied Colloid Chemistry.** Throughout the year. Credit two hours a term. Open to candidates for the degree of Bachelor of Chemistry if they have completed Chemistry 405, to others only by special permission. Professor BANCROFT. T Th 10. Baker 7.

Lectures. The theory of colloid chemistry and its application in the arts.

450. **Applied Electrochemistry.** Second term. Credit two hours. Prerequisite, Chemistry 405 and 420. Professor BRIGGS. M W 12. Baker 7.

A discussion of technical electrolytic and electrothermal processes, with emphasis on the refining of metals, the manufacture of chemical compounds, and the storage cell.

455. **Applied Electrochemistry.** Second term. Credit two hours a term. Prerequisite or parallel course, Chemistry 450. Professor BRIGGS and assistant. Day and hour to be arranged. Baker 1-A.

Laboratory practice. Qualitative and quantitative study of electrolysis; determination of electrical conductivity; potentiometric measurements; hydrogen ion concentration; determination of current and energy efficiencies in electrolytic and electrothermal work; electrolytic preparation of organic and inorganic compounds; tests of storage cells; preparation of compounds in the electric furnace; measurement of furnace temperatures.

460. **Theoretical Electrochemistry.** Throughout the year. Credit two hours a term. Prerequisite, Chemistry 405. Professor BANCROFT. T Th 11. Baker 7.

465. **Advanced Physical Chemistry.** Either term. Credit variable, but not to exceed six hours a term. Prerequisite, determined in each case by the Professor in charge. Professors BANCROFT and BRIGGS and assistants. Hour and work to be arranged. Baker 94.

Laboratory practice. Students may elect in mass law, reaction velocity, or efficiency measurements with special reference to course 415; in photo-chemistry, photography, or colloid chemistry with special reference to course 430; in conductivity; or electrometric determinations with special reference to course 460; in electrolytic, or electric furnace products with special reference to course 450; in the application of physical chemical methods to organic chemistry.

495. *Research for Seniors.* Throughout the year. Credit two or more hours a term.

## *OPTICAL CHEMISTRY

505. *Introductory Chemical Spectroscopy.* Repeated in the second term. Credit three hours.

Graduate students are advised to take this course the second term.

510. **Advanced Chemical Spectroscopy.** Either term. Credit two or more hours. Prerequisite, Chemistry 505. Professor PAPISH and assistants. Day and hour to be arranged. Baker 396.

Laboratory practice. The study of arc, spark, and absorption spectra and the application of spectroscopic methods to the identification of dyestuffs. Practice in one or more of the subjects mentioned may be selected by the student.

520. **Spectrographic Methods.** Either term. Credit one or more hours. Prerequisite, Chemistry 505. Professor PAPISH. Laboratory hours to be arranged. Baker 396. Conference, hour to be arranged.

Laboratory practice. The application of photographic methods to arc, spark, and adsorption spectroscopy. Practice is also given in the application of ultraviolet spectroscopy in chemical analysis.

530. *Introductory Chemical Microscopy.* Repeated in the second term. Credit three hours.

Graduate students are advised to take this course the first term.

535. **Microscopic Qualitative Analysis (Inorganic).** Either term. Credit

two or more hours. Prerequisite, Chemistry 530. Professors CHAMOT, MASON, and assistants. Laboratory periods, to be arranged. Baker 378.

Laboratory 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.

540. **Microscopical Methods in Organic Chemistry.** Either term. Credit two or more hours. Prerequisite, Chemistry 530, and special permission. Professors CHAMOT, MASON, and assistants. Day and hour to be arranged. Baker 378.

Laboratory practice. General manipulative methods applicable to small amounts of material, crystallization procedures, determination of melting points and molecular weights; chemical tests and reactions for elements, radicals, and various types of organic compounds. Preparation of simple derivatives.

This course may be extended to cover the analytical reactions of the vegetable alkaloids, "strong drugs," or other special groups of organic substances.

545. **Metallography.** First term. Credit two hours. Prerequisite, Chemistry 530, or special permission. Professor MASON and assistants. Th F 1:40–4. Baker 384.

Laboratory practice and conferences. An introduction to the principles and methods involved in the study of the structure of metals. The relation of microscopical appearances to thermal history and mechanical properties. Preparation of specimens for macroscopic and microscopic study. Metallographic microscopes and their use.

This course is planned approximately to parallel the lectures in the first term of course 705.

[560. **Advanced Chemical Microscopy.** Second term. Credit two hours. Hours to be arranged. Professor MASON.

Conferences and demonstrations, Theory and applications of instruments accessories and methods used in critical microscopy, ultramicroscopy, photomicrography, and other special fields. Typical applications of microscopic methods in research and industry. Not given in 1933–34.]

565. **Special Methods in Chemical Microscopy.** Either term. Credit one or more hours. Prerequisite, special permission. Professors CHAMOT and MASON. Day and hour to be arranged. Baker 378 and 382.

Laboratory practice may be elected in various fields such as photomicrography, ultramicroscopy, crystal studies, micro-manipulations, quantitative determinations, and the microscopy of industrial materials, textiles, papers and foods.

595. *Research for Seniors.* Throughout the year. Credit two or more hours a term.

## *SANITARY CHEMISTRY

*The courses in Sanitary Chemistry, which are under the direction of Professor Chamot, will not be offered in* 1933–34.

[615. *Introductory Sanitary Chemistry* (*Water*). Second term. Credit two hours. Not given in 1933–34.]

[620. *Introductory Sanitary Chemistry* (*Water*). Second term. Credit two hours. Not given in 1933–34.]

[630. **Advanced Sanitary Chemistry** (**Water**). First term. Credit two hours. Prerequisite, Chemistry 615.

Laboratory practice to accompany this course may be elected under Course 635. Not given in 1933–34.]

[635. **Advanced Sanitary Chemistry.** Either term. Credit two or more hours. Prerequisite, to be determined in each case by the instructor in charge. Baker 352, 356, 358.

Laboratory practice.

Students who have had adequate preparation may elect work in any

branch of sanitary chemistry. Among others, work along the following lines may be taken:

The bacteriology of water.

Continuation of work offered in course 620.

The control of water purification.

Water softening.

The work in many cases may be arranged to meet the need of the individual student. Not given in 1933–34.]

[695. *Research for Seniors.* Throughout the year. Credit two or more hours a term. Not given in 1933–34.]

## *INDUSTRIAL CHEMISTRY

705. *Industrial Chemistry.* Throughout the year. Credit three hours a term.

710. **Chemical Engineering.** Second term. Credit four hours.

715. **Selected Topics in Chemical Engineering.** Second term. Credit three hours. Prerequisite or parallel course, Chemistry 705. Professor RHODES. M W F 11. Baker 177.

Lectures. A discussion of special topics in industrial chemistry.

725. **The Chemistry of Fuels.** First term. Credit three hours. Prerequisite, or parallel course, Chemistry 705. Professor RHODES. M W F 11. Baker 177.

Lectures. The chemistry of coal, coke, petroleum, tars, and the fuel gases. Particular stress is laid upon the theoretical chemistry involved in the carbonization of coal, the gasification of coal, and the distillation and refining of petroleum and tar.

730. **Chemical Plant Design.** Throughout the year. Credit three hours a term. Prerequisite, Chemistry 705. Professor RHODES. Day and hour to be arranged.

Conferences and calculation periods. Practice in the calculation and design of chemical plant equipment.

[775. *Engineering Chemistry.* Repeated in the second term. Credit two hours. Not given in 1933–34.]

[776. *Chemistry of Pulp and Paper.* Second term. Credit two hours. Not given in 1933–34.]

795. *Research for Seniors.* Throughout the year. Credit two or more hours a term.

## *BIOLOGICAL CHEMISTRY

For Biological Chemistry, see page 119, under Biological Sciences.

## *AGRICULTURAL CHEMISTRY

*Students will not be allowed to register in courses in Agricultural Chemistry until after they have taken and passed Chemistry 101 and 105 or their equivalent.*

805. **Introductory Agricultural Chemistry (Fertilizers, Insecticides, Soils).** First term. Credit two hours. Prerequisite, Chemistry 305 (or 375). Professor CAVANAUGH. T Th 11. Baker 302.

Lectures. The relation of chemistry to agriculture; an introduction to the study of plant growth, the composition and chemical properties of soils, fertilizers, amendments, insecticides, and fungicides.

810. *Introductory Agricultural Chemistry.* First term. Credit three hours.

815. **Introductory Agricultural Chemistry (Foods and Feeds).** Second term. Credit two hours. Prerequisite, Chemistry 305 (or 375). Professor CAVANAUGH. T Th 11. Baker 302.

Lectures. Discussion of the sources, chemical composition, and properties of the principal foods and feeds such as cereals, fruits, animal products, and dairy

products. Relation of methods of preservation and manufacture to the nutritive value of foods.

820. *Introductory Agricultural Chemistry.* Second term. Credit three hours.

825. *Elementary Agricultural Chemistry.* Second term. Credit three hours.

830. *Elementary Chemistry of Food Products.* Second term. Credit two hours.

835. **Advanced Agricultural Chemistry (Fertilizers, Insecticides, Soils).** Either term. Credit two or more hours. Prerequisite, Chemistry 810. Professor CAVANAUGH and assistant. Day and hour to be arranged. Baker 350.

Laboratory practice. Advanced work in the chemistry of soils, fertilizers, plant composition, insecticides, or fungicides. Special topics may be selected.

840. **Advanced Agricultural Chemistry (Foods and Feeds).** Second term. Credit two or more hours. Prerequisite, Chemistry 820. Professor CAVANAUGH. Day and hour to be arranged. Baker 350.

Laboratory practice. Special topics in the chemistry of foods and food preparations.

895. *Research for Seniors.* Throughout the year. Credit two or more hours a term.

910. *Special Topics in Chemistry.* Credit one hour.

1000. **Non-Resident Lectures on the George Fisher Baker Foundation.** Credit two hours. T Th 12. Baker 177.

## NON-RESIDENT LECTURES

The George Fisher Baker Non-Resident Lectureship in Chemistry at Cornell University was established early in the year 1926 by a gift of $250,000 from Mr. Baker, the income to be used by the University for the benefit and advancement of teaching and research in Chemistry and allied sciences. Under this plan the University invites eminent men of science to come to Cornell, each for one or two semesters, to present the most recent advances, and the methods and results of their own investigations, in the fields in which they have won distinction. A private office and a research laboratory are placed at the disposal of the Non-Resident Lecturer and he is thus enabled to carry forward investigational work while in residence at Cornell.

The Non-Resident Lecturers under the George Fisher Baker Foundation deliver two lectures a week, and hold a colloquium. In some cases they also conduct experimental research with a few advanced students.

The program for these lectures is as follows:

### FIRST TERM, 1933–34

Professor V. M. GOLDSCHMIDT, Göttingen University, Göttingen, Germany.

Topics of Lectures:

Crystal Chemistry.
Geochemistry.

### SECOND TERM, 1933–34

Professor W. L. BRAGG, University of Manchester, England.

Topics of Lectures:

Crystal Structure and Methods of X-Ray Analysis.
Structure of Simple and Complex Inorganic Salts.
Aliphatic and Aromatic Organic Crystals.
X-Ray Optics.

# THE BIOLOGICAL SCIENCES

## BOTANY AND PLANT PHYSIOLOGY

*Professors* K. M. WIEGAND, LEWIS KNUDSON, A. J. EAMES, L. W. SHARP, O. F. CURTIS, W. C. MUENSCHER, L. C. PETRY, and E. F. HOPKINS.

Graduate work is offered in physiology, anatomy, morphology, cytology, paleobotany, taxonomy and economic botany.

The laboratories of the department are in the Plant Science Building, one of the buildings of the College of Agriculture, and are well equipped with the necessary apparatus and collections for research. The herbarium contains abundant local and foreign material for taxonomic study.

The very rich flora about Ithaca and its accessibility make the location especially advantageous for all phases of botany, as material may be easily obtained. Gardens and greenhouses are also available for the growing of experimental material.

The University Library and the library of the College of Agriculture are well equipped with special works and periodicals dealing with all phases of botanical science. A department library in which are kept the books in more constant use has been established in connection with the laboratories.

A seminary in plant physiology offers to graduate students opportunity to become familiar with current work in plant physiology and to consider the relations of this work to agricultural practices. At these meetings there are also held general conferences and discussions of opinions or methods not conveniently or appropriately dealt with in the general courses. Seminaries are conducted in cytology and frequently also in the taxonomy of vascular plants and plant morphology. The purpose of these various seminaries is not only to keep abreast of the literature of the subject, but to furnish to the student an opportunity to gain experience in presenting the results of his own research or in developing opinions respecting the work of others. Graduate students are expected to attend the seminaries dealing with their special fields of work.

As a prerequisite for work in general botany, anatomy, cytology, and comparative morphology, the student will be expected to have a knowledge of the fundamental features of botanical science. For work in paleobotany a knowledge of the fundamental features of both botany and geology is prerequisite.

A fundamental training in botany and chemistry is required of any student who expects to major in plant physiology. If it is not possible to obtain this training before entering upon graduate work at Cornell, then the student will be expected to broaden his knowledge in botany and chemistry after beginning graduate work. The advanced courses in plant physiology are required of all graduate students in plant physiology and preferably should precede research work in this field. Those students whose interests are in the science of crop production will find plant physiology of especial value.

The University conducts a Summer School of Biology in which there is opportunity for graduate study and research in botany. The school is in session for six weeks in July and August, but a longer period of study can be arranged. A prospective student contemplating summer work in botany and plant physiology should correspond with Professor Wiegand before coming to Ithaca.

A fellowship carrying a stipend of $400 and a scholarship with a stipend of $200 are awarded in alternate years to graduate students in Botany. Holders of these are exempt from the payment of tuition. In 1933–34 the scholarship will be awarded.

### *PLANT PHYSIOLOGY

*Professors* KNUDSON, CURTIS, and HOPKINS.

31. *Introductory Plant Physiology.* First or second term. Credit four hours. Prerequisite, Course 1 and Chemistry 101. Lectures, T Th 10. Plant Science

143. Laboratory, T Th 1:40–4 or W F 1:40–4. Plant Science 227. Professor KNUDSON or Professor O. F. CURTIS, and Assistant Professor HOPKINS and instructors. Laboratory fee, $4; breakage deposit, $3.

231. **Plant Physiology, Advanced Lecture Course.** Throughout the year. Credit three hours a term. Prerequisite, training in botany and chemistry to be determined in each case by the department. Lectures, M W F 10. Plant Science 143. Professors KNUDSON and O. F. CURTIS.

Lectures and discussions on physiological processes of plants and the factors influencing them and the relations of these processes to plant behavior.

232. **Plant Physiology, Advanced Laboratory Course.** Throughout the year. Credit three hours a term. Prerequisite or parallel, course 231. Laboratory, M 1:40–4, S 8–12:30. Plant Science 241. Professors KNUDSON and O. F. CURTIS, and Assistant Professor HOPKINS. Laboratory fee each term, $10; breakage deposit, $5.

Principally a quantitative study of various phases of plant physiology. The student will apply chemical, physical, and bacteriological methods in the study of plant physiological processes. Special attention will be given to technique.

233. **Seminary in Plant Physiology.** Throughout the year. Required of graduate students taking work in the department. Conference, F 11. Plant Science. Professors KNUDSON and O. F. CURTIS, and Assistant Professor HOPKINS.

The presentation and discussion of current contributions to plant physiology; reports on the research problems of graduate students and members of the staff.

**Research in Plant Physiology.** Professors KNUDSON, CURTIS, and HOPKINS.

## *PLANT ANATOMY

*Professors* EAMES and PETRY.

123. **Plant Anatomy.** Prerequisite, course I or the equivalent. Professor EAMES. First term, T 9–12:30; Th S 9–11:30. Given in alternate years.

A detailed study of the internal structure of vascular plants with emphasis on determination and interpretation.

**Research in Anatomy.** Professor EAMES.

## *CYTOLOGY

*Professor* SHARP.

124. **Cytology.** Prerequisite, course I or Zoology I. Professor L. W. SHARP. Second term. Lectures, T Th 9. Plant Science 143. Laboratory, T Th or W F 10–12:30, or W 1:40–4, S 8–10:30. Small group conferences to be arranged. Plant Science 219.

Intended for those who have had some biological training. The principal topics considered are protoplasm, cells and their components, nuclear and cell division, meiosis and fertilization, and the relation of these to the problems of development, reproduction, and heredity. Both plant and animal materials are used. Microtechnic is not included. Laboratory fee, $5.

224. **Seminary in Cytology.** First term. M 11. Plant Science 404. Professor L. W. SHARP.

**Research in Cytology.** Professor SHARP.

## *MORPHOLOGY

*Professors* EAMES, SHARP, and PETRY.

(**Comparative Morphology of Fungi.** Given in the Department of Plant Pathology.)

[126. **Morphology of Vascular Plants.** Prerequisite Course I or the equivalent. Professor EAMES. First term. T Th 9–12:30. Given in alternate years, not given in 1933–34.]

An advanced course in the comparative morphology, life histories and phylogeny of vascular plants.

**Research in Morphology.** Professors EAMES and PETRY.

## *TAXONOMY

*Professors* WIEGAND and EAMES.

13. *Trees and Shrubs.* Three hours a week. First term. Professor WIEGAND and Mr. LINDSEY.

117. **Taxonomy of the Higher Plants.** Second term. Credit four hours. Prerequisite, course I or its equivalent. Lecture, M 9. Laboratory, M W F 1:40–4. Plant Science 211. Professor WIEGAND.

A study of seed plants and ferns, their classification into genera, families, and orders, and field work on the local flora. Emphasis placed on wild plants, but the more commonly cultivated varieties receive some attention. Preparation of a herbarium and of keys. The course is planned to follow course I and to furnish an introduction to the field botany and classification of higher plants, as preparation for special work in various departments and for teaching. Those desiring advanced work on special groups or problems may follow this with course 145. Laboratory fee, $4; deposit, $5.

219. **Advanced Taxonomy of Vascular Plants.** Second term. Credit two hours. Prerequisite, course 117 or its equivalent. Hours to be arranged. Plant Science 211. Professor WIEGAND.

Special round-table discussion of topics of particular interest to the taxonomist. One hour is devoted to practical work on some group of plants.

**Research in Taxonomy.** Professors WIEGAND and EAMES.

## *PALEOBOTANY

*Professors* PETRY and EAMES.

**Research.**

## *ECONOMIC BOTANY

*Professor* MUENSCHER.

3. *Poisonous Plants.* Two hours a week, second term. Assistant Professor MUENSCHER and Mrs. CRAIG.

15. *Weed Identification and Control, Seed Analysis.* Three hours a week, first term. Assistant Professor MUENSCHER and Mrs. CRAIG.

**Research.** Economic Botany.

## *GENERAL BOTANY

*Professor* PETRY and instructors.

1. *General Botany.* Throughout the year. Two lectures and one laboratory period a week. Professor PETRY and instructors.

## OTHER COURSES

[141. **History of Botany.** Second term, without credit.

A course of lectures given by various members of the staff with the purpose of acquainting advanced students of botany with the historical development of their science. Not given in 1933–34.]

145. **Special Problems in General Botany, Economic Botany, Taxonomy, Histology, Cytology, and Physiology.** Throughout the year. Credit not less than two hours a term. By appointment. Professors WIEGAND, KNUDSON, EAMES, L. W. SHARP, O. F. CURTIS, and PETRY, and Assistant Professors MUENSCHER and HOPKINS.

Students engaged on special problems may register in this course. They must satisfy the instructor under whom the work is taken as to preparation for the

problem chosen. The laboratory fee depends on the nature of the work and on the number of credit hours.

## *PLANT PATHOLOGY

*Professors* L. M. MASSEY, H. H. WHETZEL, DONALD REDDICK, M. F. BARRUS, H. M. FITZPATRICK, F. M. BLODGETT, CHARLES CHUPP, W. H. BURKHOLDER, D. S. WELCH, K. H. FERNOW, A. G. NEWHALL, W. D. MILLS, C. E. F. GUTERMAN, A. B. BURRELL, and E. M. HILDEBRAND.

The laboratories of the department are fully equipped for teaching and research in this subject. Many pieces of apparatus for use in connection with specialized research problems are available and additional apparatus can be supplied whenever it is needed. Greenhouses having about 2,500 square feet of floor space afford facilities for experimental work and for the culture of diseased and healthy plants for class use. These houses are divided into compartments so that various artificial conditions of temperature and moisture can be maintained for diverse types of plants and kinds of experimental work. A garden near the laboratories is available for the use of graduate students. Field laboratories in important crop sections of the State are maintained through co-operation with growers. These laboratories provide certain graduate students who receive fellowships (several of which are usually available each year) with an opportunity of pursuing investigations on a large scale under most favorable commercial conditions.

The pathological herbarium includes a local collection of fungi and pathological materials and sets of well-known fungous exsiccati. The library contains most of the important works on plant pathology, mycology, and bacteriology, complete sets of the more important journals, many monographs, and practically all the experiment station literature on these subjects.

Candidates for the Doctor's degree should spend at least one season in the field in order to come into contact with the practical aspects of control problems. Students preparing for graduate work in plant pathology are urged to obtain a thorough knowledge of elementary physics and chemistry, including organic and physical chemistry, and of general botany, plant histology, and plant physiology. A reading knowledge of French and German is indispensable in phytopathological research and must be acquired before the beginning of the third semester of graduate work. Candidates for advanced degrees must have fundamental training in the subjects enumerated above. Opportunity is afforded for further study in these subjects after entering the Graduate School, but a student availing himself of this opportunity can not expect to receive a degree in the minimum amount of time required for residence. Members of the staff are prepared to direct investigation in the various sub-divisions of the broader field, including that of bacterial diseases of plants.

1. **General Plant Pathology.** Professor WHETZEL. First or second term. Lecture, W 8. Practice, first term, W F 1:40–4 or Th 1:40–4 and S 10:30–12:50. Practice, second term, W F 1:40–4. Plant Science Building 341 and 343.

A fundamental introductory course treating of the nature, cause, and control of plant diseases. Required of all graduate students. This course is also offered during the six-weeks summer session.

2. **Principles of Plant Disease Control.** Professor WHETZEL. First or second term. Lecture, Th 8. Practice, Th 1:40–4; S 8–10:30. Plant Science Building 342.

A consideration of the principles and methods in plant disease control. Required of all graduate students.

201. **Advanced Plant Pathology.** Professor MASSEY. First and second terms. Lecture, F 8. Practice, T F 10–12:30. Plant Science Building 304.

A presentation and analysis of the experimental and empirical knowledge of plant diseases. The phenomena of infection, susceptibility, host reactions, and symptomatology will be critically considered. Primarily for graduate students.

111. *Forest and Shade-tree Pathology, and Tree Surgery.* Credit two hours. Prerequisite, course 1. Second term.

121. **Comparative Morphology of Fungi.** Prerequisite, Botany 1 or the equivalent. Professor FITZPATRICK. First term. Lecture, M W 9. Practice, M W 1:40–4. Plant Science Building 333. Given in alternate years.

A synoptical course designed to acquaint the student with the general field of mycology. Emphasis will be placed on morphology and phylogeny, rather than on taxonomy. This course is also offered during the six-weeks summer session.

[221. **Mycology.** Prerequisite, Botany 1 or the equivalent. Professor FITZPATRICK. First and second terms. Lecture, M W 11. Practice, T Th 1:40–4. Plant Science Building 329. Not given in 1933–34.

An intensive study of the morphology, taxonomy, and phylogeny of the fungi (Phycomycetes and Ascomycetes). Primarily for graduate students.]

222. **Mycology.** Prerequisite, Botany 1 or the equivalent. Professor FITZPATRICK. First and second terms. Lecture, M W 11. Practice, T Th 1:40–4. Plant Science Building 329.

Alternating with course 221, and dealing with the Basidiomycetes and Fungi Imperfecti. Primarily for graduate students.

In the six-weeks summer session the groups of the fungi are studied in successive summers in the following order, (1) Phycomycetes, (2) Ascomycetes, (3) Basidiomycetes, (4) Fungi Imperfecti. By repeating the course, the student may obtain in four summers the equivalent of Plant Pathology 221 and Plant Pathology 222. He may begin with any one of the four groups, and need not take them in unbroken sequence. In the 1933 Summer Session group (2) will be given.

[231. **History of Plant Pathology.** Professor WHETZEL. First and second terms. Requires a reading knowledge of French and German. Designed especially for graduate students specializing in Plant Pathology. Not given in 1933–34.]

241. **Research.** Professors MASSEY, WHETZEL, REDDICK, BARRUS, FITZPATRICK, CHUPP, BURKHOLDER, BLODGETT, WELCH, FERNOW, NEWHALL, MILLS, GUTERMAN, BURRELL, and HILDEBRAND.

242. **Seminary.** Members of the staff. Weekly.

243. **Literature Review.** Members of the staff. Bi-weekly.

## *PLANT BREEDING

*Professors* R. A. EMERSON, H. H. LOVE, C. H. MYERS, F. P. BUSSELL, A. C. FRASER, R. G. WIGGANS, and J. R. LIVERMORE; *Doctor* ERNEST DORSEY.

The laboratories of this department are supplied with calculating machines necessary for statistical investigations, and are equipped with cameras and accessories for photographic work. The departmental library contains the principal books and periodicals dealing with plant breeding, evolution, and genetics. The department has greenhouse room approximating 2000 square feet of floor space, a part of which is available for the use of graduate students. A garden near the laboratories affords the necessary room for most of the plant material used by graduate students. For more extensive plantings, room is provided on the University farms.

It is advisable that the student, before entering upon graduate work, should have had the following courses or their equivalent: genetics, plant breeding, general botany or elementary zoology or biology, elementary plant, animal or

human physiology, introductory inorganic chemistry, and elementary organic chemistry. A student who has not had most of these subjects will ordinarily find it impossible to complete his graduate work in the minimum time.

Students majoring in plant breeding will ordinarily find it necessary to remain in Ithaca during the summer, or to make satisfactory arrangements for growing and studying elsewhere the plant materials used in connection with their research problems. Since the department has accommodations for only a limited number, prospective students will find it to their advantage to correspond with a member of the departmental staff some months prior to entering upon their work.

101. *Genetics.* Four hours a week. First term.

103. *Plant Breeding.* Three hours a week. Second term.

201. **Advanced Genetics.** Prerequisite, course 101 and Botany 124. Assistant Professor FRASER. Second term. M F 8–10. Plant Science Building 146. Laboratory work to be arranged.

Group discussions of advanced principles of genetics, with special attention to methods of analysis. Laboratory studies of experimental data and of genetical "unknowns" in Drosophila. Laboratory fee, $3. Deposit, $2.

211. **Biometry.** First term. For graduate students only. Th 1:40–4. Plant Science Building 146. Assistant Professor LIVERMORE.

A discussion of statistical methods for the study of variation, correlation, curve fitting, experimental error and the analysis of variance; and the application of these methods to problems in biology and related fields. Laboratory fee, $2.

**Seminary.** Second term. W 11. Plant Science Building 146. Professors EMERSON, LOVE, MYERS, BUSSELL, and Assistant Professors FRASER, WIGGANS, and LIVERMORE, and Doctor DORSEY.

## *ANIMAL BIOLOGY

*Professors* H. D. REED and B. P. YOUNG.

Every facility in the way of material and equipment is placed at the disposal of the student desiring to investigate in the following fields: General and experimental zoology, taxonomy, morphology, ecology, economic zoology, protozoology, and ornithology.

The laboratories are equipped with modern compound, binocular, and dissecting microscopes, microdissecting and injecting apparatus, euscopes, microtomes and accessories, paraffine and constant temperature ovens, projection and drawing apparatus, facilities for modeling in wax, work shop, fully equipped preparation rooms, cameras and dark rooms.

The collection includes an extensive collection of invertebrates, fishes, amphibia, reptiles, birds and mammals as well as more than 15,000 specimens of fixed material for developmental and structural studies as well as an extensive collection of prepared microscopical slides of serial sections. In assembling these collections, efforts have been made to obtain material from all parts of the world illustrating biological principles.

The Cayuga basin, with its diversified topography, its extensive fauna, and its mingling of three life zones, offers unusual opportunities for ecological field work. Within the basin are three state parks and three wild life preserves, all within walking distance of the University; the former established on account of the beauty of their scenery, the latter on account of their interesting fauna and flora. There is also a woodland bird preserve in Ithaca.

The University library, together with the special libraries of the Agricultural and Medical Colleges, the Flower Library of the Veterinary College, and the Comstock Memorial Library afford unusually rich resources for the investigator

in any field of Zoological research. They are particularly complete in the serial literature of zoology.

In order to undertake graduate study the student should not only be prepared in the fundamentals of Animal Biology but also have or acquire a foundation in the particular phase of this subject which he intends to pursue.

The members of the staff are prepared to direct the research work of graduate students in connection with the Summer School of Biology of Cornell University.

1. *Introductory Zoology.* Three hours a week. Throughout the year.

1a. *General Zoology.* Four hours a week, first semester. For Veterinary Students only.

11. *Comparative Anatomy.* Three hours a week throughout the year. Graduates admitted.

16. **Invertebrate Zoology.** Prerequisite course 1 or equivalent. Assistant Professor YOUNG. Throughout the year. Lecture, F 11, Laboratory, M and F 1:40–4. McGraw 2. A comprehensive consideration of the morphology, classification, development, and phylogeny of the invertebrates.

17. **Mammalian Anatomy.** Dr. SENNING. Three hours a week, first term. McGraw 6. Hours to be arranged.

Designed to provide a foundation in mammalian anatomy for advanced students and graduates.

99. **Zoological Problems.** Professor REED, Assistant Professor YOUNG, and Dr. SENNING.

An introduction to research.

**Garduate Work in General Zoology, Morphology, Experimental Zoology and Protozoology.** Professors REED and YOUNG. Throughout the academic year and summer period.

## *VERTEBRATE ZOOLOGY

*Professors* A. H. WRIGHT, G. C. EMBODY, and A. A. ALLEN.

The following undergraduate courses are prerequisite to graduate work in zoology.

8. *Elementary Taxonomy and Natural History of Vertebrates.* Credit three hours each term.

9. *General Ornithology.* Credit three hours. Second term.

73. *Aquiculture.* Credit three hours. First term.

74. *Fish Culture.* Credit two or three hours. Second term.

Descriptions of these courses will be found in the Announcements of the College of Arts and Sciences and the College of Agriculture.

[22. **Ichthyology, Advanced Systematic and Field Zoology.** Throughout the year. Credit three hours a term. Professor WRIGHT and Dr. HAMILTON. Not given in 1933–34.]

[23. **Herpetology (Amphibia).** First term. Credit three hours. Professor WRIGHT and Dr. HAMILTON. Not given in 1933–34.]

[24. **Herpetology (Reptilia).** Second term. Credit three hours. See announcement for course 23. Professor WRIGHT and Dr. HAMILTON. Not given in 1933–34.]

25. **Mammalogy.** Throughout the year. Credit three hours. Lectures, T Th 8. McGraw 7. Laboratory, F 1:40–4 or S 8–10:30. Professor WRIGHT and Dr. HAMILTON.

In the lectures, special emphasis is laid on the principal phases of animal life; the taxonomy, origin, and evolution of fossil and living groups; geographical distribution; and the literature and institutions of zoology. Laboratory periods are devoted to the identification of exotic and indigenous forms.

[126. **Advanced Ornithology.** First term. Credit three hours. Prerequisite,

course 8 or 9. Professor A. A. ALLEN and Messrs. KELLOGG and SUTTON. Not given in 1933–34.

A consideration of the birds of the world, their structure and classification. The first part of the term is devoted to field work on the fall migration and the identification of birds in winter plumage. Laboratory fee, $3.]

131. **Applied Ornithology.** First term. Credit three hours. Should be preceded by course 8 or 9, and presupposes an elementary knowledge of botany and entomology. Lecture, W 11. Laboratory and field work, M W 1:40–4. McGraw. Professor A. A. ALLEN and Messrs. KELLOGG and SUTTON.

This course is intended primarily for students planning professional work in ornithology. Field collecting, preparation of specimens, and natural-history photography are emphasized, together with the food and feeding habits of birds; museum and Biological Survey methods. Laboratory fee, $3.

300g. **Research in Aquiculture.** Professor EMBODY.

67. **Seminary in Systematic Vertebrate Zoology.** First and second terms. Hours to be arranged. Professor WRIGHT.

Life-zone plans of North America, 1817–1920. Distribution and origin of life in North America. Zoogeography of the Old World. Animal coloration. Other topics, to be announced.

## ENTOMOLOGY AND LIMNOLOGY

*Professors* J. G. NEEDHAM, G. W. HERRICK, O. A. JOHANNSEN, J. C. BRADLEY, ROBERT MATHESON, C. R. CROSBY, E. F. PHILLIPS, P. W. CLAASSEN, and G. F. MACLEOD.

Every facility possible in the way of material and equipment is placed at the disposal of the student desiring to investigate in the following fields: taxonomy, morphology, embryology of insects, ecology, limnology, aquiculture, parasitology, medical entomology, apiculture, economic zoology and entomology.

The laboratories are equipped with modern compound, binocular, and dissecting microscopes, microtomes and accessories, paraffine and constant temperature ovens, projection and drawing apparatus, cameras and dark rooms.

Connected with the laboratory of Insect Taxonomy are extensive collections of both indigenous and exotic insects of all orders. These have been determined by specialists and are accessible to properly prepared students for comparison. The collection includes many sets of specimens illustrative of the metamorphoses and habits of insects. There is also an extensive collection of other invertebrates, fishes, amphibia, reptiles, birds and mammals as well as more than 12,000 specimens of fixed material for developmental and structural studies. In assembling these collections, efforts have been made to obtain material from all parts of the world illustrating biological principles.

A modern insectary is available for advanced work in the biology of insects, the rearing of parasites, and the study of aquatic insects; and also offers facilities for photographing insects and examples of their work.

A fish culture experiment station on the University farm affords exceptional opportunities for investigations in the biology of fresh water organisms.

The Cayuga basin, with its diversified topography, its extensive fauna, and its mingling of three life zones, offers unusual opportunities for ecological field work. Within the basin are three state parks and three wild life preserves, all within walking distance of the University; the former established on account of the beauty of their scenery, the latter on account of their interesting fauna and flora. There is also a woodland bird preserve in Ithaca.

The University library, together with the special libraries of the Agricultural and Medical Colleges, the Flower Library of the Veterinary College, and the Comstock Memorial Library (entomology), and the Cornell Beekeeping Library

afford unusually rich resources for the investigator in any field of zoological research. They are particularly complete in the serial literature of zoology.

In order to undertake graduate study the student should not only be prepared in the fundamentals of Animal Biology but also have or acquire a foundation in the particular phase of this subject which he intends to pursue and should have a reading knowledge of French and German.

In the summer Professor Needham will devote his time to the work of graduate students, mainly on field problems; and other members of the staff are prepared to direct the research work of graduate students in connection with the summer School of Biology of Cornell University.

Supplementing the major divisions of work indicated below, practice in entomological reading is given by Professor JOHANNSEN in French and in German; a course is given in the technics of the literature of entomology and zoology by Professor BRADLEY; in entomotaxy by Professor BRADLEY; and in insectary methods by Professor MATHESON.

The following undergraduate courses are accounted a part of a preparation for graduate study in entomology:

12. *General Entomology.* Credit three hours. First term.

15. *Wing Venation and Evolution.* Credit one hour. First or second term.

21. *Elementary Morphology of Insects.* Credit three hours. First or second term.

30a. *Elementary Taxonomy of Insects.* Credit one hour. Second term.

These also are recommended for certain phases of the work:

11. *The Ecology of Insects.* Credit three hours. First term.

30b. *Entomotaxy.* Credit two hours. Second term, completed first term of following year.

41. *General Economic Entomology.* Credit three hours. Second term.

43. *Forest Insects.* Credit two hours. Second term.

61. *General Beekeeping.* Credit three hours. Second term.

71. *General Limnology.* Credit three hours. First term.

75. *Laboratory Methods in General Biology.* Credit two hours. Second term.

Descriptions of these courses will be found in the Announcements of the College of Agriculture and the College of Arts and Sciences.

## *MORPHOLOGY AND TAXONOMY

122. **Insect Morphology.** First and second terms. Credit two hours each term. Prerequisite, courses 21, and 12 or 30a. Lectures, assigned reading, and reports. T Th 10. Roberts 392. Professor JOHANNSEN.

This course deals with the anatomy, histology, embryology, and post-embryonic development of insects.

124. **Histology of Insects.** First or second term. Credit two hours. Must be preceded or accompanied by course 122. Laboratory, two periods a week, by appointment. Roberts 391. Professor JOHANNSEN.

Technic in histological methods as applied to insects. Laboratory fee, $3.

31. **Taxonomy of Insects.** This course extends through three terms, but the work of any term may be taken independently. Credit three hours. Prerequisite, courses 21, 15, and 30a. Lecture, W 11. Roberts 392. Laboratory, M W 1:40–4. Roberts 301. Professor BRADLEY, Dr. FORBES, and Mr. PATE.

A survey of the classification of the orders of insects. For the year 1933–34, the orders to be treated are: first term: Coleoptera, Lepidoptera; second term, minor orders, Orthoptera, Diptera. For the year 1934–35, the orders to be treated are: first term, Hymenoptera, Hemiptera; second term, minor orders, Diptera, Hymenoptera. Laboratory fee, $4.50.

## *APPLIED ENTOMOLOGY

241. **Natural and Biological Control of Insects.** Second term. Credit two hours. Open to qualified seniors and graduate students. Lecture, Th 11. Seminar, Th 2–4 p.m. West Basement, Bailey Hall. Professor MATHESON.

The course deals with the effects of natural factors, as temperature, moisture, food supply, parasites, predators, fungous diseases, etc., in preventing insect outbreaks. The utilization of any of these factors, particularly parasites and predators (biological control), in controlling insect pests will be dealt with in detail. The effects of sumptuary laws (inspection and quarantine laws) in preventing the introduction and natural spread of insects will be presented. The seminar will consist of reports, assigned readings and discussion of particular problems of biological control.

242. **Principles of Applied Entomology.** Throughout the year. Credit two hours a term. For seniors and graduate students. Prerequisite, permission to register. Conferences, M F 2–4. Professor CLAASSEN.

A conference course in problems of insect control, including research methods, planning and conducting experiments, and interpreting and presenting results. This course is given in cooperation with the entomological staff of the New York State Agricultural Experiment Station at Geneva, and the extension and research staffs of the Department of Entomology at Cornell University.

## *PARASITOLOGY AND MEDICAL ENTOMOLOGY

51. **Parasites and Parasitism.** First term. Credit two or three hours. Prerequisite, Biology 1 or Zoology 1. Lecture, T 9. Bailey Hall. Practical exercises, M or T 1:40–4, or T 10–12:30. Professor MATHESON and Mr. BRODY.

A consideration of the origin and biological significance of parasitism, and of the structure, life, and economic relations of representative parasites. A limited number of well prepared students will be permitted to take the extra hour's credit. The work will occupy one afternoon a week and will be devoted to the technique of the diagnosis of parasitic infections, preparation of material from post-mortem examinations, and advanced work in Parasitology. Laboratory fee, $2 or $4.

52. **Medical Entomology.** Second term. Credit two or three hours. Prerequisite, Zoology 1 or Biology 1. Lecture, T 9. Bailey Hall. Practical exercises, M or T 1:40–4, or T 10–12:30. Professor MATHESON and Mr. BRODY.

This course deals with insects and other arthropods that are the causative agents of disease in man and animals, or are the vectors, or intermediate hosts, of disease-producing organisms. A limited number of well prepared students will be permitted to take the extra hour's credit. The work will occupy one afternoon a week and will consist of detailed studies of selected groups of insects in their relation to disease causation or as vectors of pathogenic organisms of animals. Laboratory fee, $2 or $4.

## *APICULTURE

Advanced and graduate students taking courses 122 and 124, and specializing in apiculture, are permitted to use the honeybee as illustrative material in the laboratory work of these courses.

261. **Advanced Beekeeping.** First and second terms. Credit four hours a term. Open only to qualified seniors and graduate students. T Th 11–12:50. Dairy Building 128. Professor PHILLIPS.

A technical course covering investigations, especially those of a scientific character, in all phases of apiculture. Special consideration is given to the study of beekeeping regions, with particular reference to conditions in New York.

Designed for advanced students preparing to teach or to do research in apiculture.

262. **Apicultural Literature and Its Technics.** First and second terms. Credit three hours a term. Open only to qualified seniors and graduate students. Prerequisite, a reading knowledge of either French or German. T 1:40–4. Dairy Building 128. Professor PHILLIPS.

This course is planned to acquaint the student with the current technical and practical literature of beekeeping, each student being assigned certain journals for the abstracting of all important papers which they contain. Practice in the use and preparation of bibliography and abstracts, and in the preparation of technical papers for publication. Designed only for advanced students in apiculture.

## GENERAL COURSES

118. **The Technics of Biological Literature.** First term. Credit three hours. Lectures, M F 11. Roberts 392. Library work by assignment. Professor BRADLEY.

A critical study of the biologists' works of reference. Practice in the use of generic and specific indices and of bibliographies, and in the preparation of the latter; methods of preparing technical papers for publication; Zoological nomenclature. This course is of a technical nature, and is intended to aid students specializing in zoology or entomology in their contact with literature.

119. **Entomological Reading in Foreign Languages.** French first term, German second term. Two hours a week, by appointment. Without credit. Open to advanced students in entomology who have an elementary knowledge of the languages. Professor JOHANNSEN.

## RESEARCH

300. **Research.** Throughout the year. Prerequisite, permission to register from the professor under whom the work is to be taken. Roberts.

300a. **Insect Ecology and Limnology.** Professors NEEDHAM and CLAASSEN.

300b. **Insect Morphology.** Professor JOHANNSEN.

300c. **Taxonomy.** Professors BRADLEY (all orders), NEEDHAM (Neuropteroids), JOHANNSEN (Diptera), and Dr. FORBES (Lepidoptera).

300d. **Economic Entomology.** Professors HERRICK, MATHESON, CROSBY, PARROTT, GLASGOW, CHAPMAN, and CLAASSEN, and Assistant Professor MACLEOD.

300e. **Medical Entomology and Parasitology.** Professor MATHESON.

300f. **Apiculture.** Professor PHILLIPS.

300g. **Aquiculture.** Professor EMBODY.

300h. **Arachnology.** Professor CROSBY.

300i. **Insect Physiology.** Professors PHILLIPS and MATHESON, and Assistant Professor MACLEOD.

## SEMINARIES

**Jugatae.** Throughout the year. M 4:10–5. Roberts 392.

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

**Seminary in Insect Physiology.** Throughout the year. M 6:30–8. Bailey Hall. Open to qualified graduate students. Assistant Professor MACLEOD.

# *ANATOMY

*Professors* A. T. KERR and J. W. PAPEZ.

The laboratories for this subject are situated on the third floor of Stimson Hall and are admirably lighted and thoroughly ventilated. For gross dissection there

is a large general laboratory, and adjoining the dissecting room is a smaller laboratory for special work, fitted with a hood and other facilities for digestion, maceration, corrosion, etc. In this room are also the X-ray outfit and a dark room with a fluorscope. At the end of the main dissecting room is a large dark room with a projection outfit and facilities for drawing sections for making reconstructions. Upon this floor also is situated a dark room with a complete outfit for taking photographs of special preparations for illustrating research. In the basement is a compressed air apparatus for embalming and making special injections.

There is an abundance of anatomical material, which is embalmed and kept in cold storage so as to be ready for use when needed. The refrigerating apparatus is also used for freezing specimens for sections. In addition to the undissected material, there is an ample supply of special parts, such as bones, brains, the various abdominal and thoracic organs, special sense organs, etc.

The equipment includes microscopes, dissecting microscopes, microtomes, glassware, reagents, and other necessities of an anatomical laboratory.

In collaboration with the department of Histology and Embryology, every facility is offered for studying anatomical problems from both the gross and the developmental points of view.

In cooperation with the department of Physiology, there is suitable provision for operative and experimental work on animals.

In the library are to be found complete sets of practically all the important periodicals dealing with anatomy, and the proceedings and transactions of the learned societies. In addition, the library is well supplied with the most important anatomical monographs and books.

Graduate work in anatomy should be preceded by courses in biology, comparative and human anatomy. A reading knowledge of German and French is essential for successful research in anatomy.

*Courses intended primarily for undergraduates*

221. *Structure of the Human Body.* Three lectures and one demonstration a week. Second term.

222. *Anatomical Methods and Kinesiology.* One lecture and eight hours of laboratory a week. First term.

224. *Artistic Anatomy.* Primarily for fine arts students. One lecture and three to six hours of laboratory a week throughout the year.

229. *Kinesiology.* One lecture and six hours of laboratory a week. First term.

*Courses intended primarily for medical students and graduate students*

1. **Anatomy of the Head and Neck.** Prerequisites, courses in Zoology, and or, Comparative Anatomy. Professors KERR and PAPEZ. First term. Twenty-four hours a week for six or more weeks, anatomy laboratory, Stimson Hall. Daily except Saturday, 8 a.m. to 4 p.m. A detailed study of the structures in the head and neck of man, including the eye, ear, nose, pharynx, larynx and cranial nerves, but not the brain. Demonstrations, dissection, and conferences.

2. **Anatomy of the Thoracic Walls and Viscera.** Prerequisites, courses in Zoology and or, Comparative Anatomy. Professors KERR and PAPEZ. First term, twenty-four hours a week for two or more weeks. Anatomy laboratory, Stimson Hall. Daily except Saturday, 8 a.m. to 4 p.m. A detailed study of the human chest walls and of the heart, lungs, vessels and nerves of the thoracic cavity. Demonstrations, dissection, and conferences.

3. **Anatomy of the Abdominal and Pelvic Walls and Viscera.** Prerequisites, courses in Zoology, and or, Comparative Anatomy. Professors KERR and PAPEZ. First term, twenty-four hours a week for six or more weeks. Anatomy

laboratory, Stimson Hall. Daily except Saturday, 8 a.m. to 4 p.m. A detailed study of the human abdominal walls and of the organs of the digestive, urinary and reproductive systems together with the vessels and nerves of the abdominal cavity. Demonstration, dissection, and conferences.

4. **The Nervous System.** Anatomy, Histology and functional systems. Prerequisites, Anatomy and Histology. Assistant Professor PAPEZ. Second term. Nine hours a week, M W F, 1–4 p.m., anatomy laboratory, Stimson Hall. Dissection of the human spinal cord and brain. Microscopic structure and development of the nervous system of man. Laboratory with demonstrations, conferences and recitations.

6. **Anatomy of the Living Body.** Prerequisites, courses in Zoology, and or, Comparative Anatomy. Professor KERR. First term. Three lecture demonstrations a week. Interpretation of dissecting room material by means of the living body, frozen sections, and special preparations. Supplementary to the work of Courses 1, 2, and 3.

7. **Anatomy of the Upper Extremity.** Prerequisites, courses in Zoology, and or, Comparative Anatomy. Professors KERR and PAPEZ. Second term. Four hours a week for seven weeks, anatomy laboratory, Stimson Hall. M 8–12:30. A detailed study of the bones, joints, muscles, and nerves of the upper extremity of man.

8. **Anatomy of the Lower Extremity.** Prerequisites, courses in Zoology, and or, Comparative Anatomy. Professors KERR and PAPEZ. Second term. Four hours a week for eight weeks. A detailed study of the bones, joints, muscles, and nerves of the lower extremity of man.

9. **Topographical Anatomy.** Prerequisites, anatomy courses 1, 2, 3, 7, or 8. First and second terms. Professors KERR and PAPEZ. Anatomy laboratory, Stimson Hall. The detailed study and dissection of any region of the human body with particular reference to the arrangement of the parts and their variations.

250. **Advanced and Research Work in Human Anatomy and Neurology.** Throughout the year. Professors KERR and PAPEZ. Hours to be arranged. Anatomy laboratory, Stimson Hall. Two or more laboratory periods a week. The study and investigation of some special topic with training in methods of research in anatomy. For those who have taken the necessary preliminary courses and are otherwise prepared. Primarily for graduates, but undergraduates properly qualified may be admitted.

## *HISTOLOGY AND EMBRYOLOGY

*Professors* B. F. KINGSBURY and H. B. ADELMANN.

The equipment for this subject comprises a supply of modern microscopes, camera lucidas, polariscopes, microspectroscopes, photomicrographic cameras, and other special apparatus in sufficient number to give each student opportunity for learning to use them, and for applying them to any special study in which they are needed. Two projection microscopes are available for blotting paper and wax plate reconstructions. The general and research laboratories are large and are equipped with microtomes, incubators, aquaria, etc. The collection of specimens is large and constantly increasing, and comprises preserved material and embryos, as well as embryological and histological series of microscopic preparations of man, mammals, and the lower vertebrates.

In addition to the general laboratory, preparation room, and private laboratory rooms for the staff, there are for this subject a large and well-lighted advanced laboratory with three small rooms for individual workers, a photomicrographic laboratory and dark room, and a drawing and projection room. A museum of embryological models occupies the center of the advanced laboratory.

The rich and varied fauna of the Cayuga Lake region affords favorable opportunity for investigation in the histology and embryology of all the main groups of vertebrates; material for the study of the development of the sheep, cow, and pig, is also available. Advanced work in histology and embryology is of necessity individual and is abundantly provided for. In addition advanced students are sometimes recommended to take some one or more of the general courses in the subject. As preliminary to graduate work, students are expected to have had the courses in the tissues and one of the following: the organs, special histology, embryology. A year's work in zoology, biology, anatomy, or physiology may with advantage precede advanced work in this subject.

107. **Advanced Histology and Embryology.** Throughout the year. Credit three hours or more a term. Prerequisite, Animal Biology 101, and 102 or 104. Professor KINGSBURY, Assistant Professor ADELMANN, and instructor. Day and hours to be arranged. Stimson 43.

Primarily for graduates. Open to undergraduates of exceptional qualifications.

[115. **Experimental Embryology.** Second term. Credit two hours. Assistant Professor ADELMANN. Primarily for graduates and specially qualified undergraduates. The course will be conducted as a seminar. Lectures with reports by students dealing with the experimental analysis of developmental processes. Hours to be arranged. Stimson. Not given in 1933–34.]

[120. **The Theory of Development.** First term. Credit two hours. Assistant Professor ADELMANN. Hours to be arranged. Stimson 8.

Primarily for graduates. One lecture with collateral reading and reports. A series of lectures upon some important phase of Development. Not given in 1933–34.]

108. **Seminary.** First and second terms. One hour each week. Thursday, 4:30 p.m., or time to be arranged. For the discussion of problems in the field of histology, or embryology; for the review of current literature; or the presentation of original work by the members of the staff and those doing advanced work in the department.

Undergraduate courses 101, 102, and 104 (College of Arts and Sciences) may often be attended with advantage by graduate students. Satisfactory work in these obviates the requirement of the Qualifying Examination.

## *HUMAN PHYSIOLOGY

*Professors* J. B. SUMNER, H. S. LIDDELL, and J. A. DYE, and instructors.

For advanced and graduate work in experimental physiology two large laboratories and several smaller rooms are available. Laboratory A, on the first floor of Stimson Hall, is provided with electro-motor-driven shafting and Palmer recording drums of the most recent pattern, capable of giving wide ranges of speed. All necessary apparatus is available for graphic work in muscle and nerve physiology, for the investigation of problems in connection with the circulatory and respiratory systems, where objective records are desirable (for example, movements of the excised amphibian and mammalian heart), and for the experimental study of the special senses and the central nervous system. Pendulum and spring myographs are available and several forms of ergograph for the study of muscular and nervous fatigue. Each table is supplied with chronographs and time-recording tuning-forks, induction machines, keys, switches, commutators, etc. Adjoining this laboratory are two smaller rooms; one is being equipped for experimental work on animal heat and body temperature, the other contains a Ludwig kymograph with accessories, and is used primarily for experimental physiology. There is also a dark room for photographic and optical work.

Laboratory B is devoted mainly to research. The equipment includes hae-

momanometers and blood-pressure apparatus of the most recent type, and six large Brodie kymographs for continuous smoked paper. A time-recording clock and artificial respiration and chloroform apparatus have just been added. Plethysmographs for recording volume changes in the various bodily organs are provided and several clock driven drums are available.

In connection with this laboratory there is a workshop with a skilled mechanician who is capable of making and modifying any kind of apparatus which may be required for special research.

In the basement, on a solid concrete floor, a room has been equipped with galvanometers, capillary electrometers, shunts, rheocords, bridges, and all the other apparatus required in electrophysiology.

Recently a field station has been added to the department within two miles of the Medical College. This consists of two fenced fields, each of about five acres of orchard and pasture land, together with barn and housing for large animals such as sheep and goats. Another fenced field of twenty acres adjacent to the station has been leased for five years and is available for pasture. On this station, which is entirely devoted to research in physiology and biochemistry, many problems are under investigation and as much of this work can be carried out by graduate students, under supervision, it may be considered as an important asset to the Graduate School.

A problem demanding original investigation is prescribed for each student, who is guided in his choice of a subject by one of the professors in charge, due consideration being given to his previous training and to the line of work in which he desires to specialize. Having selected a subject the student will be expected to concentrate his efforts upon it. While the work is done under the supervision of some one of the members of the teaching staff, and every facility provided in the way of apparatus, etc., the student is encouraged to rely on his own resources as far as possible, especially in planning and carrying out his experiments. Any special apparatus which he may require or which he may himself design, will be made for him by the laboratory mechanic. It is expected that the results of his work will be embodied in a thesis, and if this is judged to be of sufficient merit it will be published in full or in abstract in some accredited scientific journal.

The prerequisites necessary for a student intending to major in biological chemistry are inorganic chemistry, qualitative and quantitative analysis, physical chemistry, advanced organic chemistry, and physiology.

### FACILITIES FOR BEHAVIOR STUDY

Cornell University offers exceptional facilities for the experimental study of behavior. The Physiological Field Station provides accommodation for large and small animals under ideal conditions. A special laboratory with sound-proof rooms is equipped for conditioned reflex experiments and a comprehensive program of investigation has been in progress for a number of years. Provision has also been made at the Field Station for other methods of behavior study. In Stimson Hall another laboratory for the study of motor or salivary conditioned reflexes in the dog is available for advanced study and research. An extensive collection of standard physiological apparatus is also available and an instrument maker can construct equipment for special investigations.

### ADVANCED WORK AND RESEARCH IN BEHAVIOR

Opportunities for experimental investigation of behavior will be available to properly qualified students. Detailed study of the experimental literature can also be pursued under supervision.

It is possible to pursue work under the personal direction of members of the Faculty during the summer.

## *BIOLOGICAL CHEMISTRY

*Professor* SUMNER, *Dr.* HAND, and *Mr.* HOWELL.

The Biochemical laboratories on the second floor of Stimson Hall include a student laboratory, a research laboratory, a stockroom and two offices. The laboratories are well-equipped for work in biological chemistry. The principal periodicals, monographs, and textbooks dealing with the biological sciences are to be found in the Van Cleef Library on the ground floor of Stimson Hall.

### FACILITIES FOR WORK IN ENZYME CHEMISTRY

Unusual opportunity is offered the graduate student for advanced and research work with enzymes. The Laboratory of Biochemistry has been equipped for this express purpose and it is safe to say that practically every type of apparatus required for enzyme experiments is available.

314. *Biochemistry for Undergraduates.* Three lectures a week. First term.

314a. *Biochemistry Laboratory for Undergraduates.* Two afternoons a week. First term.

315. **General Biochemistry.** Second term. Credit seven hours. Intended for Medical and Graduate Students. Lectures, T 8–9, Th F S 9–10; Laboratory, Th 1–4, F S 10–1. Professor SUMNER, Dr. HAND, Mr. HOWELL.

315a. **Physical Biochemistry.** Second term. Credit two hours. To be taken together with Biochemistry 315. Lectures, W 9–10; Laboratory, W 10–12:30. Dr. HAND.

[317. **Selected Topics in Biochemistry, with special reference to Enzymes.** First term. Credit one hour. Lecture, Th 10. Not given in 1933–34. Alternates with Biochemistry 317a. Professor SUMNER.]

317a. **Selected Topics in Biochemistry, with special reference to Biological Oxidations, Plant Metabolism, Photosynthesis, Plant Pigments, Biology of Iron.** First term. Credit one hour. Lecture, Th 10. Alternates with Biochemistry 317. Dr. HAND.

320. **Advanced Work and Research in Biochemistry.** Throughout the year. Professor SUMNER.

## *FOODS AND NUTRITION

*Professors* HELEN MONSCH, MARION PFUND, HAZEL HAUCK, L. A. MAYNARD, and C. M. MCCAY.

The laboratories for graduate work in food and nutrition are situated in the new College of Home Economics and in the Dairy Building. Six laboratories are available for graduate work: a child nutrition laboratory, equipped for nutrition work with infants and small children; an adult nutrition laboratory for dietary studies and experiments with energy metabolism; a nursery school for the study of feeding problems with pre-school children; an animal laboratory, adequately equipped for nutrition work with small animals; and two chemical laboratories, provided with apparatus for work in the application of chemistry to the study of food and nutrition.

In order to take up graduate work in the chemistry of food and nutrition, the student should have had the equivalent of the following courses: quantitative chemical analysis, biological chemistry, physiology or biology, nutrition and dietetics. In addition to the courses listed, a knowledge of physics and physical chemistry is highly desirable.

The facilities of the laboratory of Animal Nutrition are described on page 131.

*Courses for Undergraduate Students*

2. *Science Related to Food Preparation.* First and second terms.

[9. *Food Preparation: Principles and Comparative Methods.* First or second term. Not given in 1933–34.]

22. *Food Selection: Dietetics, Introductory Course.* First or second term.

109. *Food Preparation, Advanced Course.* First or second term.

111. *Meal Planning and Preparation.* First term.

121. *Food Selection: Nutrition and Dietetics.* First or second term.

122. *Food Selection: Nutrition and Dietetics.* First or second term.

*Courses for Graduate Students*

124. **Food Selection in Relation to the Treatment of Disease.** Second term. Open to seniors and graduate students. Limited to twenty students. Advised for those specializing in hospital dietetics. Prerequisite, Foods 122. T 11; Th 11–1. Martha Van Rensselaer Hall 426 and 358. Assistant Professor HAUCK.

This course consists of a study of diet in those diseases in which choice of food is an important factor of treatment. Fee for materials, $5.

131. **Problems of Family Nutrition with Special Emphasis on Child Feeding.** First term. Credit 1, 2, 3, or 4 hours. May all be taken in one term or in two consecutive terms. Open to seniors and graduate students. Two hours advised for teachers; one hour advised for all students. Prerequisite, Foods and Nutrition 121, 122, or the equivalent. Lectures and discussions, T 2–4. Martha Van Rensselaer Hall 117. Laboratory, Infant Feeding, Th 1:40–4. Homes in Ithaca and Well-baby clinic; Feeding of Pre-school Children, T 10:30–12:50 one section, Th 10:30–12:50 one section. Nursery School and homes in Ithaca; Feeding of School Children. F 1:40–4. Martha Van Rensselaer Hall 358, public schools and homes in Ithaca. Infant Feeding Laboratory limited to sixteen students. Pre-school Feeding Laboratory limited to six in each section. School Feeding Laboratory limited to ten students. Professor MONSCH and Mrs. BIZAL.

This is a study of family problems in nutrition which gives special emphasis to the nutritional need of the child. It offers experience for the study of actual family situations provided by laboratory practice in a well-baby clinic, in private homes, in the nursery school, and in the cafeteria. The nutritional needs of children of all ages, the importance of proper feeding to the physical health of the child, and the relation between sound nutrition practice in feeding children and the community health and family income are considered. Laboratory fee, $6 for each laboratory credit hour.

224. **Human Calorimetry.** First term. Credit two hours. Primarily for graduate students but open to seniors with the permission of the instructor. Class limited to six students. Hours to be arranged. Assistant Professor HAUCK. The laboratory work in this course consists of energy metabolism determinations using the portable respiration apparatus. Laboratory fee, $5. Martha Van Rensselaer Hall.

229. **Research in Food and Nutrition.** Throughout the year. Professor MONSCH, Assistant Professors PFUND and HAUCK, Professor MAYNARD, and Assistant Professor MCCAY. This course offers opportunity for individual research in animal nutrition, human nutrition and metabolism, food chemistry, chemical changes taking place in the process of food preparation. Laboratory fee, from $5 to $25. Martha Van Rensselaer Hall.

230. **Seminary in Foods and Nutrition.** Throughout the year. Credit two hours. Required of graduate students specializing in Foods and Nutrition. Professor MONSCH, Assistant Professors PFUND and HAUCK. Martha Van Rensselaer Hall.

In addition to the above, the following courses in Nutrition are offered in the Laboratory of Animal Nutrition (See page 132).

110. **Animal Nutrition.** Professor MAYNARD.

111. **Animal Nutrition, Laboratory Course.** Assistant Professor McCAY.

210. **Special Topics in Animal Nutrition.** Professor MAYNARD and Assistant Professor McCAY.

## *BACTERIOLOGY

*Professors* J. M. SHERMAN, OTTO RAHN, C. N. STARK, and GEORGES KNAYSI.

Before taking up graduate work in bacteriology, it is desirable that the student have general chemistry, qualitative and quantitative analysis, organic chemistry, and introductory courses in the biological sciences.

Formal courses open to undergraduate and graduate students are given in the following subjects:

*For Undergraduates and Graduates*

1. **General Bacteriology.** First term. Credit six hours. Lectures, recitations and laboratory practice, M W F 1:40–5. Dairy Building 119 and 301. Professor STARK and Mrs. STARK.

An introductory course; a general survey of the field of bacteriology, with the fundamentals essential to further work in the subject. Laboratory fee, $15.

2. *Elementary Bacteriology.* Credit four hours a week. First term.

105. **Higher Bacteria and Related Microorganisms.** First term. Credit three hours. Prerequisite, course 1. Lectures, recitations, and laboratory practice, T Th 1:40–4:30. Dairy Building 119 and 323. Assistant Professor KNAYSI.

A study of the higher bacteria together with the yeasts and molds which are of especial importance to the bacteriologist. Laboratory fee, $15.

106. **Dairy Bacteriology.** Second term. Credit four hours. Prerequisite, course 1. Lectures, recitations, and laboratory practice, M W 1:40–5. Dairy Building 119 and 323. Professor SHERMAN and Assistant Professor KNAYSI.

An advanced course for students in bacteriology or dairy industry. The relation of microorganisms to milk and milk products. The subject is treated from the standpoint of economic dairy bacteriology and also from the standpoint of milk hygiene and sanitary control. Laboratory fee, $15.

210. **Physiology of Bacteria.** Second term. Credit two hours. Prerequisite, course 1 and at least one additional course in bacteriology. Lectures, M W 8. Dairy Building 120. Professor RAHN.

An advanced course in the physiology of bacteria and the biochemistry of microbic processes.

210a. **Physiology of Bacteria, Laboratory.** Second term. Credit two hours. Must be preceded or accompanied by course 210. Time to be arranged. Dairy Building. Professor RAHN and Mr. FOTER.

An advanced laboratory course dealing with the biological principles of growth, fermentation, and death of bacteria. Laboratory fee, $15.

211. **Taxonomy of Bacteria.** First term. Credit two hours. Prerequisite, course 1 and at least one additional course in bacteriology. Lectures, T Th 8. Dairy Building 120. Professor RAHN.

An advanced course, dealing with the natural groups and variability of bacteria, with a study of the systems of nomenclature and classification.

212. **Bacteriological Literature.** Throughout the year. Credit one hour a semester. For seniors and graduate students. F 8. Dairy Building 120. Professor RAHN.

Presentation and discussion of current literature in bacteriology.

213. **Morphology and Cytology of Bacteria.** First term. Credit two hours. For seniors and graduate students. Lectures, W F 5. Dairy Building 119. Assistant Professor KNAYSI.

The morphology, cytology, and microchemistry of microorganisms.

221. **Seminary.** Throughout the year. Without credit. Required of graduate students specializing in the department; open to undergraduate students taking advanced work. Hours to be arranged. Dairy Building. Professor SHERMAN.

*For Graduates*

Research problems may be selected in various phases of pure and applied bacteriology; taxonomy; physiology; technique; dairy bacteriology; food bacteriology; water and sanitary bacteriology; industrial fermentations. (For pathogenic bacteriology, see Animal Pathology and Bacteriology; for soil bacteriology, see Agronomy.)

## *ANIMAL PATHOLOGY, BACTERIOLOGY AND IMMUNITY

*Professors* W. A. HAGAN, PETER OLAFSON, E. L. BRUNETT, and A. ZEISSIG.

The laboratories of pathology and bacteriology are well equipped with apparatus for research in pathological anatomy, pathogenic bacteriology, and immunity. The department operates two diagnostic laboratories to which a great deal of pathological materials come. A variety of fresh material is thus made available for study. In the Flower Library which is housed in the same building with the department, a very complete set of current periodicals, and the more important books and monographs dealing with the work of the department is available.

Candidates for advanced degrees, electing pathology or bacteriology as their major subjects must have had at least the corresponding general subjects given in this department, or their equivalents. Candidates electing a minor subject in this department may take up a research problem, if they possess sufficient preliminary training, or may pursue regular undergraduate course work, the courses taken being subject to the approval of the staff member who is in charge of the minor.

The following courses are open to graduate students. For additional information, see the Announcement of the New York State Veterinary College.

40. *General Pathology.* Prerequisites: Course 6 (Microscopy and Histology) or equivalent. It is desirable, also, that students should have had at least one year's work in anatomy and physiology. In special cases, the prerequisites may be waived for students majoring in the field of biology, when they wish to take this course for its general informational value and expect to do no more work in the field. In this case, credit in the course will not be accepted as a prerequisite for others. Professor OLAFSON. First term. Two hours. T Th 8.

40a. *General Pathology Laboratory.* Professor OLAFSON. First term. Two hours. T 9–12; Th 9–11. Laboratory fee, $5.

41. *Special Pathology.* Professor OLAFSON. Second term. Two hours. Lectures, W S 8.

41a. *Special Pathology Laboratory.* Professor OLAFSON. Second term. Two hours. T Th 10–12:30. Laboratory fee, $5.

42. *Pathology of Infectious Diseases.* Professor HAGAN. First term. Two hours. Lectures, T Th 12.

43. *General Bacteriology.* Professor HAGAN. First term. Two hours. Lecture and recitation, M W 8.

43a. *General Bacteriology Laboratory.* Professor ZEISSIG and Dr. BRUNER. First term. Two hours. M 10–12:30, F 8–10:30. Laboratory fee, $10.

46. *Diseases of Poultry.* Professor BRUNETT. Second term. Two hours. Lectures, W Th 9.

48. *Food Hygiene.* Professor ZEISSIG. Second term. One hour. Lecture, F 8.

49. *Pathogenic Bacteriology and Immunity.* Prerequisite, Course 43 or equivalent. Professor HAGAN. Second term. Two hours. T Th 8.

49a. *Pathogenic Bacteriology Laboratory.* Professor ZEISSIG. Second term. Three hours. This course should accompany course 49. The course includes a study of the more important bacteria which are pathogenic for animals, studies of the immune reactions, and the pathology of the infectious diseases. General pathology is a prerequisite. M W F 1:40–4. Laboratory fee, $10.

149. *Pathogenic Bacteriology Laboratory.* Dr. BRUNER. Second term. Two hours. This course should accompany course 49. It differs from course 49a in that the pathology of infectious diseases is not considered, and general pathology is not required as a prerequisite. T 1:40–4, Th 1:40–4. Laboratory fee, $10.

151. **Immunological Methods.** Prerequisites, Courses 49, and 49a or 149. Professor ZEISSIG. First term. Class limited to twelve students. Two laboratory periods on consecutive days. Hours to be arranged. Laboratory fee, $10.

152. **Advanced Work in Pathology and Bacteriology.** For students who have completed the undergraduate courses in pathology and bacteriology. Professors HAGAN and OLAFSON. Special problems or assignments will be given. Hours to be arranged. Laboratory fee, $2 a credit hour.

153. *Hematology.* Professor OLAFSON. Second term. One hour. Time to be arranged. Laboratory fee, $2.

154. **Seminar.** First and second terms. One hour, time to be arranged. Required of all graduate students.

(For Dairy Bacteriology, see Dairy Bacteriology; for soil bacteriology, see Agronomy.)

## *VETERINARY MEDICINE, AMBULATORY CLINIC, AND OBSTETRICS INCLUDING DISEASES OF THE GENITAL ORGANS

*Professor* D. H. UDALL, *Doctors* M. G. FINCHER, W. J. GIBBONS, and S. D. JOHNSON.

Opportunity for the clinical study of internal diseases of animals is afforded by material in the ambulatory clinic. This clinic has gradually developed until it demands a large part of the time of two clinicians. Especially abundant are affections of dairy animals. Students are required to report their observations. Files of notes on completed cases are available for additional information. Special and research students will be given individual instruction to meet their requirements, and may supplement their clinical experience with further study in the various laboratories and museums of the College.

## *DISEASES OF BREEDING CATTLE

*Professors* R. R. BIRCH and H. L. GILMAN.

The department has available for research in connection with the diseases of cattle a herd with a complete history of each animal. There is also an extensive collection of material illustrating various morbid conditions of the genital organs of cattle. Ample facilities are at hand for the study of the clinical and bacteriological aspects of this group of diseases.

Extensive researches are being conducted on the diseases of the genital organs of cattle, with special reference to abortion, sterility, and kindred phenomena.

## *VETERINARY PHARMACOLOGY AND DISEASES OF SMALL ANIMALS

*Professors* H. J. MILKS and H. C. STEPHENSON.

The laboratories of the department are well equipped for research in veterinary pharmacology. The clinic supplies abundant material for research both in external and internal diseases of small animals.

There is an operating room with modern equipment and facilities for handling approximately sixty animals. The library facilities are good.

20. *Pharmacology.* Two hours a week throughout the year. Prerequisite, Chemistry 101, 105, and Physiology.

21. *Materia Medica and Pharmacy.* Two hours. First term.

22. *Diseases of Small Animals.* Two hours a week. Second term. Prerequisite, General Surgery 30, and Physical Diagnosis 51.

22a. *Diseases of Small Animals.* Two hours a week. For senior students.

23. *Recitations in Materia Medica and Therapeutics.* Two hours. Senior students.

24. **Advanced Work.** This course will consist principally of the study of the action of drugs upon well and sick animals, and of the diseases of small animals. This will be supplemented by collateral reading and reports.

25. *Small Animal Clinic.* Six actual hours a week.

## *VETERINARY SURGERY

*Professor* J. N. FROST.

The laboratory in surgery is well equipped for research and special study along surgical lines especially in connection with diseases of bones, tendons, and tendon sheaths.

Candidates for advanced degrees should have as preliminary preparation, general pathology, physiology, general and special surgery.

**Special Surgery.** Professor FROST.

**Research in Surgical Diseases.** Professor FROST.

## *VETERINARY PHYSIOLOGY

*Professors* H. H. DUKES and C. E. HAYDEN; *Doctor* JESSE SAMPSON.

The laboratories of the department are well equipped for research work in the physiology of the domestic animals. Adequate facilities are available for work in both the experimental and the applied chemical fields. The Flower Library, in James Law Hall, provides a well-assorted collection of periodicals and books on physiology and related subjects. These may be supplemented by the many works on physiology in the University Library. The Veterinary Experiment Station, not far from the College, may be utilized for the study of those problems outside the scope of the laboratory.

Graduate students who plan to do their major work in veterinary physiology must have had the basic subjects of the department or their equivalents. Graduate students who plan to do minor work in veterinary physiology may undertake special problems or research work if they are qualified, or they may pursue work in the regularly scheduled courses of the department.

10. *Animal Physiology.* Three hours a week, either term.

11. *Chemical Physiology.* Six hours a week, second term.

12. *Physiology of the Domestic Animals.* Four hours a week, second term.

13. *Physiology of the Domestic Animals.* Four hours a week, first term. (Beginning in 1934–35.)

14. *Physiology Laboratory.* Five hours a week, first term.

15. *Urine Analysis.* Three hours a week, second term.

17. **Advanced Physiology.** Both terms. Hours to be arranged. The work will be adapted to the needs of the students and will consist of laboratory work, conferences, collateral readings, and reports. For advanced undergraduates and graduates. Laboratory fee, $2 a credit hour. Professors DUKES and HAYDEN and Doctor SAMPSON.

18. **Research.** Throughout the year. Hours to be arranged. For graduates only. Professors DUKES and HAYDEN.

# THE AGRICULTURAL SCIENCES

## *AGRONOMY

*Professors* T. L. LYON, J. A. BIZZELL, H. O. BUCKMAN, J. K. WILSON, L. G. ROMELL, and B. D. WILSON.

Special laboratories are provided for graduate students; they are equipped for chemical and bacteriological investigations of soils and of crop production. Greenhouses provide opportunity for conducting crop and soil tests during the winter, and for experiments with nutrient solutions and sand cultures. A field for plant experiments gives ample facility for work on a larger scale. These and other facilities afford opportunity for students properly trained in any one or more of the several sciences to investigate soil or plant nutrition problems.

A graduate student who desires to make agronomy his major subject should have had sufficient training in analytical chemistry and in bacteriology to give him a command of the technique as well as the principles of the subject. It is also desirable that he should have had enough technical agriculture to enable him to see the agricultural bearing of the work.

1. *The Nature and Properties of Soils.* First or second term. Credit five hours.

2. *Forest Soils.* First term. Credit three hours.

3. *Practical Soil Management.* First term. Credit three hours. Given in alternate years.

11. *Production of Field Crops.* First term. Credit four hours.

107. **Soil Bacteriology.** Second term. Credit three hours. Prerequisite, course 1, Bacteriology 1, and Chemistry 210 and 225. Lecture, W 8. Caldwell 143. Laboratory, W F 1:40–4. Caldwell 201. Professor J. K. WILSON.

A course in biological soil processes designed primarily for students specializing in soil technology and bacteriology. The laboratory work is supplemented by reports and by abstracts of important papers on the subject. Laboratory fee, $5.

201. **Soils, Advanced Lecture Course.** First term. Credit three hours. Prerequisite, course 1 and Chemistry 210 and 225. Students must consult Professor BIZZELL before registering for this course. Lectures, T Th S 8. Caldwell 143. Professor BIZZELL.

An advanced course designed primarily for students specializing in soil technology. The lectures deal with the important properties of soils from the theoretical and technical standpoints. Review of the literature and preparation of papers are important parts of the work.

202. **Soils, Advanced Laboratory Course.** First term. Credit one hour. Prerequisite, course I and Chemistry 225 or its equivalent. Laboratory, F 1:40–4. Caldwell 294. Professor BIZZELL. Laboratory fee, $3.

A course designed primarily for special training in methods used in soil investigation.

221. **Research in Agronomy.** Throughout the year. For graduate students only. Hours by appointment. Caldwell 350. Professors LYON, BIZZELL, BUCKMAN, and J. K. WILSON, and Assistant Professor B. D. WILSON.

223. **Research in Forest Soils.** Professor ROMELL. For graduates only. Prerequisite, a working knowledge of German and basic training in forestry and soils.

222. **Seminary.** Throughout the year, without credit. Required of graduate students taking work in the department. S 11–12:30. Caldwell 143.

## *FLORICULTURE AND ORNAMENTAL HORTICULTURE

*Professors* E. A. WHITE, R. W. CURTIS, J. P. PORTER, and C. J. HUNN.

The field of investigation and research in floriculture and ornamental horticulture is a broad one, and there are excellent opportunities for original work in these subjects. Studies in variation, nutrition, or in regard to the culture and improvement of plants may be undertaken. Monographic studies on the various genera of ornamentals offer an important field of research. Summer work is of special importance in studying plant materials, and it is desirable that candidates for the Master's degree spend at least one summer at the University. This is required of all candidates for the Doctor's degree.

Every candidate for an advanced degree must have had a thorough training in chemistry, general biology, botany, economic entomology, soils, fertilizers, and genetics. A student who takes his major subject in the department must already have had the courses noted below or their equivalent, excepting only the advanced courses. A student who takes his minor subject for the Master's degree in this department of study may register for these courses. Each student is required to deposit a typewritten copy of his thesis with the department.

In addition to the classroom and laboratory equipment, a range of greenhouses, aggregating sixteen thousand square feet of glass, is now available for instructional purposes. The department has about thirty acres of land devoted to nurseries of ornamental plants and to field experiments with peonies, gladioli, irises, roses, asters, and other perennial plants. This area also furnishes material for laboratory exercises.

The library equipment consists of a large and steadily increasing collection of works of reference, comprising a number of the rarer books of the ancients, and an unusually full assortment of the garden herbals of the sixteenth, seventeenth, and eighteenth centuries, and the leading monographs and manuals of modern times, supplemented by complete sets of a large number of the horticultural journals of Europe and America. The largest bound collection of seed, plant, and nursery catalogues in the United States is in the library of the department. This collection is very useful to students monographing horticultural plants. Students have access to an herbarium comprising about thirteen thousand cultivated plants.

The University Campus affords an excellent collection of woody plants in mature condition, and an arboretum is rapidly being developed which exhibits all the useful plant forms in arrangement for type study and also in their grouping for various uses.

Graduate students who have been trained in general horticulture and who have not had specialized courses in Floriculture and Ornamental Horticulture may be required to take certain undergraduate courses.

## *FORESTRY

*Professors* R. S. HOSMER, A. B. RECKNAGEL, JOHN BENTLEY, JR., C. H. GUISE, J. N. SPAETH, and L. G. ROMELL.

Students who wish to do graduate work in forestry, either for a Master's degree or for a Doctor's degree, are offered opportunity for advanced study or research in silviculture, forest management, forest policy, forest protection, and forest utilization.

The Matthias H. Arnot Forest of 1830 acres, located 20 miles south of Ithaca, a gift conveyed to Cornell University for the use of the Department of Forestry, offers exceptional opportunities for graduate work in Forestry. The Arnot Forest is, over the great part of its area, made up of second growth hardwoods, and hemlock. The University is also in possession of other parcels of wooded and open land, in the vicinity of Ithaca, aggregating approximately 670 acres. This property is well adapted to research work and graduate study in forestry.

Candidates for the Master's degree register for one major and one minor subject and pursue either advanced study or research along these lines. This year is normally devoted to individual work done under the direction of a member of the Forestry Staff, not to undergraduate class work taken by graduate students, although in special cases a part of the student's time may be so spent.

Candidates for the degree of Master in Forestry must show adequate preparation in the following fundamental subjects or their equivalents: English, inorganic chemistry, solid geometry, trigonometry, plain and topographic surveying, introductory physics, dynamic geology, general botany, plant physiology, general biology, zoology, general entomology, economics. They must also have satisfactorily completed forestry courses the equivalent of those offered in the four-year undergraduate course in the Department of Forestry, New York State College of Agriculture, leading to the degree of Bachelor of Science. (See the Announcement of the New York State College of Agriculture at Cornell University.) In addition they must have had at least three months' experience in forestry work, satisfactory proof of which is to be a signed statement, or an examination in woodsmanship, or both. Students who enter as graduates without having had undergraduate instruction in forestry should be able to complete the work for the Master's degree in two years, if they have had satisfactory training in fundamental sciences. If they lack this, it will require a correspondingly longer time to get the Master's degree. Prospective students should write to the Department of Forestry for information regarding the special lines of graduate work which they desire to follow.

A student entering the Graduate School as a candidate for the degree of Master in Forestry should enter the beginning of the first (autumn) term. Otherwise it will be difficult to arrange his work satisfactorily. The student will be advised whether he should attend the forestry summer camp.

In connection with the Charles Lathrop Pack Research Professorship in Forest Soils, excellent opportunity is available for research work in this subject. Students interested in graduate work in the field of forest soils should consult the Department of Agronomy.

*Advanced Work and Research*

Advanced work and research may be done in the following sub-fields:

***Silviculture.** Assistant Professor SPAETH.

***Forest Management.** Professor RECKNAGEL, Professor BENTLEY, and Assistant Professor GUISE.

***Forest Policy.** Professor HOSMER.

***Forest Protection.** Professor HOSMER.

***Forest Utilization.** Professor RECKNAGEL and Professor BENTLEY.

*Primarily for Undergraduates*

## GENERAL FORESTRY

1. *The Farm Woodlot.* Two hours a week, both terms.
3. *Conservation of Natural Resources.* Two hours a week, second term.
4. *The Field of Forestry.* Two hours a week, first term.

## PROFESSIONAL FORESTRY

### Forest Policy

111. *The Development of Forestry.* Three hours a week. First term.
112. *Forest Policy: Federal and State.* Two hours a week. Second term.

### Silviculture

121. *Timber Trees and Forest Regions.* Four hours a week. First term.
123. *Forest Planting.* Three hours a week. Second term.
124. *Silviculture A.* Three hours a week. First term.
125. *Silviculture B.* Three hours a week. First term.

### Forest Protection

131. *Forest Protection.* Three hours a week. Second term.

### Forest Utilization

140. *Seasoning and Preservation of Timber.* Two hours a week. Second term.
141. *Wood Technology.* Two hours a week. Second term.
142. *Forest Utilization.* Three hours a week. First term.
143. *Forest Industries.* Two hours a week. Second term.
144. *Forest Engineering.* Two hours a week. First term.

### Forest Management

151. *Forest Mensuration.* Three hours a week. Second term.
152. *Advanced Forest Mensuration.* Two hours a week. First term.
153. *Forest Management.* Three hours a week. Second term.
154. *Forest Administration.* Two hours a week. Second term.
155. *Forest Finance.* Three hours a week. First term.

*For Both Graduates and Undergraduates*

156. **Advanced Forest Management.** Prerequisite, Forestry 153 or its equivalent. Professor Recknagel. First term. Credit one or three hours. T Th 11; S 9–11:30. Theory and practice of forest management, including the making of a forest working plan.

*Primarily for Graduates*

254. **Statistical Methods in Forestry.** Prerequisites, Forestry 152 and 155 or their equivalent. Assistant Professor Guise. Second term. Credit two hours. T Th 10. The application of statistical methods to problems in forestry.

261. **Seminary.** Professors Hosmer, Recknagel, Bentley, Romell, and Assistant Professors Guise and Spaeth. Second term. Without credit. Hours to be arranged. Field and classroom conferences on important phases of forestry.

262. **Advanced Work.** Professors Hosmer, Recknagel, Bentley, Romell, and Assistant Professors Guise and Spaeth. Throughout the year. Credit two or more hours a term. Hours by appointment. Individual advanced study of designated topics.

## *POMOLOGY

*Professors* A. J. Heinicke, L. H. MacDaniels, D. B. Carrick, G. W. Peck, and Joseph Oskamp.

The large experimental and varietal orchards of different fruits at Ithaca and at Geneva are available for graduate use. Representative varieties of all domes-

ticated species that grow in this climate may be found in these orchards. Each year a large collection of exotic fruit is brought together at the College; herbarium and preserved material is also available. Modern apparatus for research work on pomological problems involving chemical, histological and physiological technique is available in the departmental laboratories. Special opportunity for investigation of fruit storage problems is afforded by a modern cold storage plant which is equipped for experimental purposes. The important pomological literature required for research is found in the libraries at Cornell and at the State Station.

In order to enter upon graduate work in Pomology, the student should have the equivalent of the following courses: General Botany, Elementary Plant Physiology, Economic Entomology, Elementary Plant Pathology, Introductory Inorganic and Elementary Organic Chemistry, Elementary Pomology and Systematic Pomology. In addition, students are required as part of their graduate work in Pomology to take advanced courses in Plant Physiology and Chemistry, unless minors are chosen in those subjects. They are urged, however, to choose a minor in some phase of Botany, particularly Plant Physiology.

On account of the nature of the work, it is very desirable that graduates studying for the Master's degree should spend one summer at Ithaca or in the field investigating their special subject. This is expected of graduates working for a Doctor's degree.

1. *General Pomology.* Second term. Credit three hours.
2. *Fruit Varieties.* First term. Credit two hours.

111. *Packing and Storage of Fruit for Market.* First term. Credit two hours.

112. *Advanced Laboratory Course.* Second term. Credit two hours.

121. **Economic Fruits of the World.** First term. Given in alternate years. Lectures, T Th 11. Laboratory, W 1:40–4. Professor MacDaniels. Given in 1933–34.

131. **Advanced Pomology.** Second term. Discussion, M W F 8. Plant Science 141. Professor Heinicke or Professor MacDaniels. A systematic study of the sources of knowledge and opinion as to practices in pomology; methods and difficulties in experimental work in pomology, and results of experiments that have been concluded or are being conducted.

202. **Special Topics in Pomology.** Throughout the year. Conference periods to be arranged. Plant Science 141. Professor Heinicke, Professor Carrick, Professor MacDaniels, or Professor Oskamp.

Different topics will be considered each term, the aim being to cover the entire field in two years. In this course the student is expected to review critically and evaluate the more important original papers relating to pomological practice and research. Interpretation of the literature will be made on the basis of the fundamental principles of plant biology and recent experimental methods.

201. **Research Problems in Pomology.** First and second terms. Plant Science 135. Varietal, taxonomic, histological and morphological. Professor MacDaniels; nutritional, Professor Heinicke; winter injury of fruit tree tissues, and cold storage of fruits, Professor Carrick; various phases of general fruit culture, members of the staff.

200. **Seminary.** Members of the staff. First and second terms. M 11. Plant Science 404.

## *VEGETABLE CROPS

*Professors* H. C. Thompson, Paul Work, E. V. Hardenburg, J. E. Knott, and Ora Smith; *Doctor* Hans Platenius.

Opportunity is offered for research in such lines of vegetable growing and handling as the student may select. There are excellent opportunities for original work in this subject.

The facilities available include the regular classrooms and laboratories; research laboratories, with the necessary equipment for chemical and physiological work; cold storage and common storage rooms; greenhouse space of approximately 7,500 square feet; hotbeds and cold frames, and about 25 acres of land devoted to teaching and research work. Special equipment is obtained as needed for students majoring in this field.

In order to enter upon graduate work in this field, the student should have the equivalent of the following courses: Botany 1 and 31, Plant Pathology 1, Entomology 12, Agronomy 1, Vegetable Crops 1, 2, 11, 12. These courses are outlined in the Announcement of the College of Agriculture. In case a student has not had all of these courses, he should take them early in his period of graduate study. Students taking either a major or a minor in vegetable crops are required to take the courses 101, 113, 121, and to attend the seminar.

Students majoring in vegetable crops will ordinarily find it necessary to spend one summer in Ithaca, in order to grow and study plant materials used in their research work.

1. *Vegetable Crops.* Professor WORK. Second term. Credit three hours.

2. *Special Vegetable Crops.* Professor HARDENBURG. Botany 1 should precede or accompany this course. Second term. Credit three hours.

11. *Vegetable Forcing.* Professor WORK. Prerequisite, course 1. Second term. Credit three hours. Given in alternate years.

12. *Grading and Handling Vegetable Crops.* Professor WORK. First term. Credit three hours.

101. **Advanced Vegetable Crops.** Professor THOMPSON. Prerequisite, course 1 and Botany 31. Second term. Credit four hours. Lectures, M W F 9. One conference period to be arranged. East Roberts 223.

This course is devoted to a systematic study of the sources of knowledge and opinions as to practices in vegetable production and handling. Results of experiments that have been concluded or are being conducted are studied and their application to the solution of practical problems is discussed.

113. **Types and Varieties of Vegetables.** Professor WORK. Prerequisite, course 1. First term. Credit three hours. Given in alternate years. Lecture, M 8. East Roberts 223. Laboratory, M 1:40–4. East Ithaca gardens. One week of laboratory work preceding the beginning of regular instruction is required: Sept. 21–27, 1933. Report at East Ithaca, 9 a. m., Sept. 21.

Taxonomy, origin, history, characteristics, adaptation, identification, classification, exhibition, and judging, of kinds and varieties of vegetables. Characteristics, production, and handling of vegetable seeds. The leading varieties of the vegetable crops are grown each year. Laboratory fee, $2.

121. **Morphology and Anatomy of Vegetable Crop Plants.** Assistant Professor SMITH. Prerequisite, course 1 and Botany 1. First term. Credit two hours. Lecture, Th 9. East Roberts. Laboratory, Th 1:40–4. East Roberts.

A study of the anatomy and development of the roots, stems, leaves, flowers, fruits, and seeds, and of the reproductive processes of vegetable crop plants.

221. **Research.** Members of the staff are prepared to direct investigations in the various lines of vegetable production and handling.

222. **Seminar.** Members of the department staff. Recent literature is taken up for general study and discussion. All graduate students in vegetable crops are required to take part in this seminar. Time to be arranged. East Roberts 223.

# ANIMAL HUSBANDRY, ANIMAL NUTRITION, ANIMAL BREEDING

*Professors* F. B. MORRISON, M. W. HARPER, E. S. SAVAGE, L. A. MAYNARD, R. B. HINMAN, C. M. MCCAY, S. A. ASDELL, and E. S. HARRISON.

The department is well equipped with herds and flocks of animals of the leading breeds of livestock and with modern barns adapted for experimental work. The livestock include a herd of over 150 dairy cattle, a herd of beef cattle, studs of draft horses, a flock of over 200 sheep, and a herd of breeding swine. The library includes a very full collection of the herd and flock registries of all of the breeds of domestic animals kept in this country, amounting to more than one thousand volumes, and affording excellent facilities in heredity and genetics.

The animals of the herds and flocks and their records provide opportunity for studying problems of nutrition, livestock feeding, breeding, and production.

Colonies of white mice, rats, and rabbits are available for research in the principles of animal nutrition and animal genetics. Excellent facilities are provided for the study of the physiology of the mammalian reproduction and lactation. Laboratories are provided adequately equipped for the study of the chemistry and physiology of nutrition, the chemistry of feeding stuffs and of animal products, and the histology of animal tissue.

Slaughter and meat laboratories are available for the study of the relation of breeding and nutrition to anatomical structure and to chemical composition and food value. The college animals are available for studies relating to the production and the processing, sale, grading, and measuring of their various products such as milk, meat, and horse power, including animal mechanics.

Graduate students may elect animal husbandry as a major field and select a problem dealing with the feeding, breeding or management of one of the classes of farm animals, or they may elect animal breeding or animal nutrition as their major.

## *ANIMAL HUSBANDRY

*Professors* MORRISON, HARPER, SAVAGE, HINMAN, and HARRISON.

In order to enter upon graduate study in animal production, the student should have the equivalent of the following courses. Elementary feeds and feeding, elementary breeding and the elementary production courses in dairy and beef cattle, horses, sheep, and swine.

1. *Livestock Production.* First term. Two lectures and one laboratory period a week.

10. *Livestock Feeding.* Second term. Two lectures and one laboratory period a week.

40. *The Horse.* Second term. Two lectures and one laboratory period a week.

50. *Dairy Cattle.* Second term. Two lectures and one laboratory period a week.

51. *Advanced Judging, Dairy Cattle.* Second term. Hours by appointment.

60. *Beef Cattle.* Second term. Two lectures and one laboratory period a week.

70. *Swine.* Second term. Two lectures and one laboratory period a week.

80. *Sheep.* First term. Two lectures and one laboratory period a week.

90. *Meat and Meat Products.* First or second term. One lecture and two laboratory periods a week.

93. *Meat Cutting.* First or second term. One period a week.

200. **Research.** First and second terms. Hours by arrangement. Professors MORRISON, HARPER, SAVAGE, HINMAN, and HARRISON.

201. **Seminary.** First and second terms. Required of all graduate students

taking either a major or minor subject in the department. M 11. Professor MORRISON and departmental staff.

## *ANIMAL NUTRITION AND PHYSIOLOGY

*Professors* MAYNARD, MCCAY, ASDELL, MORRISON, and SAVAGE.

In order to enter upon graduate study in this field, the student should have had the equivalent of the following courses: introductory inorganic chemistry, elementary organic chemistry, introductory physics, elementary zoology or biology, elementary human or veterinary physiology and an introductory course in animal breeding or genetics.

110. **Animal Nutrition.** First term. Prerequisite, course 10 or Home Economics 122. Lectures, M W F 10. Animal Husbandry Building B. Professor MAYNARD.

The chemistry and physiology of nutrition and the nutritive requirements for growth, reproduction, lactation, and other body functions.

111. **Animal Nutrition.** First term. Laboratory course. Must be preceded or accompanied by course 110. Registration by permission. M W F 1:40–4. Animal Nutrition Laboratory, Dairy Building. Professor MCCAY.

This course is designed to familiarize the student with the application of chemical methods to the solution of fundamental problems of nutrition. Laboratory fee, $5; breakage deposit, $5.

125. **Physiology of Reproduction.** Second term. Registration by permission. M 10. Animal Husbandry Building B. Professor ASDELL.

A course in the physiology of the process of reproduction, chiefly in mammals, and of the related internal secretions.

[130. **Physiology of Lactation.** Second term. Registration by permission. W 10. Animal Husbandry Building B. Professors MAYNARD and ASDELL.

A discussion of the development of the mammary gland and the physiological process governing its activity. Not given in 1933–34.]

210. **Special Topics in Animal Nutrition and Physiology.** First and second terms. Weekly conferences at a time to be arranged. Registration by permission. Professors MAYNARD, MCCAY, and ASDELL.

A consideration of the experimental data on which the principles of animal nutrition are based, and a critical review of current literature.

**Research.** Professors MAYNARD, MCCAY, ASDELL, MORRISON, and SAVAGE.

## *ANIMAL BREEDING

*Professors* HARPER and HINMAN.

In order to enter upon graduate study in animal breeding the student should have had the equivalent of the following courses. Elementary human or veterinary physiology, elementary biology, elementary genetics, principles of animal feeding and breeding, and production courses in dairy and beef cattle, horses, sheep and swine.

20. *Animal Breeding.* First term. Two lectures and one laboratory a week.

120. **Problems in Animal Genetics.** First term. Prerequisite, Animal Breeding 20 or Plant Breeding 1. T Th 11. Recitation by appointment. Professor HARPER.

Lectures, conferences, and reports, including statistical methods as applied to breeding animals. The work will consist largely of practice in making reports on statistical problems.

**Research.** Professors HARPER and HINMAN.

# *DAIRY INDUSTRY

*Professors* J. M. SHERMAN, H. E. ROSS, H. C. TROY, P. F. SHARP, E. S. GUTHRIE, and W. E. AYRES, and *Doctor* HERRINGTON.

The laboratories of the department are well equipped for special work and offer excellent opportunities to graduate students for research.

Before taking up graduate work in dairy industry, it is desirable that the student have general chemistry, qualitative and quantitative analysis, organic chemistry, and general bacteriology, in addition to the elementary courses in the particular field in which he wishes to do his graduate work.

Formal courses open to undergraduate and graduate students are given in the following subjects:

*For Undergraduates and Graduates*

1. *Introductory Dairy Science.* Credit three hours a week. Either term.

101. **Analysis of Dairy Products.** Second term. Credit three hours. Lecture and laboratory practice, T 1–6. Dairy Building 218. Dr. HERRINGTON.

The application of chemical methods to commercial dairy practice; analysis by standard chemical and factory methods; standardization and composition control; tests for adulterants and preservatives. Laboratory fee, $10.

102. **Market Milk and Milk Inspection.** Second term. Credit five hours. Must be preceded or accompanied by course 1, should be preceded or accompanied by Bacteriology 1 or its equivalent. Lecture and laboratory practice, T Th 1–6. Dairy Building 218 and 146. Professor ROSS.

Attention is given to the production and control of market milk, with special reference to its improvement; milk as food; shipping stations; transportation and sale; pasteurizing; standardizing; clarification; certified milk; milk laws; commercial buttermilk; methods of cooling; harvesting and storage of ice; duties of milk inspectors; apparatus and buildings. The practice includes visits to dairies in the vicinity of Ithaca. A required two-day inspection trip in the neighboring counties may be arranged. Laboratory fee, $10.

103. **Milk-Products Manufacturing.** First term. Credit five hours. Prerequisite, course 1. Lectures, recitations, and laboratory practice, T Th 1–6. Dairy Building 120. Professor GUTHRIE and Assistant Professor AYRES.

The principles and practice of making butter, cheese, and casein, including a study of the physical, chemical, and biological factors involved. Consideration is given also to commercial operations and dairy-plant management. Laboratory fee, $10.

104. **Milk Products Manufacturing.** Second term. Credit five hours. Prerequisite, course 1; should be preceded or accompanied by course 101. Lectures, recitations, and laboratory practice, F 1–6, S 8–1. Dairy Building 120. Assistant Professor AYRES.

The principles and practice of making condensed and evaporated milk, milk powders, ice cream, and by-products, including a study of the physical, chemical, and biological factors involved. Laboratory fee, $10.

105. **Dairy Chemistry.** First term. Credit two hours. Prerequisite, qualitative and quantitative analysis and organic chemistry. Lectures, M W 8. Dairy Building 119. Professor P. F. Sharp.

A consideration of milk and dairy products from the physico-chemical point of view.

. **Dairy Bacteriology.** (See Bacteriology 106.)

200. **Milk Products.** Throughout the year. Credit two hours each term. Must be preceded or accompanied by course 105. Lectures, T Th 8. Dairy Building 218. Professor P. F. Sharp.

An advanced consideration of the scientific and technical aspects of milk products.

202. **Seminary.** Throughout the year. Without credit. Required of graduate students specializing in the department; open to undergraduate students taking advanced work. Hours to be arranged. Dairy Building. Professor SHERMAN.

*For Graduates*

Graduate students may elect research problems in any of the various fields of dairy industry: the analysis of milk and its products; the sanitary production and control of market milk; the manufacture and technology of milk products; dairy chemistry.

## *POULTRY HUSBANDRY

*Professors* J. E. RICE, G. F. HEUSER, H. E. BOTSFORD, L. C. NORRIS, G. O. HALL, and A. L. ROMANOFF.

This department of study is well equipped with facilities for carrying on advanced work. The equipment includes special appliances and a flock of over 2,000 fowls with which to conduct investigations in breeding, housing, incubation, marketing, management, and nutrition. Laboratories provide means for doing the anatomical and analytical work required in poultry experiments.

Owing to the fact that many colleges do not give the undergraduate courses in poultry husbandry which are prerequisite to graduate work in the subject, students coming from other institutions can not in all cases enter immediately upon graduate study. Many students will find it necessary or desirable to spend a year in preliminary study taking undergraduate courses before beginning graduate work.

1. *Farm Poultry.* Second term. Credit four hours. Lectures and recitations, M W F 9. Poultry Building 375. Laboratory, Th or F 1:40–4 or S 8–10:20. Poultry Building 300. Professors RICE and HEUSER, Assistant Professors HALL and BRUNETT, and Messrs. BRUCKNER, DAVISSON, and VAN WAGENEN.

[2. *The Field of Poultry Husbandry.* First term. Credit one hour. Lecture, W 9. Poultry Building 174. Professor RICE. Not given in 1933–34.]

10. *Poultry Nutrition.* Second term. Credit three hours. Not open to freshmen. Lectures, T Th 9. Laboratory, Th 1:40–4. Poultry Building 174. Professor HEUSER and Research Assistant Professor NORRIS.

110. **Special Topics in Poultry Nutrition.** First and second terms. Credit one hour a term. For seniors taking course 109 and graduate students. Registration by appointment. Weekly discussion, time to be arranged. Poultry Building. Research Assistant Professor NORRIS.

A study of special phases of poultry nutrition, and a critical review of current literature.

210. **Experimental Methods in Poultry Nutrition.** First term. Credit two hours. For graduate students. Registration by appointment. Lecture and laboratory period, W 1:40–5. Given in alternate years (not given in 1934–35). Poultry Building. Research Assistant Professor NORRIS and Mr. RINGROSE.

A critical consideration of the domestic fowl's suitability as an experimental animal and of the experimental methods used in conducting research projects in poultry nutrition.

20. *The Breeds of Poultry, and Judging.* First term. Credit two hours. Not open to freshmen. Lecture or recitation, F 11. Poultry Building 174. Laboratory, Th or F 1:40–4. Breed observation house. Assistant Professor HALL.

120. **Poultry Breeding.** Second term. Credit two hours. Prerequisite, course 20. Lecture or recitation, M 11. Poultry Building 174. Laboratory, M 1:40–4. Poultry Building 174. Assistant Professor HALL.

The principles and practices of poultry breeding. Trips to poultry farms are made.

30. *Poultry Incubation and Brooding.* Second term. Credit three hours. Lecture, Th 11. Poultry Building 174. Laboratory, F 1:40–4. Practice in operating incubators and in brooding chicks, hours to be arranged. Mr. DAVISSON.

230. **Experimental Embryology of Domesticated and Game Birds.** Second term. Credit one hour. Open to graduate students and qualified seniors. Lectures, time to be arranged. Research Assistant Professor ROMANOFF.

A consideration of biological laws governing the growth and the development of the embryo, with special reference to the principles of artificial incubation of various species of domesticated and game birds.

40. *Poultry Housing.* First term. Credit two hours. Lecture and recitation, W 10. Laboratory, W 1:40–4. Poultry Building 174. Mr. BRUCKNER.

50. *Marketing Poultry Products.* First term. Credit three hours. Lecture, M W 11. Poultry Building 174. Laboratory, M or T 1:40–4. Poultry Building 174. Mr. VAN WAGENEN.

150. **Poultry Marketing, Advanced Course.** Second term. Credit two hours. Prerequisite, course 50, or permission to register. Recitations, T Th 11. Poultry Building 174. Mr. VAN WAGENEN.

A study of poultry and egg marketing organizations and the analysis of market reports. The weekly market letter is continued.

160. *Poultry Farm Management.* Second term. Credit three hours. Prerequisite, eight hours credit in poultry courses or permission to register. Lectures, T Th 10. Laboratory, W 1:40–4. Poultry Building 174. Professor RICE and Extension Professor BOTSFORD.

170. *Poultry Hygiene and Disease.* First term. Credit two hours. Prerequisites, Animal Physiology 10 or Human Physiology 303, Agricultural Bacteriology 3, Poultry Husbandry 10 and 30. Lectures, T Th 10. James Law Hall. Assistant Professor BRUNETT.

109. *Research.* First or second term, or throughout the year. Credit one or more hours a term. Open primarily to seniors who are qualified for research. Registration by permission. Time to be arranged. Poultry Building. Members of the departmental staff.

209. **Seminary.** Throughout the year. Required of all graduate students in poultry husbandry and of students taking course 109. F 10. Poultry Building 174. Members of the departmental staff.

A discussion of advanced work in poultry husbandry.

## *POULTRY BREEDING

*Assistant Professor* HALL.

In order to enter upon graduate study in poultry breeding the student should have had the equivalent of the following courses: Elementary human or veterinary physiology, elementary biology, elementary genetics, and poultry courses 10, 30, 20, 50, 160. In case a student has not had all of these courses he should take them early in graduate study.

**Problems in Poultry Genetics and Breeding.** Assistant Professor HALL.

**Research.** Assistant Professor HALL.

## *POULTRY NUTRITION

*Professor* HEUSER and *Research Assistant Professor* NORRIS.

Before undertaking graduate work in poultry nutrition, the student should have had elementary courses in poultry husbandry, animal nutrition, physiology, genetics, and physics; and also introductory courses in inorganic chemistry, qualitative and quantitative analysis and organic chemistry.

**Special Topics in Poultry Nutrition.** Research Assistant Professor NORRIS.
**Experimental Methods in Poultry Nutrition.** Research Assistant Professor NORRIS.
**Research.** Professor HEUSER and Research Assistant Professor NORRIS.

## *POULTRY INCUBATION

*Research Assistant Professor* ROMANOFF.

In order to undertake graduate study in poultry incubation, the student should have had elementary courses in poultry husbandry and should have acquired a fundamental knowledge in the fields of physical and biological science: physics, chemistry, physiology, embryology, and genetics.

The major study may be conducted by the application of either physical or chemical methods, or by the using of methods of physiological essay. Such a study is intended to prepare the student for either research or teaching in the field of incubation.

**Experimental Embryology of Domesticated and Game Birds.** Research Assistant Professor ROMANOFF.
**Research.** Research Assistant Professor ROMANOFF.

# THE NEW YORK STATE AGRICULTURAL EXPERIMENT STATION AT GENEVA

U. P. HEDRICK, *Director.*

*Professors* R. S. BREED, D. C. CARPENTER, R. C. COLLISON, H. J. CONN, A. C. DAHLBERG, H. GLASGOW, G. J. HUCKER, J. G. HORSFALL, M. T. MUNN, P. J. PARROTT, C. S. PEDERSON, W. H. RANKIN, F. C. STEWART, H. B. TUKEY, C. B. SAYRE, G. P. VAN ESELTINE, RICHARD WELLINGTON.

Since July 1, 1923, the State Agricultural Experiment Station at Geneva has been under the administration of Cornell University, the research workers of its staff are eligible to membership on the faculty of the Graduate School, and its facilities for research are available to graduate students.

The Station has a farm of approximately two hundred acres which is used for field experimental work with fruit and vegetable crops and certain special soil studies. A dairy herd is maintained for special studies by the several interested departments. It has laboratory buildings devoted to research in agricultural bacteriology, agricultural chemistry, agricultural botany, dairying, economic entomology, pomology, and vegetable crops. It has also a research reference library, permanent exhibits and records of progress of its research, suitable conference rooms, and adequate facilities for publication and distribution of results of station work.

Certain phases of the investigations now being conducted at the Station and other problems for which the facilities of the Station are suitable may be used as thesis problems by graduate students.

There is opportunity at the Station for graduate research in the following lines, under the direction of members of the staff as indicated:

## AGRICULTURAL BACTERIOLOGY

**Dairy Bacteriology.** Professors BREED and HUCKER.
**Soil Bacteriology.** Professor CONN.
**Biological Stains.** Professor CONN.
**Fermentation Bacteriology.** Professor PEDERSON.
**Systematic Bacteriology.** Professor BREED.

### AGRICULTURAL CHEMISTRY

**Chemistry of Milk and its Products.** Professor CARPENTER.
**Chemistry of Plant Tissues.** Professor CARPENTER.

### AGRICULTURAL BOTANY

**Plant Disease.** Professors STEWART, RANKIN, and HORSFALL.
**Seed Control and Improvement.** Professor MUNN.

### DAIRYING

**Dairy Products.** Professor DAHLBERG.

### ECONOMIC ENTOMOLOGY

**Orchard Insects.** Professors PARROTT and GLASGOW.
**Canning Crop Insects.** Professor GLASGOW.

### POMOLOGY

**Genetics of Fruit Breeding.** Professor WELLINGTON.
**Fruit Propagation and Management.** Professor TUKEY.
**Systematic Botany of Horticultural Plants.** Professor VAN ESELTINE.
**Orchard Soil Management.** Professor COLLISON.
**Cytology.** Dr. B. R. NEBEL.

### VEGETABLE CROPS

**Canning Crops.** Professor SAYRE.
**Variety Studies of Vegetables.** Professor SAYRE.

## THE MEDICAL SCIENCES

AS PRESENTED IN THE MEDICAL COLLEGE IN NEW YORK CITY

For a description of the work in the Medical College in Ithaca and in New York City see the Announcement of the Medical College. Students desiring to enter the Graduate School for work in the medical sciences can obtain application blanks at the office of the Dean of the Medical College. Professor C. V. Morrill, Chairman of the Group, may be consulted for additional information.

The Medical College in New York City now occupies a portion of the plant of the New York Hospital-Cornell Medical College Association. This new medical center is located on the bank of the East River north of the Rockefeller Institute for Medical Research. It occupies several city blocks extending from the East River on the east to York Avenue on the west, and from Sixty-eighth Street on the south to Seventy-first Street on the north. All city streets within the area, except Seventieth Street, have been eliminated. Thus the buildings in the group comprising the plant are for the most part contiguous and so arranged as to facilitate easy access between the clinical departments of the Medical College situated in the New York Hospital and the laboratories of the preclinical departments of the Medical College.

The Medical College group consists of buildings in the western part of the plant, facing York Avenue, opposite Sixty-ninth Street. These buildings are five stories high with two basements, each measures 110 feet by 50 feet, except the portion occupied by the Department of Pathology, which is seven stories high and 150 feet long. These buildings from north to south are occupied by the departments of Anatomy, Public Health, Bacteriology, Pathology, Physiology, Biochemistry and Pharmacology. The library is located in the building of the Department of Pathology and is constructed to accommodate with its

stacks 100,000 volumes. Together with the plant of the Rockefeller Institute to the south beginning at Sixty-fourth Street, the whole presents an imposing array of buildings devoted to the study of the science of Medicine.

The Graduate Faculty of the Medical College constitutes Section F of the Graduate Faculty of Cornell University. The qualifications required of graduate students are in every particular those which are required of the students of the other sections.

## *ANATOMY

*Professors* C. R. STOCKARD, C. V. MORRILL, G. N. PAPANICOLAOU, J. F. NONIDEZ, and P. B. ARMSTRONG.

Abundant material and sufficient apparatus are available for advanced study and work in the various branches of anatomy, embryology, histology, comparative morphology, descriptive anatomy, and experimental anatomy. Students desiring to pursue graduate work in any of these branches must have had in their college courses preliminary training in general zoology and comparative anatomy. A reading knowledge of German and French is essential.

New York City offers exceptional advantages for obtaining fresh human materials. The large slaughter-houses are accessible for comparative mammalian tissues and organs. The extensive collections of specimens and models in the city museums are extremely helpful and instructive to the advanced student.

The members of the staff offer courses in the various phases of anatomy in which they are especially engaged. The courses offered for the medical students appear in the Announcement of the Medical College, and are particularly recommended to those students who have not pursued work of this kind. Technical and practical anatomical work are fully provided.

Preliminary Requirements: Physics, Chemistry, and Biology as required for admission to the Medical College.

**Morphology, Embryology, Histological Technic, General Histology, Microscopic Anatomy and Organology, Descriptive Anatomy, including courses in dissection of the human body. Demonstrations on the Cadaver, Live Anatomy, Topographical Anatomy, Neuro-Anatomy and Neuro-Histology, Applied Anatomy, Organs of Special Sense, Anatomical Research.**

**Anatomy of the Living Body.** Professor STOCKARD.

**Special and Topographical Studies of Different Regions.** Professors STOCKARD and MORRILL.

**Human Histology and Histogenesis.** Professor NONIDEZ.

**Experimental Morphology.** Professor STOCKARD.

**Anatomy of the Infant and Postnatal Development.** Professor STOCKARD.

## *BACTERIOLOGY AND IMMUNOLOGY

*Professors* JAMES M. NEILL and J. LIONEL ALLOWAY, and *Doctors* JOHN Y. SUGG, and LYLE A. WEED.

The course given to second year students consists of lectures, laboratory work, and group conferences. Emphasis is placed upon the aspects of bacteriology and of immunology that are pertinent to an understanding of the etiology and pathogenesis of infectious diseases. The study of infectious material from patients is included in the laboratory part of the course, not only to acquaint the student with the technical procedures but to illustrate the directness of application of the fundamental principles of the subject to the practical methods used in the examination of clinical material.

*Graduates and special students.* Opportunities for advanced study and for research will be offered to students particularly interested in bacteriology and immunology. Hours to be arranged.

## *BIOCHEMISTRY AND CHEMICAL PATHOLOGY

*Professor* S. R. BENEDICT.

The laboratories available for advanced work and research in physiological chemistry and chemical pathology include those of the Department of Biochemistry, and a research laboratory in the General Memorial Hospital. These laboratories provide adequate equipment for investigation in a great variety of special problems in the chemistry of the plant, animal, or human organism in health or disease, by chemical, physical, or optical methods. In the college and departmental libraries the principal journals relating to these subjects are on file.

Students expecting to pursue investigation in physiological chemistry or chemical pathology should have adequate preliminary training in inorganic, analytical, and organic chemistry, as well as in physics, physiology, and physical chemistry, though a study of these latter subjects may be pursued at the College, together with more advanced work in special lines.

**Organic and Physiological Chemistry: Research.**
**Physiological Chemistry.**
**Chemical Pathology.**

## *PATHOLOGY

*Professor* EUGENE L. OPIE.

The departmental laboratories are suitably equipped for carrying on graduate study and research problems in the general field of Pathology. Facilities for the care of animals are generally available. There is a small departmental library where the most important current journals and reference books are kept on file. The main library is situated on the floor immediately beneath the department, and is accordingly instantly accessible. There is a carefully culled collection of mounted museum specimens, in addition to an active file of preserved gross material for study. The histological collection is likewise unusually rich in material. Autopsies for the entire hospital are performed by the members of the department, and offer an opportunity for the study of fresh pathological tissues.

No regular course of study is offered by the department for graduate students, but applicants in this field are given every opportunity for special work under the direct supervision of a member of the department. Such work may include the original investigation of some problem, and may be credited towards the applicant's graduate degree. Applicants who have been admitted to the Graduate School are required to present the equivalent of the first two years of medicine for admission to graduate work in the department.

Preliminary requirements: Anatomy, including Histology and Embryology. General Pathology, including Pathological Anatomy. Autopsy Technique and Experimental Pathology.

## *PHARMACOLOGY

*Professor* R. A. HATCHER.

The department is well equipped for general work and research in both the chemical and pharmacodynamic aspects of Pharmacology. Special opportunities will be afforded for the investigation of the action of drugs on the circulation. An electrocardiograph and other special apparatus are available. Arrangements can be made in special cases for correlating laboratory and clinical results of pharmacologic studies.

The departmental library is sufficient for the immediate needs of workers and its facilities are readily amplified by that of the college, and others nearby, which furnish every opportunity for extending the work.

A knowledge of chemistry and physiology is required.

**Materia Medica and Pharmacy; Pharmacology.**

**Research in Pharmacodynamics.**

**Toxicology.**

## *PHYSIOLOGY

*Professors* HERBERT S. GASSER, DAYTON J. EDWARDS, MCKEEN CATTELL, and WILLIAM H. CHAMBERS.

The laboratories of this department are equipped for teaching and for research on special problems. Advantages are afforded also by a departmental library that contains complete sets of the principal physiological journals with selected sets on certain allied subjects and a fairly large number of books on physiology and related topics.

There are no courses arranged especially for graduate students but it is expected that candidates electing a major in physiology will familiarize themselves with the regular required work for the students of medicine. In addition there will be opportunity to pursue intensively some topic which the candidate may elect with the advice of a member of the department. Special facilities are available for carrying on work in the subjects of nerve conduction, energetics of muscle, dynamics of the heart and circulation, and calorimetry as applied to animal metabolism.

Students electing physiology as a minor course may select either the regular work given to medical students, or may select only a portion of this course provided an additional amount of special work is undertaken.

As a prerequisite for graduate work in physiology the student will be expected to have a thorough training in the fundamental sciences of physics, chemistry, and biology.

## *PUBLIC HEALTH AND PREVENTIVE MEDICINE

*Professors* JOHN C. TORREY, WALTER C. KLOTZ, and MORTON C. KAHN.

**Public Health and Preventive Medicine.** This course is comprehensive in nature and deals with the fundamental factors concerned in the origin, increase and control of communicable and non-communicable diseases. It is intended to familiarize the student with the opportunities for disease prevention through public health organizations and in private practice, both in urban and rural communities. Among the subjects discussed in a series of lectures are environmental control, sources and modes of infection, specific and non-specific prophylaxis, vital statistics and public health administration. Many of these subjects are illustrated by laboratory and field demonstrations. 80 hours, first two quarters, fourth year.

**Epidemiology.** A study of the factors and principles concerned in the origin, spread and abatement of the more important communicable diseases as illustrated by past and, when possible, current outbreaks. Collection of epidemiological data and statistical analyses. Conferences. Hours to be arranged.

**Medical Zoology and Parasitology.** This course is intended to supplement and extend the required work in this field. Diagnosis, life histories of parasites and their vectors, and control measures are considered. Laboratory work and conferences. Hours to be arranged.

**Practical Field Work in Public Health.** Technic of sanitary surveys. Study of municipal and county health organizations and their activities. Hours to be arranged.

**Tropical Hygiene.** Special hygienic problems associated with a tropical environment. Lectures and conferences. Hours to be arranged.

**Public Health Laboratory Methods and Procedures.** Students may select specific problems for investigation or the course may be made of general character. Fourth year elective.

# FELLOWS: SCHOLARS: ROSTER OF DEGREES

## FELLOWS AND GRADUATE SCHOLARS IN 1932–33

### HONORARY FELLOWS

Bacon, Edmund Norwood, B.Arch. (Cornell) 1932.
Glanville, Albert Douglas, A.B. (Cornell) 1928, A.M. (Illinois) 1928, Ph.D. (Cornell) 1932.
Schubert, Herman Jacob Paul, B.S. in M.E., M.E. (Brooklyn Polytechnic Institute) 1927, 1928, A.M., Ph.D. (Columbia) 1930, 1932.

### RESIDENT DOCTORS

Brown, Sarah Harriet, A.B. (Washington) 1923, A.M. (Cambridge) 1924, Ph.D. (Radcliffe) 1927.
Cothran, John Cleveland, A.B., Ph.D. (Cornell) 1908, 1931.
Hansen, Esther Violet, A.B. (Vassar) 1921, A.M. (Wisconsin) 1922, Ph.D. (Cornell) 1930.
Hering, Paul Edmund, A.B. (Columbia) 1925, M.S., Ph.D. (Cornell) 1927, 1932.
Hirsh, Frederick, A.B., A.M., Ph.D. (Cornell) 1926, 1928, 1931.
Holroyd, Howard Byington, B.S. in M.E. (Iowa State College) 1924, Ph.D. (California Institute of Technology) 1929.
Kreezer, George, A.B., Ph.D. (Cornell) 1924, 1928.
Moser, Frank, B.S. (Iowa State College) 1927, M.S.A. (Purdue) 1929, Ph.D. (Cornell) 1932.
Pugsley, James William, A.B., A.M. (Cornell) 1925, 1928.
Shaw, Luther, B.S. (North Carolina State College) 1928, M.S. (Arkansas) 1929, Ph.D. (Wisconsin) 1932.
Smart, John, B.S., Ph.D. (Edinburgh) 1930, 1932.
Smith, Laura Lee Weisbrodt, B.S. (Miami) 1925, M.S. (Iowa State) 1927, Ph.D. (California) 1930.
Thorp, William Hardy, B.S. (Stout Institute) 1928, M.S., Ph.D. (Wisconsin) 1931, 1932.
de Tomasi, James Ambrogio, D.Sc. (Milan) 1924.
Willandt, Otto Wilhelm, Dr.Agr. (Helsinki) 1927.
Wiltse, Charles Maurice, A.B. (West Virginia) 1929, Ph.D. (Cornell) 1932.
Wolf, Louis Edward, A.B. (Missouri) 1922, M.S., Ph.D. (Cornell) 1926, 1930.

### ENDOWED FELLOWSHIPS AND SCHOLARSHIPS

*The Anna Cora Smith Fellowship in Home Economics:* Mrs. Eleanor Augur Tasker, A.B., Hillsdale College, 1922.
*The Charles Bull Earle Memorial Fellowship:* Joseph A. Strelzoff, E.E., M.E., Liege, 1923, 1925.
*The Charles E. Bennett Scholarship in Latin and Greek:* George H. Tyler, A.B., Cornell, 1928.
*The Clinton DeWitt Smith Fellowship in Agriculture:* Pao-chi Ma, B. S., Nanking, 1929.
*The Edgar J. Meyer Memorial Fellowship in Mechanical and Electrical Engineering and the Sibley Fellowship in Mechanical Engineering:* Kennedy F. Rubert, M.E., Cornell, 1927, Eero.E., New York University, 1928.
*The George C. Boldt Fellowship in History:* Solomon Katz, A.B., Cornell, 1930.
*The McGraw Fellowship in Civil Engineering:* Tom R. Johnson, B.S., Arizona, 1929.

## UNIVERSITY FELLOWSHIPS

*The Cornell Fellowship in English:* Leslie L. Lewis, A.B., Illinois, 1925, A.M., Colorado, 1927.

*The Erastus Brooks Fellowship in Mathematics:* Joseph Lev, B. S., Yale, 1926, A.M., Cornell, 1931.

*The Fellowship in American History:* Walter Pingrey Rogers, A. B., A.M., Oberlin, 1930, 1932.

*The Two Fellowships in Latin and Greek:* Walter Hugh Johns, A.B., Western Ontario, 1930; Manuel Rosenblum, A.B., A.M., Cornell, 1930, 1931.

*The Two Fellowships in Political Economy:* Walter Francis Ryan, A.B., Whitman College, 1930, A.M., Tufts, 1932; Louis Morton Bernstein, A.B., Cornell, 1932.

*The Goldwin Smith Fellowship in Botany:* Andrew George Lang, B.S., Miami University, 1932.

*The President White Fellowship in Modern History:* Anne I. Faulkner, A.B., Wellesley, 1928.

*The President White Fellowship in Physics:* Horace J. Grover, A.B., Rochester, 1929.

*The President White Fellowship in Political and Social Science:* Harold W. Metz, A.B., A.M., Cornell, 1930, 1931.

*The Sage Fellowship and Graduate Scholarship in Chemistry:* David H. Howard, A.B., Davidson, 1928.

*The Schuyler Fellowship in Animal Biology:* (First term) Jacobus Faure, B.S., A.M., Cornell, 1912, 1913; Jane L. Chidsey, A.B., Wellesley, 1929, A.M., Brown, 1931.

*The Susan Linn Sage Fellowships in Philosophy:* Henry Martyn Estall, A.B., A.M., McGill, 1930, 1931; Milton R. Konvitz, B.S., A.M., Jur.D., New York University, 1928, 1930.

*The Susan Linn Sage Fellowship in Psychology:* (Second term) John D. Coakley, A.B., Louisville, 1932.

*The University Fellowship in Agriculture:* George M. Cameron, B.S.A., Illinois, 1918, M.S.A., Tennessee, 1928.

*The University Fellowship in Architecture:* George Irving Bottcher, B.Arch., Cornell, 1932.

*The University Fellowship in German:* Herbert Franz Ferdinand Schaumann, A.B., Berlin, 1932.

## SPECIAL TEMPORARY FELLOWSHIPS

*The American Dry Milk Institute Fellowship:* Horace Jewel Davis, B.S., Louisiana State University, 1932.

*The American Rose Society Fellowship:* Bruce Parsons, B.S., Wyoming, 1930.

*The Corn Gluten Meal Fellowship:* Richard C. Ringrose, B.S., Cornell, 1932.

*The Genesee-Orleans Vegetable Growers Association Fellowship:* William Walters Stuart, B.S., M.S., Utah State Agricultural College, 1928, 1930.

*The Kraco Fellowship:* Victor Heiman, B.S., Washington State College, 1931.

*The Merriam Fellowship in Psychology:* (First term) George Kreezer, A.B., Ph.D., Cornell, 1924, 1928; (Second term) Albert Douglas Glanville, A.B., Cornell, 1928, A.M., Illinois, 1928, Ph.D., Cornell, 1932.

*The Nassau Farm Bureau Fellowship:* Pascal Pompey Pirone, B.S., Cornell, 1929.

*The New York Florists' Club Fellowship for Investigation of Diseases of Cyclamens and other Potted Plants:* Denzell Leigh Gill, B.S., Louisiana State University, 1931.

*The New York Florists' Club Fellowship for Investigation of Diseases of Roses Grown under Glass:* Eldon Wood Lyle, B.S., Oregon State College, 1930.
*The Niagara Sprayer and Chemical Company Fellowship for the Testing and Development of Fungicides:* Russell A. Hyre, B.S., Ohio State University, 1930.
*The Niagara Sprayer and Chemical Company Fellowship:* Cyril Galloway Small, B.S., Cornell, 1928.
*The Charles Lathrop Pack Fellowship in Nature Education and Forestry:* Philip G. Johnson, B.S., M.S., Nebraska, 1923, 1931.
*The du Pont Fellowship in Chemistry:* Paul W. Vittum, A.B., Cornell College, 1929.
*The du Pont Fellowship in Mechanical Engineering:* Morris Birney Wright, M.E., Cornell, 1927.
*The Rogers Brothers' Seed Company Fellowship:* Arthur Leslie Harrison, B.S.A., Ontario Agricultural College, 1929.
*The Uhlmann Grain Fellowship:* Tadeusz Brudzinski, Agr. Eng., LL.M., Warsaw, 1923, 1925, M.S. in Agr., Cornell, 1931.

## SCHOLARSHIPS

*The Graduate Scholarship in Animal Biology:* Margaret Shea, A.B., Oberlin, 1930, A.M., Wellesley, 1932.
*The Graduate Scholarship in Archaeology and Comparative Philology:* Eleanor Guilford Barnett, A.B., Wheaton, 1930, A.M., Radcliffe, 1932.
*The Graduate Scholarship in Architecture:* Morris Early Trotter, B.L.A., Cornell, 1932.
*The Graduate Scholarship in English:* Carmen Lou Rogers, A.B., Meredith College, 1918, A.M., Cornell, 1923.
*The Graduate Scholarship in Civil Engineering:* Irving Carl Watkins, C.E. Cornell, 1931.
*The Graduate Scholarship in History:* Robert P. Ludlum, A. B., Cornell, 1930.
*The Graduate Scholarship in Latin and Greek:* Ellen Whilden Townes, A.B., Winthrop College, 1932.
*The Graduate Scholarship in Mathematics:* Helen M. Schlauch, A.B., New York, 1928, A.M., Cornell, 1929.
*The Graduate Scholarship in Physics:* William Gilbert Cook, A.B., Williams College, 1932.
*The Graduate Scholarship in Veterinary Medicine:* Fred D. Patterson, D.V.M., M.S., Iowa State College, 1923, 1927.
*The Susan Linn Sage Graduate Scholarships in Philosophy:*
Cornelius M. DeBoe, A.B., Calvin College, 1930, A.M., Illinois, 1931.
Louis Kattsoff, A.B., A.M., Pennsylvania, 1929, 1930.
Lawrence A. Kimpton, A.B., Stanford, 1931.
Henry A. Myers, A.B., Niagara, 1929.
Julius Weinberg, A.B., Ohio State, 1931.
*Susan Linn Sage Scholarships in Psychology:* Walter S. Neff, A.B., A.M., Pennsylvania, 1930, 1931; Gertrude Louise Bestor, A.B., Minnesota, 1929.
*University Scholarship in Geology:* Allan McIlroy Short, B.S., Colgate, 1926.

## TUITION SCHOLARSHIPS AWARDED BY THE GRADUATE SCHOOL

Jose L. Baralt, A.B., Porto Rico, 1928, A.M., Clark, 1929, LL.B., Porto Rico, 1931.
Julius M. Bloch, A.B., Cornell, 1932.

William C. Curtiss, B.S., Illinois, 1927.
J. W. Curvin, A.B., Cornell, 1932.
Henry Dietrich, B.S., Cornell, 1917.
John B. Douds, A.B., Harvard, 1924, A.M., Columbia, 1926.
Margaret Erb, A.B., Bucknell, 1931, A.M., Cornell, 1932.
Vagn Fenger, B.S., Copenhagen, 1930.
Ruth Evelyn Gordon, A.B., M.S., Cornell, 1932, 1933.
William J. Koster, B.S., Cornell, 1931.
Anna L. Nestmann, B.Chem., M.Chem., Cornell, 1930, 1931.
Jacob Neufeld, E.E., Liege, 1929, M.S., South Carolina, 1930.
John George Nikulin, Eng.Agr., Zagreb, 1928.
Hasso von Puttkamer.
Harold Gill Reuschlein, A.B., Iowa, 1927.
Antonio Rodriguez, B.S., Pennsylvania State, 1929, M.S., Cornell, 1931.
Knud Valdemar Rottensten, Landsbrug Kand., Copenhagen, 1926.
Diran H. Tomboulian, A.B., A.M., Rochester, 1927, 1929.
Dorothy Wertz, A.B., A.M., Cornell, 1930, 1931.
Charlotte Wiser, Ph.B., Chicago, 1914.
Clarence R. Wylie, A.B., B.S., Detroit City College, 1931, M.S., Cornell, 1932.

## ADVANCED DEGREES CONFERRED IN 1931–32

### MASTERS OF ARTS

CONFERRED SEPTEMBER 30, 1931

Kurt Arthur William Anderson, A.B.: Industrial Relations, Finance. Thesis: *Rebellion in the Miners' Union since* 1919. *An Analysis of the Factor of Leadership.*

Louise Marshall Atkins, A.B.: Educational Method, Educational Measurement. Thesis: *The Relationship between the Socio-Economic Status and Physical Condition of a Group of Elementary School Children.*

Virginia Carrington Bailey, B.S.: Ethics, Dramatic Literature. Thesis: *The Foremost Theories of Nicholas Malebranche.*

Miriam Apthorp Bond, A.B.: American History, European History. Thesis: *The Participation of Women in Some of the Reform Movements in the United States,* 1830–1850.

Margaret Anne Bowers, A.B.: Mathematics, Education. Thesis: *Construction of Conics Partially Determined by Conjugate Pairs.*

Robert Franklin Brand, A.B.: French, Spanish. Thesis: *The Critics of Emile Zola.*

Arthur William Brewington, A.B.: Nineteenth Century English Literature, Teaching of English. Thesis: *The Teaching of Prose Fiction in the Secondary School.*

Emerson Gibbs Chamberlain, A.B.: American History, Labor. Thesis: *The Early American Labor Movement, Emphasizing the Entry of Organized Labor into the Politics of New York State,* 1828–1838.

Percy Ernest Clubine, A.B.: Invertebrate Zoology, Histology and Embryology. Thesis: *The English Sparrow (Passeur Domesticus) as a Carrier of Poultry Coccidiosis with Data on the Frequency of Infection with Isospora Lacazei.*

Raymond Roscoe Dise, A.B.: French, English. Thesis: *Marcel Proust as an Observer of Nature.*

Edwin Joseph Duerr, A.B.: Dramatic Production, Dramatic Literature. Thesis: *Early Stage Decoration in the American Theatre,* 1772–1872.

Sara McDowell Gaither, A.B.: Dramatic Production, Dramatic Literature. Thesis: *Brander Matthews on Playmaking. A study of His Theory of Dramaturgy.*

John Clifford Harlan, A.B.: Government, International Law. Thesis: *The Power of Congress to Judge the Elections, Returns, and Qualifications of Its Members.*

Pauline Cook Holcombe, A.B.: American History, Government. Thesis: *Edmond-Charles Genet and His Relations with the American Government.*

Hyman Horwitz, B.S.: Physiology, Bacteriology. Thesis: *The Influence of the Thyroid Gland on the Growth and Composition of the Skeletal System.*

John Theodore Hughes, A.B.: Plant Physiology. Thesis: *The Annual Increments in Growth in Various Parts of a Tree as an Indication of the Distribution of Carbohydrates Made during Any Particular Year.*

Charlotte Lucile Ingalls, A.B.: Latin, Literary Criticism. Thesis: *The Influence of Plato's* Phaedrus.

Helen Curtis Jefferson, A.B.: Latin, Ancient History. Thesis: *A Translation of the First Book of Manilius'* Astronomica *with Literary Parallels.*

Frieda Florence Jones, B.S.: Child Guidance, Psychology. Thesis: *A Study of the Guidance Procedures Used by Eighteen Practice House Mothers.*

Ruth Furmage Kimball, A.B.: Physics, Theoretical Physics. Thesis: *Relations in the Spectra of Atoms and Ions Having Due Valence Electron.*

Velma Knox, A.B.: Entomology, Still Life in Color. Thesis: *Observations on the Inhabitants of Two Amphibolips Galls of the Black Oak.*

Frederick Jesse Leverich, A.B.: Education, History. Thesis: *The Relation of Public Education to Crime.*

Eleanor Lowenstein, A.B.: Psycholoy, Physiology. Thesis: *The Limen for Heat.*

Fred Albert Mettler, A.B.: Anatomy, Physiology. Thesis: *Connections of the Auditory Cortex of the Cat.*

Aneurin Varr Morris, B.S.: Geometry, Mathematical Analysis. Thesis: *Examples of Resolutions of Singularities of Algebraic Curves.*

Kaspar Osvald Myrvaagnes, B.S.: German Philology, German Literature, Thesis: *Die Einheitsfrage in der Faustkritik eine Historische Ubersicht.*

George Franklin Reeves, A.B.: Finance, Statistics. Thesis: *A Study in American Investment Trust Finance.*

Mary Kathrina Rogers, A.B.: Dramatic Production, Dramatic Literature. Thesis: *Stark Young, His Critical Theories of the Theatre.*

James A. Sheehy, Ph.B.: Dramatic Production, Dramatic Literature. Thesis: *Critical Opinions and Theories of William Archer on the Theatre, Actors, and Acting.*

Ervin Leslie Small, B.S.A.: Rural Education, Psychology. Thesis: *A Comparative Study of Pupil-Progress in a Rural Teacher-Training Program.*

Jamie Ward Strader, A.B.: Mathematical Analysis, Geometry. Thesis: *The Fundamental Theorem of Algebra.*

Dorothy Wood Stuart, A.B.: Organic Chemistry, Physical Chemistry. Thesis: *A Study of the Alkyl Cyclohexanols.*

Mae Stewart Thompson, A.B.: Education, Educational Measurements. Thesis: *The Determination of the Extent and Character of the Preparation of the Undepartmentalized Teacher of Physical Education and Health in Elementary Schools.*

Elinor Tilford, A.B.: Dramatic Production, Dramatic Literature. Thesis: *The Development of Theatrical Masks.*

Constance Josephine Timlin, A.B.: English Literature, American History. Thesis: *A Study of Elizabeth Browning.*

Alan Turner Wager, B.S.: Mathematics, Physics. Thesis: *Application of Theory of Numbers to Magic Squares.*

Mary Elizabeth Woodruff, B.S., A.M.: Latin, English. Thesis: *The Minor Poets of the Ciceronian Age, Their Lives, Works, and Literary Associations.*

CONFERRED FEBRUARY 10, 1932

Paul Denison Cargill, A.B.: Experimental Physics, Alternating Currents. Thesis: *A Study of the Ion Currents to Negatively Charged Electrodes in a Mercury Discharge.*

Charles Auguste Choquette, A.B.: French, Spanish. Thesis: *The Habitant in French-Canadian Prose.*

Violet Louise Dvorak, A.B.: Elizabethan Literature, English Language. Thesis: The Weakest Goeth to the Wall, *Edited with Introduction and Notes.*

Arthur Coe Gray, A.B.: Dramatic Production, Dramatic Literature. Thesis: *Stage Lighting up to and Including the Introduction of Electricity.*

Ethel Almira Hadley, A.B.: Public Speaking, English Drama. Thesis: *George Henry Lewes's* On Actors and the Art of Acting, *Edited with Introduction and Notes.*

Ruth Hoffman, A.B.: Botany, Zoology. Thesis: *A Sketch of the History of the Classification of Plants.*

Theresa Margaret Jamer, A.B.: Zoology, Botany. Thesis: *The Skunk, an Indigenous Mammal Peculiar to America.*

Evelyn Ruth Kennedy, A.B.: American History, English History. Thesis: *A Study of the Efforts of the United States Government to Aid Indian Education Prior to* 1860.

Elizabeth Winchester Kingsbury, A.B.: Ornithology, Entomology. Thesis: *A Study of the Hairy Woodpecker Dryobates Villosus Villosus.*

Esther Ober McCormick, A.B.: Geometry, Algebra. Thesis: *Quadratic Plane Transformations.*

Helena Merriman, A.B.: Dramatic Production, Dramatic Literature. Thesis: *Percy Fitzgerald and His Theories of Dramaturgy.*

Louis Olshevsky, A.B.: Geometry, Analysis. Thesis: *Functions for Self Conjugate Equations Analogous to Those of Sturm.*

Myra Rose Ten Cate, A.B.: Dramatic Production, Dramatic Literature. Thesis: *Pictorial Composition in the Theatre.*

Lawrence Jensby Voss, A.B.: Dramatic Production, Dramatic Literature. Thesis: *The Theory and Practice of Change of Place in the Drama and Scene Shifting in the Theater.*

Esther Helen Weiner, A.B.: Education, Physics. Thesis: *A Study of the Development of Subject Matter in Elementary Physics Textbooks.*

CONFERRED JUNE 20, 1932

Alton Marion Alday, A.B.: American Literature, Education. Thesis: *Emerson as a Practical Idealist.*

Maxine Rogene Alverson, A.B.: Literary Criticism, Music. Thesis: *The* Antigone *of Sophocles and the* Rhetoric *of Aristotle.*

John Franklin Anderson, A.B., M.B.A.: Finance, Marketing. Thesis: *The Investment Trust as Exemplified in Recent American Experience.*

Eula Barton, A.B.: English Nineteenth Century Poetry, English History. Thesis: Laon and Cythna, *Edited with Introduction and Notes.*

Wilhelmina Barton, A.B.: Literary Criticism, English History. Thesis: *A Prose Passage of Milton Critically Examined.*

Sarah Wooten Briggs, A.B.: Middle English, Theory of Poetry. Thesis: *The Legend of Tristram and Iseult from Malory's* Morte D'Arthur *through Modern Poetry.*

Mary Campbell Brill, A.B.: Literary Criticism, Modern Writers. Thesis: *The Speeches in Aeschylus'* Choephori.

Mary Florence Callahan, A.B.: Public Speaking, Modern Dramatic Literature. Thesis: *Rhetoric in Ibsen's Social Dramas.*

Shih-Ping Chao, A.B.: Education, Secondary Education. Thesis: *A Survey of Recent Developments in the Aims, Principles, and Practices of School Supervision.*

Marjorie Chapman, A.B.: Botany, Taxonomy. Thesis: *The Ovule and Its Embryogeny in Saxifraga Virginiensis.*

Joseph Rudolph Chelikowsky, A.B.: Economic Geology, Stratigraphy. Thesis: *Investigation of Unsupported Fragments in Veins.*

Francis Joseph Coty, A.B.: Modern European History, International Relations. Thesis: *Collot D'Herbois, Member of the National Convention and the Committee of Public Safety.*

Lucy Wortley Crowe, A.B.: European History, English History. Thesis: *Gypsies, Their History, Origin, and Culture.*

Helen Hill Currier, A.B.: Literary Criticism, English History. Thesis: *The Structure of the Greek Romance,* Theagenes and Chariclea.

Marie Dehner, A.B.: German, French. Thesis: *A Study of Mysticism in the Works of Rainer Maria Rilke.*

Foster Leroy Dennis, B.S.: Geometry, Analysis. Thesis: *Construction and Properties of the Bipartite Circular Cubic.*

Janice Kathryn Deringer, A.B.: Latin, Greek. Thesis: *The Epithalalium in Greek and Latin Literature.*

Samuel Edward Duncan, A.B.: Educational Methods, Sociology. Thesis: *A Critical Study of the Methods of Organization in General Science Textbooks.*

Isidor Eisner, A.B.: Histology and Embryology, Physical Chemistry. Thesis: *An Investigation of the Osteoclast.*

Margaret Ballou Erb, A.B.: Psychology, Physiology and Comparative Neurology. Thesis. *Adaptation to Pressure.*

Chamberlain Ferry, A.B.: Economic Geology, Structural Geology. Thesis: *Experiments on the Growth of Crystals in Rock Fractures.*

Rudd Fleming, Ph.B.: Literary Criticism, Modern Writers on Art. Thesis: *The* Ethos *of Macbeth and the Function of Tragedy.*

Philip Herbert Freund, A.B.: English Literature, Dramatic Production. Thesis: *The Quintessence of the Novel.*

Helen Jane Fullerton, A.B.: Geometry, Physics. Thesis: *Combination Properties of Linear Transformations in One and Two Dimensions.*

Charles Edward Galbreath, A.B.: Finance, Accounting. Thesis: *Credit Factors as a Cause of the Business Reaction of* 1929.

Nicolas John Galucci, A.B.: English, Spanish. Thesis: *The Influence of William Godwin on Percy Bysshe Shelley.*

Ermanno Francis Gizzarelli, A.B.: American History, Musicology. Thesis: *The Public Activities of Alexander Hamilton after His Retirement from the Treasury.*

Evelyn Virginia Grier, A.B.: English Literature, English Language. Thesis: *A Translation of Louis Maigron's* Le Roman Historique a l'Epoque Romantique.

Edith Charlotte Harrison, A.B.: Celtic Literature, Old English. Thesis: *Studies in the Celtic Renascence.*

Edward Liberty Herbst, B.S.: Literary Criticism, English Drama. Thesis: *The Diction in Milton's* At a Solemn Musick.

Ann Bertha Herrick, A.B.: Latin, Greek. Thesis: *Selections from the* Controversiae *of Seneca, Rendered into English, with an Introduction.*

Margaret Shaw Herring, A.B.: Modern European History, American History. Thesis: *The World Peace Movement,* 1889–1914.

Raymona Elsie Hull, A.B.: English Literature, American Literature. Thesis: *The Early Novels of Francis Marion Crawford.*

Eleanor Cowdrey Iler, A.B.: English History, European History. Thesis: *Henry Oxinden of Barham* (1609–1670) *and His Letters.*

Zelma Raye Langworthy, A.B.: American Literature, Dramatic Literature. Thesis: *The Godwinian and Radcliffian Elements in the Novels of Charles Brockden Brown.*

Robert Phillips Ludlum, A.B.: American History, Government. Thesis: *The Growth of Commerce on the Great Lakes and the Demand for Federal Harbor Improvements,* 1825–1855.

Alice Eugenia Merrick, A.B.: French, Latin. Thesis: *Classical Allusions in* Le Capitain Fracasse.

Barbara Grace Merritt, A.B.: American History, Modern European History. Thesis: *Glimpses of Western New York,* 1700–1825.

Ruth Laura Miller, A.B.: French, English. Thesis: *Flaubert Theoricien Litteraire D'Apres Sa Correspondence* (1830–1857).

Roberta Pearl Molyneaux, A.B.: German Literature, German Philology. Thesis: *The Characteristics of Theodor Storm's Prose Style as Seen in His Novellen.*

Morris Harry Moss, A.B.: Labor, Finance. *Some Aspects of the Planned Economy of Soviet Russia.*

Mardel Ogilvie, A.B.: Education, Public Speaking. Thesis: *The Status of the Teaching of Economics in United States, with Particular Attention to New York State.*

Horace Peterson, A.B.: American History, European History. Thesis: *The Campaign for American Participation in the World War.*

Lillian Frances Petsche, A.B.: German Literature, French Literature. Thesis: *Weltanschanung und Schicksalsbegriff in den Werken Ricarda Huchs.*

William Roland Phinney, B.S.: Literary Criticism, English History. Thesis: *References to Singing in Old English Writings.*

Adrian Fargher Reed, A.B.: Neuro-Anatomy, Physiology. Thesis: *The Nuclear Masses in the Spinal Cord of Pithecus Rhesus.*

Elinor Troy Rice, A.B.: French, Education. Thesis: Les Ballades Françaises *of Paul Fort.*

Robert Davis Richtmyer, A.B.: Theoretical Physics, Spectroscopy. Thesis: *X-Ray Energy Levels by Quantum Mechanics.*

Harry Rosner, A.B.: Finance, Statistics. Thesis: *Methods of Safeguarding Bank Depositors.*

Philip Leonard Rothenberg, A.B.: German Literature, German Philology. Thesis: *Lessing's Relationship to Fable Literature.*

Katherine Gertrude Shea, A.B.: Literary Criticism, English History. Thesis: *The Construction of Speeches in* Samson Agonistes.

Bernard Stambler, A.B.: Literary Criticism, Modern Writers on Art. Thesis: *The "Villain" in Greek Drama.*

Estelle L. Thompson, A.B.: Histology, Neuro-Anatomy. Thesis: *The Haematopoietic Activity of the Spleen in Anemic Albino Rats.*

Marjorie Beth Tobey, A.B.: English, Education. Thesis: *Style in the Brontës.*

Norman VanderWall, A.B.: Nineteenth Century English, Seventeenth Century English. Thesis: *A Study of Addison's Criticism in Relation to Its Sources.*

Grace Frances Wilson, B.S.: Educational Supervision, Educational Psychology. Thesis: *Professional Growth of Teachers-in-Service with Special Reference to the State of New Jersey.*

William Hendricks Wiser, Ph.B.: Rural Social Organization, Rural Education. Thesis: *The Hindu Jajmani System.*

Frances Dunham Wormuth, A.B.: English History, Law. Thesis: *The Translation of the English Judicial System to the American Colonies.*

John Goddard Wright, A.B.: Inorganic Chemistry, Physical Chemistry. Thesis: *Studies in the Oxidation of Hydrazine.*

## MASTERS OF ARTS IN EDUCATION

CONFERRED SEPTEMBER 30, 1931

Roy Arnold Anderson, A.B.
Earle William Norton, A.B.

CONFERRED JUNE 20, 1932

Robert Franklin Baker, E.E.
Gertrude Burroughs Rivers, A.B.
Ruth Starr Tanner, B.S.

## MASTERS OF SCIENCE

CONFERRED SEPTEMBER 30, 1931

Wayne West Adams, B.S.: Agricultural Education, Secondary Education. Thesis: *The Launching of Vocational Agriculture Boys into Supervised Farm Practice Work.*

John Harvey Bondurant, B.S.A.: Farm Management, Marketing. Thesis: *Methods of Pro-Rating Farm Equipment Costs.*

Edith Eleanor Burke, B.S.: Education, Child Training. Thesis: *A Course of Study in Home Economics Planned for the Ithaca Junior High School.*

Mabel Elizabeth Conoway, B.S.: Child Guidance, Home Economics Education. Thesis: *Studies of Pre-School Children by Case Method. Some Factors at Home and at School Which Influenced Behavior.*

Charles Walter England, B.S.: Bacteriology, Organic Chemistry. Thesis: *A Comparison of Culture Media for Use in the Bacteriological Examination of Water.*

Charles Emanuel Entemann, A.B.: Organic Chemistry, Physical Chemistry. Thesis: *The Relative Reactivities of Various Organic Compounds with a Grignard Reagent.*

Eva Lucretia Gordon, B.S.: Entomology, Nature Study. Thesis: *The Ephemerid Genus Leptophlibia in the Eastern United States.*

Ira John Hollar, B.S.: Poultry Marketing, Farm Management. Thesis: *A Study of the Factors Affecting the Quality of Eggs in Transit.*

Mattie Lee Hollar, B.S.: Child Guidance, Educational Psychology. Thesis: *Studies of Pre-School Children by Case Method. Some Factors at Home and at School Which Influenced Behavior.*

Howard M. Leichty, A.B.: Agricultural Education, Agricultural Economics. Thesis: *Agricultural Education in Syria in the Light of Present Social and Economic Conditions.*

Grace Beatrice Long, B.S.: Child Guidance, Rural Education. Thesis: *Studies of Pre-School Children by Case Method. Some Factors at Home and at School Which Influenced Behavior.*

Reuben Roosvelt McDaniel, B.S.: Mathematics, Physics. Thesis: *On Certain Definitions of the Definite Integral.*

Carl Marzzacco, B.S.: Inorganic Chemistry, Physics. Thesis: *Action of Sulfur and Hydrogen Sulfide on Hydrazine Sulfate and Hydrazine Hydrate. Effect of Presence of Hydrogen Sulfide on the Identification of Hydronitric Acid.*

Carleton Allen Moose, B.S.: Physics, Biology. Thesis: *Relations in Spectra of Atoms Involving Two Valence Electrons.*

Earl Nishimoto, B.S.: Parasitology, Bacteriology. Thesis: *The House Fly, Musca Domestica Linn., as a Possible Carrier of the Abortion Organism Brucella Abortus Bang.*

Marion Orcutt, A.B.: Bacteriology, Histology. Thesis: *A Study of Bacillus Necrophorus Obtained from Cows.*

George Shapiro, B.S.: Inorganic Chemistry, Physical Chemistry. Thesis: *Equilibria in the Binary Systems Sodium Iodide, Ammonia, Potassium Thiocyanate, Ammonia.*

Alice Elizabeth Sherman, B.S.: Entomology, Nature Study. Thesis: *A Study of the Characters of the Larvae of Mycetophila, with Special Reference to the Mouth-Parts.*

Hattie Vevers Steele B.S.A.: Economic Entomology, Plant Pathology. Thesis: *A Study of the Greenhouse White-Fly with Special Reference to Its Parasitism by Encarsia formosa.*

Kenneth Leroy Turk, B.S.: Animal Husbandry, Animal Nutrition. Thesis: *The Effect of Various Feeds upon the Dry Matter Content and Consistency of the Feces of Dairy Heifers.*

CONFERRED FEBRUARY 10, 1932

Harvey Bird Bowman, B.S.A.: Zoology, Entomology. Thesis: *A Descriptive and Ecologic Study of the Margined Mad Tom, Rabida insignis (Richardson).*

Shifu Chi-gao Chen, B.S.: Ornamental Horticulture, Landscape Design. Thesis: *A Study of Cotoneasters Hardy in New England and New York State.*

Leon Nathan Diamond, B.S.: Education, Nature Study. Thesis: *A Critical Examination of Tests in High School Science.*

Ian Dunbar Gray, B.S.: Genetics, Cytology. Thesis: *The Rubber Tree Hevea Brasiliensis and Its Improvement.*

Nisar Ahmad Khan, B.S.: Animal Husbandry, Agricultural Economics. Thesis: *Corn Silage in Place of Hay in Rations for Wintering Yearling Dairy Heifers.*

Pincus Philip Levine, B.S.: Bacteriology, Dairy Bacteriology. Thesis: *The Effect of Gaseous Environment upon the Growth of an Aerobic Spore-Bearing Bacillus.*

Russell Ray Nellist, B.S.: Rural Education, Agricultural Education. Thesis: *The Development of a Suggested Course of Study in Rural School Shop Work for the Richland Consolidated Teacher-Training School at Richland, Michigan.*

Lela Margaret Reitz, A.B.: Botany, Zoology. Thesis: *Comparative Study of the Florets of the Species in the Tribe Astereae of the Cayuga Lake Basin.*

Shou-Keng Ru, B.S.A.: Plant Breeding, Plant Physiology. Thesis: *Genetics and Breeding of Rice.*

CONFERRED JUNE 20, 1932

Alan Thacker Busby, B.S.: Animal Husbandry, Veterinary Science. Thesis: *A Study of Hereditary Influences on the Transmission of Butter-fat Test in Holstein-Friesian Cattle.*

Forrest Clifton Button, B.S.: Dairy Industry, Sanitary Chemistry. Thesis: *A Study of the Relations between Ice Formation and Swell Development in Freezing Ice Cream.*

Hugh Stuart Cameron, D.V.M.: Diseases of Cattle, Veterinary Obstetrics. Thesis: *The Viability of Brucella Abortus.*

Ho Cheng Chai, B.S. in Eng.: Structural Engineering, Railway Engineering. Thesis: *A Comparative Study of Vascule and Center Bearing Swing Bridges.*

Tsai-piao Chao, B.S. in Agr.: Rural Economy, Agricultural Statistics. Thesis: *A Study of the Short Time Loans of 121 Farms in Hohsien, Anhwei, China, 1930.*

Paul Andrew Chapman, B.Chem.: Sanitary Chemistry, Bacteriology. Thesis: *The Application of Microscopy in the Sanitary Examination of Water.*

Theodora Morris Cope, A.B.: Vertebrate Ecology, Ornithology. Thesis: *Some Observations on the Vertebrate Ecology of a Pennsylvania Mountain Farm.*

Douglas Belden Crane, D.V.M.: Insecticides, Diseases of Cattle. Thesis: *Some Studies on the Use of Rotenene as a Canine Parasiticide.*

Aubrey Wayne Crawford, B.S.: Economic Entomology, Insect Morphology. Thesis: *The Life History and Control of the Oriental Fruit Moth in New York.*

Nedelcho Stojcho Deleff, B.S.: Agricultural Economics, Marketing. Thesis: *Marketing Bulgarian Eggs.*

Philip Holmes Dewey, B.S. in Chem.: Physical Chemistry, Physics. Thesis: *The Catalytic Oxidation of Acetaldehyde.*

Nevzat Djemal, A.B.: Animal Husbandry, Animal Health and Diseases. Thesis: *Live Stock Improvement in Turkey in the Light of Research Which Is Being Carried Out in American, British, and French Tropical Possessions.*

Earle Lawrence Douglass, B.S.: Dairy Production, Rural Education. Thesis: *A Study of Breeding Efficiency in Dairy Cows Including a Project Plan for Extension Work in This Subject.*

Donald DeWitt Eastman, B.S.: Farm Management, Agricultural Prices and Statistics. Thesis: *Farm Mortgage Credit in Tioga County, New York.*

Thomas Edward Ellis, B.S.: Organic Chemistry, Physical Chemistry. Thesis: *A Study of Tervalent Nitrogen.*

Che Fang Feng, B.S.: Plant Breeding, Plant Physiology. Thesis: *Technic Involved in Comparative Tests of Cotton.*

Alice Jean Ferguson, D.S.: Bacteriology, Biochemistry. Thesis: *Morphological Changes in Yeasts Induced by Biological Radiation.*

Milton John Foter, B.S.: Bacteriology, Biochemistry. Thesis: *A Study of the Sources and the Physiology of Certain Ropy Milk Bacteria.*

Victor Eugene Gould, B.S.: Ornithology, Systematic Zoology. Thesis: *A History of the Bob-White in New York State with Particular Reference to Restocking.*

James Albert Hammack, jr., B.S., in C.E.: Sanitary Engineering, Hydraulic Engineering. Thesis: *The Treatment of Whey Wastes.*

Margaret Kaechele Harper, B.S.: Nutrition, Statistics. Thesis: *Findings from Correspondence Service in Infant Nutrition at the College of Home Economics, Cornell University.*

Grace Jackson, A.B.: Mycology, Plant Physiology. Thesis: *Investigations of the Fungus Flora of Storage Apples.*

Eric Leonard Jones, B.S.: Farm Management, Marketing. Thesis: *A Brief Review of the English Hop Industry.*

Walter Everett Jones, B.S.: Industrial Marketing, Industrial Engineering. Thesis: *Problems in Industrial Marketing.*

William Warren Jones, B.S.: Applied Mathematics, Pure Mathematics. Thesis: *The Potential of, and Green's Function for a Circular Disc or Spherical Bowl.*

Minnie Pearl Kelley, A.B.: Geography, Meteorology. Thesis: *A Geographic Reconnaissance of Acadian South Louisiana.*

Harold Francis Keyes, B.S.: Farm Management, Marketing. Thesis: *Use of Special Potato Equipment on Farms in Four Areas in New York,* 1929.

Trimbak Ramkrishna Khadilker, B.Agr.: Plant Genetics, Plant Physiology. Thesis: *Inheritance and Variability of Anatomical Structures in Plants.*

George Joseph King, A.B.: Organic Chemistry, Physical Chemistry. Thesis: *Derivatives of Phenylacetylene.*

Shan Pao King, B.S.: Plant Breeding, Plant Physiology. Thesis: *Genetics and Breeding of Soy Beans.*

Carlos Arnaldo Krug, Agr.Eng.: Plant Breeding, Botany. Thesis: *Corn Breeding Methods and Present Status of Corn Genetics.*

Newton Earl Landis, B. S.: Animal Production, Dairy Industry. Thesis: *Curves of Normal Production in Dairy Cows.*

Alvin Thorvald Martinus Lee, B.S.: Farm Management, Marketing. Thesis: *Relation of Weather Conditions to the Yield per Acre of Wheat in the United States Spring Wheat Area,* 1895–1930.

James Josephus Loving, jr., B.S. in E.E.: Electrical Engineering, Physics. Thesis: *Analogy between Electrical and Heat Conduction, with Application to Heating Curves of Electrical Machinery.*

Duncan McConnell, B.S.: Mineralogy, Economic Geology. Thesis: *Garnets from Sierra Tlayacac, Morelos, Mexico.*

Abdul Majid Mahmud, B.S.: Soil Technology, Agricultural Economics. Thesis: *Factors Affecting the Water Requirements of Crops.*

Charles Edward Michener, A.B.: Structural Geology, Economic Geology. Thesis: *The Northward Extension of the Sweetgrass Arch.*

James Joseph Murphy, B.S. in E.E.: Electrical Engineering, Physics. Thesis: *Transmission Line Transients. Cases of Open and Short Circuited Line. A Fourier Series Analysis.*

Carl Frederick Newell, B.S.: Zoology, Education. Thesis: *The Distribution of Lateral Sense Line Organs in Larval Salienta.*

Andrew Basil Phucas, B.S.: Farm Mechanics, Rural Engineering. Thesis: *Agricultural Engineering in Greek Agriculture.*

Joseph William Plank, B.S.: Zoology, Histology and Embryology. Thesis: *The Morphological History of the Lower Jaw of Siren Lacertina.*

David Rabinow, B.S. in E.E.: Electrical Engineering, Physics. Thesis: *Transmission Line Transients. Simple Traveling Wave Theory. Transmission Line with Source Displaced from the End.*

Arthur Raymond Riddle, A.B.: Physiology, Biochemistry. *The Photodynamic Response as a Function of Wave-Length Preliminary Paper.*

Charles Henry Riggs, B.S.A., B.D.: Rural Engineering, Extension Methods in Rural Engineering. Thesis: *Agricultural Engineering in Chinese Agriculture.*

Charles Andrew Robards, B.S.: Electric Power Plants, Physics. Thesis: *A Preliminary Investigation of a Proposed Hydro-Electric Power Development.*

Charles Sheer, B.S.: X-Rays, Spectroscopy. Thesis: *The Intensity of X-Ray Satellites as a Function of Cathode-Ray Current.*

Robert William Stafford, A.B.: Organic Chemistry, Biochemistry. Thesis: *The Preparation of the Bensyl Derivatives of Zinc.*

George McLeod Tait, B.S.A.: Vegetable Gardening, Plant Physiology. Thesis: *Correcting the Unproductiveness of Acid and Alkaline Muck Soils for the Growing of Vegetable Crops.*

Francis Gilbert Aubrey Tarr, B. Applied S.: Electrical Engineering, Physics. Thesis: *Calculation of Fault Currents in Alternating-Current Networks by Symmetrical Components.*

Abram Vorhis Tunison, B.S.: Animal Nutrition, Aquiculture. Thesis: *The Effect of Drying Temperatures upon the Biological Value, Digestibility, and Vitamin-A Content of Various Fish Meals.*

Helen Adele Elizabeth van Löben Sels, A.B.: Zoology, Nature Study. Thesis: *Some Observations on Phalacrus Politus and Other Inhabitants of the Heads of the New England Aster.*

Robert Brainerd Whittredge, B.S.: Electrical Engineering, Physics. Thesis: *Transmission Line Transients. Simple Traveling Wave Theory. Transmission Line with Source Displaced from the End.*

James Crawford Woodward, B.S.A.: Animal Nutrition, Biochemistry. Thesis: *The Effects of Synthetic Diets on Herbivora.*

Clarence Raymond Wylie, A.B., B.S.: Geometry, Applied Mathematics. Thesis: *Self-Dual Curves.*

Braxton Cladist Young, A.B.: Inorganic Chemistry, Organic Chemistry. Thesis: *The Oxidation of Hydrazine in Alkaline Solution by Mono-Delectronators, Di-Delectronators, and Complex Delectronators.*

## MASTERS OF SCIENCE IN EDUCATION

CONFERRED FEBRUARY 10, 1932

William Seward Salisbury, B.S.

CONFERRED JUNE 20, 1932

Lucy Clay Barrow, B.S.
Chi Wen Chang, B.S.A.
Gertrude Harriett Keep, B.S.
Doris Lillian Mitchell, B.S.

## MASTERS OF SCIENCE IN AGRICULTURE

CONFERRED JUNE 20, 1932

Francis Craig Hersman, B.S.: Agronomy, Agricultural Education. Thesis: *The Relation of Weather to the Efficiency of Fertilizers.*

Paul Chen Hsu, B.S.A.: Agricultural Marketing, Agricultural Statistics. Thesis: *A Study of Selected Agricultural Cooperative Associations in the United States and Canada.*

French Marion Hyre, B.S.: Marketing, Farm Management. Thesis. *A Study of Cooperative Business in West Virginia,* 1930.

## MASTERS IN FORESTRY

CONFERRED SEPTEMBER 30, 1931

Harry Diehl Switzer, B.S.: Forest Utilization, Plant Pathology. Thesis: *Russian Spruce, Its Quality, Quantity, and Economic Significance.*

CONFERRED FEBRUARY 10, 1932

Kenneth Abbott Hinkley, B.S.: Silviculture, Plant Pathology. Thesis: *Nature and Results of Silvicultural Treatment of Two University Woodlots.*

## MASTERS OF CHEMISTRY

CONFERRED JUNE 20, 1932

Francisco de Paula Correa, B.S.: Organic Chemistry, Industrial Chemistry. Thesis: *Syntheses of v-keto Acids.*

Albert Kingsley Shadduck, B.Chem.: Industrial Chemistry, Physical Chemistry. Thesis: *The Dehydration of Water Gas Tar.*

## MASTERS OF ARCHITECTURE

CONFERRED JUNE 20, 1932

Jerome Glendenning Armstrong, B.Arch.: Architectural Design, Landscape Architecture. Thesis: *A Tubercular Sanitorium and Research Institute at Sierre Madre, California.*

Samuel Broadus Earle, jr., B.S. in Arch.: Architectural Design, History of Architecture. Thesis: *A Plan for the Physical Development of Clemson College.*

Helen Elizabeth C. Gillespie, B.Arch.: History of Architecture, History of Landscape Architecture. Thesis: *The Early Architecture of Central New York.*

Gerhardt Theodore Kramer, B.Arch.: Architectural Design, History of Architecture. Thesis: *A Peace Palace for the Pan-American Union.*

## MASTERS OF CIVIL ENGINEERING

CONFERRED SEPTEMBER 30, 1931

Chien-Hsi Liu, C.E.: Structural Engineering, Concrete Construction. Thesis: *Wind Stresses in Reinforced Concrete Buildings.*

Manuel Sales y Acosta, B.S.C.E.: Structural Engineering, Highway Engineering. Thesis: *A Comparative Study of a Steel and a Reinforced Concrete Highway Bridge under Philippine Conditions.*

CONFERRED FEBRUARY 10, 1932

Hung Kuei Chang, B.S.C.E.: Railroad Engineering, Structural Engineering. Thesis: *Modern Methods of Maintenance of Way.*

Chitty Ho, B.S.: Experimental Hydraulics, Hydraulic Engineering. Thesis: *The Flow of Water over Sharp Crested Weir Notches; Rectangular, Trapezoidal, and Triangular.*

Salahuddin Itani, A.B., B.S.C.E.: Sanitary Engineering, Sanitary Biology. Thesis: *Chlorination of Water Supplies.*

Ahmed Muktar Sijan, A.B., B.S. in C.E.: Hydraulic Engineering, Water Power Engineering. Thesis: *Experimental Study on the Backwater Suppressor for Hydraulic Power Plants.*

Hsiang Meng Sun, B.S.: Structural Engineering, Testing of Materials. Thesis: *Economical Design of Reinforced Concrete Building.*

Wei Ao Sun, B.S.: Railroad Engineering, Structural Engineering. Thesis: *The Location of Proposed Mu-Mi Railroad in China.*

Sze Ling Wu, B.S.: Hydraulics, Hydraulic Engineering. Thesis: *The Flow of Water over Sharp Crested Weir Notches; Rectangular, Trapezoidal, and Triangular.*

CONFERRED JUNE 20, 1932

James Bastion Burke, C.E.: Steel, Concrete. Thesis: *An Investigation of the Relation of Architecture to Structural Design.*

Henry Carlson Eagle, B.S.: Experimental Hydraulics, Hydraulic Engineering. Thesis: *An Investigation of Differential Pressure Gages.*

Frank Louis Panuzio, C.E.: Experimental Hydraulics, Highway Engineering. Thesis: *Erosion Effects Downstream from a Model Spillway Dam, Involving Toe Design, Backwater, and Hydraulic Similitude.*

Hsi-Lin Shen, B.S.C.E.: Railroad Engineering, Structural Engineering. Thesis: *A Study of Railroad Track.*

Hung-Pin Tien, B.S.: Sanitary Engineering, Structural Engineering. Thesis: *The Design of the Separate Sewage Sludge Digestion Tank for the City of Ithaca, N. Y.*

Warren Elvin Wilson, C.E.: Experimental Hydraulics, Hydraulic Engineering. Thesis: *An Investigation of Differential Pressure Gages.*

## MASTERS OF MECHANICAL ENGINEERING

CONFERRED SEPTEMBER 30, 1931

Leslie Elmer Herbert, M.E.: Industrial Engineering, Personnel. Thesis: *A Problem in Manufacturing Planning and Practice.*

Charles Edwin Thomas, M.E.: Mechanics of Materials of Construction, Metallography, Theory, and Pedagogical Aspects. Thesis: *A Study of Relation of Form of Cross Section to Deformation in Tension Test Specimens.*

CONFERRED FEBRUARY 10, 1932

Tsung Han Chen, B.S.: Design of Steam Plant, Experimental Engineering. Thesis: *Some Important Phases of Steam Power Plant Engineering.*

CONFERRED JUNE 20, 1932

Wilbur Stanley Cooper, M.E.: Condenser Performance Tests, Power Plant Testing. Thesis: *A Test Method for Determining Steam Condenser Performance as a Function of Tube Fouling.*

Robert Phillips Kolb, M.E.: Heat-Power Engineering, Metallography. Thesis: *Heat Transfer in Air-Cooled Furnace Walls.*

Marcel Jacques Lemmers, Min.C.E.: Heat-Power Engineering, Thermodynamics. Thesis: *The Utilization of Steam at Very High Pressures for Power Generation.*

John Robert Moynihan, M.E.: Experimental Engineering, Industrial Engineering. Thesis: *An Investigation of Chimney Performance.*

## MASTERS OF ELECTRICAL ENGINEERING

CONFERRED SEPTEMBER 30, 1931

Kuo Sung Wang, B.S.: Electrical Power Engineering, Electrical Machinery. Thesis: *A Distribution System for Hangchow City.*

CONFERRED FEBRUARY 10, 1932

Thomas Tamotsu Hiyama, B.S.: Electrical Communication, Physics. Thesis: *Study of a Tuned Radio-Frequency Amplifier and Its Important Characteristics.*

Yoeh-Min Wang, B.S.E.E.: Electrical Communications, Experimental Physics. Thesis: *Radio Receiver Circuit Design.*

CONFERRED JUNE 20, 1932

Delos Samuel Calkins, E.E.: Electrical Communication, Physics. Thesis: *The Characteristics and Uses of the Pentode.*

Kung Huan Chang, B.S. in E.E.: Electrical Engineering, Physics. Thesis: *Campbell's Frequency Bridge. Study of Its Sensitivity and Use in Calibration of an Oscillator.*

Shu Kwi Chen, B.S. in E.E.: Electric Power Plants, Water Supply. Thesis: *Transmission Line System Stability.*

Walter Wendell Cotner, E.E.: Electrical Engineering, Aerodynamics. Thesis: *An Ultra-Precision Wave Meter.*

Ralph Edwin Parry, E.E.: Electrical Communications, Physics. Thesis: *Ultra-Short Wave Transmission.*

William Hewlett Searing, E.E.: Electrical Engineering, Economics. Thesis: *Thermal Demand Meters.*

Joseph A. Strelzoff, E.E., M.E.: Electrical Engineering, Mathematics. Thesis: *Stability of Electrical Transmission Systems. A Critical Study of the Principal Methods in Use.*

Mitsu Yoshimatsu, A.B., B.S.: Geometry, Applied Mathematics. Thesis: *Some Transient Phenomena in Electrical Machinery and Apparatus.*

## DOCTORS OF PHILOSOPHY

CONFERRED SEPTEMBER 30, 1931

Frederic Roland Bean, A.B.: Organic Chemistry, Physical Chemistry, Inorganic Chemistry. Thesis: *A Study of Substituted Aromatic Boric Acids.*

Robert Lloyd Beck, A.B.: Logic and Metaphysics, History of Philosophy, Psychology. Thesis: *The Doctrine of Universals in Contemporary Philosophy.*

Beatrice Edith Bolton, A.B., A.M.: Paleontology, Stratigraphy, Physical Geography. Thesis: *Gastropoda of the Barton (Upper Eocene).*

Nancy Lee Booker, A.B., M.S.: Nutrition, Physiology, Economics of the Household. Thesis: *A Study of the Food Habits and Health of about* 550 *Farm Families in Tompkins County, New York,* 1928 *and* 1929.

Herman Jacob Brueckner, B.S.: Dairy Industry, Bacteriology, Physical Chemistry. Thesis: *Primitive or Filterable Forms of Bacteria and Their Occurrence in Milk.*

Norman Sharpe Buchanan, A.B., A.M.: Finance, Accounting and Corporation Finance, Economic Theory. Thesis: *The Electric Bond and Share Company. A Case Study of a Public Utility Holding Company.*

Harold Thurston Cook, A.B.: Plant Pathology, Plant Physiology, Bacteriology. Thesis: *Studies on the Downy Mildew of Onions and the Causal Organism, Peronospora Destructor "Berk" Caspary.*

John Cleveland Cothran, A.B.: Inorganic Chemistry, Analytical Chemistry, Industrial Organization. Thesis: *A Study of Certain Compounds Containing Chains of Four Nitrogen Atoms.*

Samuel Sayford Cromer, A.B., B.S.: Agricultural Education, Secondary Education, Rural Social Organization. Thesis: *Development of a Scale for Measuring the Professional Attitude of a Teacher of Vocational Education in Agriculture.*

Giles Edwin Dawson, A.B., A.M.: Elizabethan Drama, Chaucer, Mediaeval Latin. Thesis: *Massinger's* The Picture. *An Edition with Introduction and Notes.*

Lemo Theressa Dennis, B.S., A.M.: Rural Social Organization, Child Guidance, Psychology. Thesis: *A Descriptive Study of Family Relationships from the Viewpoint of Child Guidance and Parent Education.*

James Allen Dickey, A.B.: Rural Social Organization, Farm Management, Economics and Statistics. Thesis: *Farm Organization and Management in a Typical Upland Section of Arkansas.*

Gustav John Dippold, B.S.A., B.S. in Ed., A.M.: Agricultural Education, Secondary Education, Agricultural Economics. Thesis: *A Basis for a Proposed Course of Study in Agricultural Economics and Farm Management for Departments of Vocational Agriculture in Missouri.*

M. Gale Eastman, B.S., M.S. in Agr.: Farm Management, Marketing, Economics. Thesis: *An Economic Study of Dairy Farming in Grafton County, New Hampshire.*

Willard Lavay Fancher, A.B.: Rural Education, Agricultural Economics, Educational Administration. Thesis: *A Study of the Characteristics of the Population of High School Age of a Rural County of New York with Reference to Secondary Education.*

Lambert Rudolf van Graan, B.S., M.S.: Rural Education, Agricultural Education, Vegetable Production. Thesis: *The Reorganization of Elementary Education in the Orange Free State to Meet the Needs of the Rural School.*

Ralph I. Hale, B.S., M.S.: Agricultural Education, Extension Methods, Rural Economics. Thesis: *Occupational Interests in Relation to the Provision for Exploration in Agricultural Activities for Boys in a Junior High School for Trumansburg, New York.*

Carsie Hammonds, B.S.A.: Rural Education, Agricultural Economics, Educational Psychology. Thesis: *The Distribution of Time of Teachers of Vocational Agriculture in Kentucky. Its Relation to Distribution of Aid and to Teacher Training.*

Thomas Watkins Hatcher, B.S., M.E., M.S.: Applied Mathematics, Mathematics, Experimental Engineering. Thesis: *Symmetric Strain in an Infinite Plate with a Circular Hole.*

William Clarence Herring, A.B., A.M.: Educational Administration, Secondary Education, Psychology. Thesis: *The Rural Teacherage, with Special Reference to Oklahoma.*

Lawrence Huston Houtchens, A.B., A.M.: Victorian Literature, Poetry of Browning, Literature of Renaissance. Thesis: *Carlyle's Influence on Dickens.*

Raymond Clifford Ingraham, B.S. in Chem. Eng.: Industrial Chemistry, Organic Chemistry, Physical Chemistry. Thesis: *The Electrolytic Deposition of Alloys.*

Joseph Stanley Kirk, B.S.: Biological Chemistry, Physical Chemistry, Bacteriology. Thesis: *Antiurease.*

William Taylor Miller, D.V.M., M.S.: Pathology, Diseases of Cattle, Biochemistry. Thesis: *The Blood Picture in Healthy Cattle, and Cattle Affected with Johne's Disease.*

Russell Milliser, A.B.: Neurology, Physiology, Embryology. *Cortical Lesions and Projection Fibers in the Brain of the Rat.*

Winton Irving Patnode, B.Chem.: Inorganic Chemistry, Organic Chemistry, Optical Chemistry. Thesis: *Gallium Triethyl.*

Philip John Schaible, Ch.E., A.M.: Animal Husbandry, Biochemistry, Pathogenic Bacteriology. Thesis: *Plasma Lipids in Lactating and non-Lactating Animals.*

Burch Hart Schneider, B.S., M.S.: Animal Husbandry, Animal Nutrition, Genetics. Thesis: *The Comparative Efficiency of the Proteins of Several Fish Meals.*

Eugene Warren Scott, B.S.: Organic Chemistry, Biochemistry, Optical Chemistry. Thesis: *The Rearrangement of the A-Furfuryl Group.*

John Victor Shankweiler, B.S., M.S.: Zoology, Ecology, Genetics. Thesis: *The Regeneration of the Poison Glands of the Anura.*

George Anderson Shipman, A.B., A.M.: Political Science, American History, International Law and Relations. Thesis: *The Constitutional Doctrines of Stephen J. Field.*

Anne Louise Steger, Ph.B., M.S.: Entomology, Nature Study, Zoology. Thesis: *The Genus Ephemerella in Northeastern North America.*

Edward August Taylor, A.B., A.M.: Rural Social Organization, American History, Sociology. Thesis: *The Relationships of the Open Country Population of Genesee County, New York, to Villages and Cities.*

Jay R. Traver, A.B., A.M.: Limnology, Zoology, Aquiculture. Thesis: *Mayflies of North Carolina.*

Ernest Canfield Van Keuren, A.B., A.M.: Elizabethan Literature, Late Middle English, English History. Thesis: *The Poetomachia between Ben Jonson and the Poetasters,* 1599–1601.

Stanley Whitson Warren, B.S.: Farm Management, Economics, Marketing. Thesis: *An Economic Study of Agriculture in Northern Livingston County, New York,* 1908–1918–1928.

Lillian Alice Wilcox, B.S., A.M.: Educational Supervision, Educational Psychology, Educational Administration. Thesis: *A Study of Fusion Courses in the Social Studies.*

Francis Henry Wilson, B.S., M.S.: Economic Entomology, Zoology, Histology. Thesis: *A Biological and Systematic Study of the Mallophaga.*

Edna Spring Winters, A.B., A.M.: English, Psychology, Education. Thesis: *A Modern Socrates: John Galsworthy.*

CONFERRED FEBRUARY 10, 1932

Howard Bushnell Allen, B.S., M.S.: Rural Education, Farm Management, Rural Social Organization. Thesis: *A Study of the Activities of Teachers of Vocational Agriculture in Utilizing the Pupils' Home Farm Resources for Farm Practice.*

Howard Barton Boyd, B.S.A.: Marketing, Economics, Poultry Husbandry. Thesis: *Cigar Tobacco, Production, Consumption and Prices in the United States.*

Helen Calkins, A.B., A.M.: Analysis, Geometry, Algebra. Thesis: *Some Implicit Functional Theorems.*

Evelyn Teresa Carroll, A.B., A.M.: Geometry, Mathematical Analysis, Algebra. Thesis: *Systems of Involutorial Birational Transformation Contained Multiply in Special Linear Line Complexes.*

Ford Elmore Curtis, A.B., A.M.: English Literature, English History, Philosophy. Thesis: *John Marston: His Life and Works.*

Leslie Edward Dills, B.S., M.S.: Economic Entomology, Apiculture, Vertebrate Zoology. Thesis: *A Study of Some Fatty Acids and Their Potassium Soaps as Contact Insecticides.*

Anne Lydia Eastman, A.B.: Modern European History, History of Renaissance and Reformation, English History. Thesis: *The Influence of the Thermidorian Reaction on the Proletariat of Paris.*

Marion Fish, B.S.: Economics of the Household, Agricultural Economics and Statistics, Economic Theory. Thesis: *A Statistical Analysis of the Purchasing Practices of Farm Households.*

Joe Roudolph Furr, B.S. in Agr.: Pomology, Plant Physiology, Plant Breeding. Thesis: *A Study of the Water Conducting System of the Apple with Special Reference to the Relative Efficiency of the Xylem in Different Parts of the Tree.*

Floyd Arthur Harper, B.S.: Farm Management, Economics, Marketing. Thesis: *Cooperative Purchasing and Marketing Organizations in New York State.*

Stephanus Johannes Gerhardus Hofmeyr, B.S., M.S.: Agricultural Education, Rural Education, Agronomy. Thesis: *A Suggested Procedure in Setting Up a Four-year Program in Vocational Agriculture for High Schools in the Transvaal Union of South Africa.*

Joseph Douglas Hood, A.B., A.M.: Systematic Entomology, Insect Morphology, Limnology. Thesis: *The Classification of the Thysanoptera.*

Clifford Darton Kelly, B.S.A., M.S.A.: Bacteriology, Organic Chemistry, Biochemistry. Thesis: *Chemical Changes in Cheddar Cheese in Their Relationship to the Lactic Acid Streptococci.*

Alexander Barrett Klots, B.S., M.S.: Systematic Entomology, Vertebrate Zoology, Animal Ecology. Thesis: *A Generic Revision of the Pieridae (Lepidoptera) with a Study of the Male genitalia.*

Elsie Broughton Klots, A.B., A.M.: Systematic Entomology, Limnology, History of Painting. Thesis: *A Venational Study of the Gomphinae "Order Odonata."*

Elmer Hiram Mereness, B.S.: Farm Management, Finance, Statistics. Thesis: *An Analysis of Costs and Returns of Farm Crops in Western New York, 1927–1929.*

David Skinner Morton, B.Chem., A.M.: Inorganic Chemistry, Physical Chemistry, Physics. Thesis: *The Polymorphism of Germanium Dioxide.*

Herbert Joseph Muller, A.B., A.M.: English Modern Novel, Early Nineteenth Century English, Modern Drama. Thesis: *The Modern Conception of Tragedy.*

Louis John Paradiso, B.S., A.M.: Analysis, Algebra, Theory of Economics. Thesis: *Solutions of Bounded Variation of the Fredholm Stieltjes Integral Equation.*

Max Jennings Plice, B.S.A., M.S.: Forest Soils, Geology, Forestry. Thesis: *Studies on Forest Litter and Its Relation to Humus Formation.*

Dimiter Ramadanoff, B.S.: Applied Electricity, Physics, Mathematics. Thesis: *Photoelectric Properties of Composite Surfaces at Various Temperatures and Potentials.*

John Owen Rankin, A.B., B.S.A., A.M.: Agricultural Economics, Rural Social Organization, Government. Thesis: *Rural Economy of Nebraska.*

Marcus Morton Rhodes, B.S., M.S.: Plant Breeding, Cytology, Physical Chemistry. Thesis: *Cytoplasmic Inheritance of Male Sterility in Zea mays.*

Wallace Campbell Stiles, B.S., M.S.: Animal Husbandry, Dairy Husbandry, Agricultural Economics. Thesis: *Protein and Other Nutrients Required by Fattening Cattle.*

Mary Frances Tenney, A.B., A.M.: Latin, Greek, Comparative Study of Literature. Thesis: *Tacitus in the Middle Ages and the Early Renaissance and in England to about the Year* 1650.

Cynthia Westcott, A.B.: Plant Pathology, Physical Chemistry, Plant Physiology. Thesis: *Brand Canker of Rose Caused by Coniothyrium Wernsdorffiae Laubert.*

John Taylor Wheeler, B.S., M.S.: Rural Education, Rural Economics, College Teaching. Thesis: *Determining the Agricultural Constants in a Preparatory Curriculum for High School Teachers of Agriculture in Georgia.*

Lawrence Arnell Wood, A.B.: General Physics, Electricity, Mathematics. Thesis: *The Hall Effect with Audio Frequency Currents.*

CONFERRED JUNE 20, 1932

Harold Dwaine Allen, B.S., M.S.: Industrial Chemistry, Physical Chemistry, Organic Chemistry. Thesis: *Lubricating Properties of Greases from Petroleum Oils.*

Raymond Peck Allen, A.B.: Physical Chemistry, Physics, Chemical Microscopy. Thesis: *Experiments with a High Temperature Ozonizer.*

Maurice Oliver Baker, A.B.: Organic Chemistry, Physical Chemistry, Spectroscopy. Thesis: *The Synthesis of 3-Furoic Acid.*

Amos Hale Black, A.B., A.M.: Geometry, Analysis, Physics. Thesis: *Types of Involutorial Space Transformations Associated with Certain Rational Curves.*

Mary Elizabeth Bohannon, A.B., A.M.: English History, European History, English Literature. Thesis: *Studies of the Barrington Family in England in the Seventeenth Century.*

Lloyd Lawrence Bolton, A.B., A.M.: Histology and Embryology, Vertebrate Taxonomy, Aquiculture. Thesis: *Basophile (Mast) Cells in the Alimentary Canal of Salmonoid Fishes.*

Harry Elwyn Bradford, A.B., A.M.: Agricultural Education, Secondary Education, Educational Psychology. Thesis: *An Analysis of Achievements of Certain University of Nebraska Students Who Offered Vocational Agriculture as Credit for Entrance, Compared with Achievements of a Similar Group Who Offered the Traditional Entrance Subjects.*

Robert Franklin Brand, A.B., A.M.: French Literature, Modern European History, Spanish Literature. Thesis: *Henry Ceard.*

Mary Alene Brightbill, A.B., A.M.: Latin, Greek, Literary Criticism. Thesis: *The Text of Cicero's* De Oratore *in Codex D (Cornell MSS. B 2). A Collation and an Estimate of Its Worth as a Representative of the L. Tradition.*

Auburn Edmond Brower, A.B., B.S.: Economic Entomology, Plant Pathology, Taxonomy in Entomology. Thesis: *A Study of the Bionomics of the Genus Catocala in North America (Lepid. Noctuidae).*

Charles David Buchanan, A.B., A.M.: German Philology, German Literature, Old Norse. Thesis: *Substantivized Adjectives in Old Norse.*

Harold Gottfried Carlson, A.B., A.M.: German Literature, German Philology, Icelandic. Thesis: *The Motiv of Heredity in Modern German Literature with Particular Reference to the Naturalistic Drama.*

Rachael Chait, A.B., A.M.: Elizabethan Drama, Romantic Poets, Old English. Thesis: *Satire of Ben Jonson.*

Ho Nien Chu, B.S., M.S.: Neuro-Anatomy, Physiology, Histology. Thesis: *The Biencephalon of the Opossum, Didelphis Virginiana. A Study of Cell Masses and Fiber Connections.*

Feliciano Mercado Clara, B.Agr.: Plant Pathology, Plant Physiology, Bacteriology. Thesis: *A Comparative Study of the Green Fluorescent Bacterial Plant Pathogens.*

John Montgomery Clarkson, A.B., A.M.: Geometry, Analysis, Theoretical Physics. Thesis: *Some Involutorial Line Transformations Interpreted as Points of* $V_2$ *of* $S_5$.

Maynard A. Connell, Ph.B., A.M.: Old and Middle English, Modern Writers on Art, Rhetoric. Thesis: *A Study of Accidie and Some of Its Literary Phases.*

Willard Francis Crosier, A.B.: Plant Pathology, Plant Physiology, Biological Chemistry. Thesis: *Studies in the Biology of Phytophthora Infestans (Mont) De Bary.*

Margaret Dann, A.B.: Physiology, Physiological Chemistry, Anatomy. Thesis: *The Influence of the Vitamin-B Complex of the Metabolism of Glucose Administered to the Fasting Dog.*

Jesse Allison DeFrance, B.S., M.S.: Plant Materials, Agronomy, Landscape Architecture. Thesis: *A Study of the Broad Leaf Evergreens of the Southeastern States.*

Harry Curtis Diener, B.S., A.M.: Educational Administration and Supervision, Educational Methods, American History. Thesis: *A Study of the Decline of the Academy System in New York State and the Disposition of the Property.*

Raymond Earle Douglas, B.S., M.S.: Economic Entomology, Limnology, Invertebrate Zoology. Thesis: *A Study of Certain Insects Injurious to Ornamental Greenhouse Plants with Special Reference to the Coccidae.*

Frank Lisle Drayton, B.S.A.: Plant Pathology, Plant Physiology, Mycology. Thesis: *The Sexual Function of the Microconidia of Schlerotinia Gladioli (Massey) N. Comb.*

Marjorie Bullard Drury, A.B.: Psychology, Physiological Psychology, Education. Thesis: *Progressive Changes in Non-Foveal Perception of Line-Patterns.*

John Bernard Emperor, A.B., A.M.: English Literature, English Language, Victorian Literature. Thesis: *The Juvenalian and Persian Element in English Literature from the Restoration to Dr. Johnson.*

O. Rex Ford, A.B., A.M.: Alternating Currents, Theoretical Physics, Mathematics. Thesis: *A Survey of the Satellites of the K-Series X-Ray Lines.*

Luella Pearl Gardner, A.B.: Educational Psychology, Neurology, Child Guidance. Thesis: *The Learning Process in Horses.*

Albert Douglas Glanville, A.B., A.M.: Psychology, Physiology, Philosophy. Thesis: *The Empirical Significance of the Horopter.*

Max Manley Hoover, B.S.Agr., M.S.Agr.: Plant Breeding, Cytology, Plant Physiology. Thesis: *Inheritance Studies of the Reaction of Selfed Lines of Maize to Smut "Ustilago Zeae."*

Ira Owen Horsfall, A.B., A.M.: Geometry, Analysis, Mechanics. Thesis: *Transformations Associated with the Lines of a Cubic or Linear Complex.*

Yin-chi Hsu, B.S., M.S.: Limnology, Systematic Entomology, Insect Morphology. Thesis: *Biology of Genus Ecdyonurus of Northeastern North America.*

Ruth Willard Hughey, A.B., A.M.: English Literature, English History, Nineteenth Century Poetry. Thesis: *Cultural Interests of Women in England from 1524 to 1640 Indicated in the Writings of the Women. A Survey.*

Lee Sisson Hultzén, A.B.: Literary Criticism, Public Speaking, Old English. Thesis: *Aristotle's* Rhetoric *in England to* 1600.

Charles Williams Jones, A.B., A.M.: Literary Criticism, Classics, English History. Thesis: *Materials for an Edition of Bede's* De Temporum Ratione.

George Merrill Kunkel, B.S., M.S.: Experimental Engineering, Machine Design, Industrial Engineering. Thesis: *Testing Radiators in a Vacuum for Direct Radiation and Connection.*

Thomas Eldredge LaMont, B.S., M.S.: Farm Management, Pomology, Economics. Thesis: *Factors Affecting Costs and Returns in Producing Apples in the Newfane-Olcott Area, Niagara County, New York,* 1926 *to* 1928.

Amalia Elizabeth Lautz, B.S., M.Ed.: Nutrition, Biochemistry, Rural Education. Thesis: *The Comparative Digestion of Pepsin in Vitro by Artificial Infant Feedings as Used in America Today.*

Gideon Tingwei Lew, B.S., M.S.: Limnology, Morphology of Insects, Economic Entomology. Thesis: *Head of Odonata with Special Reference to the Development of the Compound Eyes.*

Emmett B. McNatt, A.B., A.M.: Labor, Finance, Constitutional Law. Thesis: *Employment Representation in the Lehigh Valley Railroad Shops: A Case Study in Company Unionism.*

Evans Blakemore Mayo, A.B.: Petrography, Structural Geology, Economic Geology. Thesis: *Petrography of a Portion of the Sierra Nevada Batholith, California.*

Jose Antonio Bernabe Nolla, B.S.A., M.S.: Plant Pathology, Plant Breeding, Cytology. Thesis: *The Damping-off of Tobacco and Its Control in Porto Rico.*

Myron Gould Pawley, E.E., M.S.: Applied Electricity, Mathematics, General Physics. Thesis: *The Frequency Characteristics of Mechanical Vibration Detectors and Their Modification by Means of Selective Amplifiers.*

Harold Sanford Perry, A.B.: Plant Breeding, Plant Physiology, Cytology. Thesis: *The Inheritance and Linkage Relations of Dwarf-5 and Pygmy, Two Dwarf Types of Maize.*

Edwin Joseph Purcell, A.B., A.M.: Geometry, Analysis, Algebra. Thesis: *Involutorial Space Cremona Transformations Determined by Non-Linear Null Reciprocities.*

Albert Glenn Richards, jr., A.B.: Systematic Entomology, Insect Embryology, Genetics. Thesis: *Comparative Skeletal Morphology of the Noctuid Tympanum.*

Sarah Louisa Ridgway, A.B., A.M.: Physical Chemistry, Organic Chemistry, Optical Chemistry. Thesis: *Phase Rule Studies on the Proteins VI. Non-aqueous Solutions.*

Jesse LeRoy Riebsomer, A.B.: Organic Chemistry, Physical Chemistry, Inorganic Chemistry. Thesis: *An Examination of the Fatty Oil from Lycopodium Spores.*

William Napoleon Rivers, jr., A.B., A.M.: French, French Philology, Spanish. Thesis: *A Study of the Metaphors and Comparisons of Theophile Gautier Including a Dictionary.*

William Brunner Robertson, B.S., A.M.: Nineteenth Century English, Spanish, American Literature. Thesis: *The Relation of Wordsworth to Science.*

Ashley Robey, B.S., M.S.: Organic Chemistry, Physical Chemistry, Inorganic Chemistry. Thesis: *Studies of Sulfinic Acids and Sulfinates. The Reactions of 9-Fluorenyl-magnesium Bromide.*

Jason Almus Russell, A.B., A.M.: Early American Literature, Victorian Literature, Modern European History. Thesis: *The Indian in American Literature,* 1775–1875.

Clair Eugene Safford, B.S.: Bacteriology, Biochemistry, Physical Chemistry. Thesis: *The Occurrence and Numbers of Primitive Forms of Bacteria in Nature and in Pure Culture.*

Irene Hannah Sanborn, B.S., A.M.: Physical Chemistry, Organic Chemistry, Microscopy. Thesis: *A Study of Glycine Anhydride.*

George Bradford Saunders, A.B.: Ornithology, Systematic Zoology, Entomology. Thesis: *A Taxonomic Revision of the Meadowlarks of the Genus Sturnella Vieillot and the Natural History of the Eastern Meadowlark Sturnella Magna Magna (Linnaeus).*

Roscoe Joseph Saville, B.S., M.S.: Farm Management, Statistics, Economic Theory. Thesis: *Factors in the Organization and Successful Operation of Louisiana Rice Farms,* 1930.

Augustus Sisk, A.B.: Geometry, Analysis, Algebra. Thesis: *The Plane Symmetric Quintic Cremona Revolutions.*

Harry Sohon, E.E., M.E.E.: Electrical Communications, Physics, Mathematics. Thesis: *Supervisory and Control Equipment for Audio Frequency Amplifiers.*

George Miksch Sutton, B.S.: Ornithology, Mammalogy, Fine Arts. Thesis: *The Birds of Southampton Island, Hudson Bay.*

Edward Andrews Tenney, A.B., A.M.: English Literature, Literary Criticism, English History. Thesis: *A Life of Thomas Lodge,* 1558–1625.

Alexander Thomson, A.B.: English History, Ancient History, Modern European History. Thesis: *Denzil Holles, His Life and Political Career to the Outbreak of the Civil War,* 1599–1642.

George Richard Townsend, B.S.: Plant Pathology, Plant Physiology, Agronomy. Thesis: *Bottom Rot of Lettuce.*

Abd El Magid Wahby, D.V.M.: Dairy Bacteriology, Dairy Industry, Physical Chemistry. Thesis: *Growth of the Pathogenic Bacteria in Milk.*

Wilfred August Welter, B.S., M.S.: Ornithology, Plant Cytology, Nature Education. Thesis: *The Natural History and Taxonomy of the Marsh Wren, Telmatodytes Palustris (Wilson).*

David Truxton Wilber, A.B.: Crystallography, Inorganic Chemistry, Physical Chemistry. Thesis: *The Crystal Structure and Chemical Constitution of Calcite and Aragonite.*

Harold Gridley Wilm, B.S., M.F.: Silviculture, Economic Entomology, Nursery Practice. Thesis: *The Relationship of Successional Development to the Silviculture of Forest Burn Communities in Southern New York.*

Ralph Wood, A.B., A.M.: German Literature, German Philology, Old Norse-Icelandic Language and Literature. Thesis: *Geschichte des Deutchen Theaters von Cincinnati.*

# MEMBERS OF THE STAFF OFFERING GRADUATE WORK

# INDEX

The announcements of the several colleges of the University describe opportunities and facilities for advanced work with more detail than this pamphlet does. Reference to those Announcements is indicated below by means of the symbols in parenthesis, as follows: College of Arts and Sciences (A & S), College of Agriculture (Ag), Veterinary College (Vet), Medical College in Ithaca (Med), Medical College in New York City (NYMed), College of Architecture (Arch), College of Engineering (E), College of Home Economics (HE), Law School (L), Experiment Station at Geneva (G). See the last page of the cover of this pamphlet.