

GRADUATE STUDY

After somewhat extended consideration the plan for graduate study has been worked out and is here submitted. It seems to me to be a workable plan. I believe those who may be able to avail themselves of this opportunity will both enrich themselves and enhance the value of the service they render.

HENRY C. WALLACE.

THE DEPARTMENT OF AGRICULTURE proposes to establish this fall (1921) an unofficial system of advanced instruction in those scientific and technical subjects related to the work of the Department, in which adequate instruction is not otherwise available in Washington.

1. Object. -- The purpose is to enlarge and improve the service rendered by the Department by affording an opportunity to those who wish to fit themselves for greater usefulness through better training and increased knowledge.

2. Kinds of Courses. -- It is proposed that there be two more or less distinct kinds of work offered: (a) Lecture and drill courses on what is known of certain fundamental subjects in which the personnel of two or more Bureaus may be interested; (b) intensive graduate training in special topics.

3. Who is eligible. -- Any one in the service of the Department is eligible to take these courses, provided he is adequately prepared to do so. The courses will all be of the highest University grade, hence none but advanced and serious students will be admitted to them.

4. Recognition. -- It is expected that successful completion of any of these courses will be recognized for adequate credit in some of our better educational institutions, both for undergraduate and for postgraduate degrees.

5. Number of courses a student may take. -- While several courses will be offered, it is thought that one graduate course a year generally will be sufficient. Each case, however, will be considered

on its own merits.

6. Hours. -- The time of lecture instruction will be immediately after office hours.

7. Place. -- To be announced later.

8. Cost. -- On the assumption that a class will number fifteen or more, the tuition will be \$25.00 per year (30 weeks with two lectures each week), or \$15.00 per half year.

Where the students are too few to meet the cost of a special lecturer, they may, in many cases, with the approval of the Educational Committee, and working through a local or other institution, have the council and guidance of some of the abler scholars of the Department. In this case the cost will have to be fixed by the institution in question.

COURSES SOME OF WHICH IT IS EXPECTED TO OFFER THIS YEAR
(1921-1922)

General or Fundamental Courses in which many may be interested

1. Biological Chemistry.
2. Plant Pathology.
3. Statistical Methods. An elementary course in the underlying principles of statistics, and training in the practical methods and applications of statistics.
4. Genetics. Fundamental laws and principles, with illustrations from both plants and animals.
5. Agricultural Economics. The first half year, at least, of this course will be given by H. C. Taylor, Chief of the Bureau of Markets.

Advanced or Graduate Courses

1. Physics of the Air. Given by Dr. W. J. Humphreys, Prof. of Meteorological Physics, Weather Bureau. Requires previous training in physics and mathematics.
Already arranged for through the George Washington University.
2. Mathematical Statistics. The mathematical development of the theory of statistics. Requires previous considerable training in pure mathematics, at least differential and integral calculus.
3. Economic Entomology.
4. Soil Physics. Requires previous training in physics.
5. Agricultural Economics. Intensive training in special phases of the subject.
6. Plant Genetics.
7. Plant Physiology.
8. Animal Genetics.
9. Plant Cytology.

UNITED STATES DEPARTMENT OF AGRICULTURE

ANNOUNCEMENT OF EDUCATIONAL WORK FOR 1921-1922

Date of Opening. Courses except as announced will start on the designated days in the week beginning Monday, Oct. 17, 1921. Full-year courses will continue for 30 weeks; half-year courses for 15 weeks.

Registration will be at the office of the Director of Scientific Work.

Tuition for one full-year course or two half-year courses taken in the same year will be \$25.00 of which \$15.00 is payable at time of registration and \$10.00 at the beginning of the second half-year. For a half-year course the tuition will be \$15.00, payable in advance.

Graduate Credits. All students who desire to use these courses in obtaining graduate credits at educational institutions should file requests with the graduate committee before Nov. 1, together with a statement showing in detail their educational training and subsequent experience.

Text and Reference Books may be secured through the committee.

Rotation of Courses. Most of the courses offered this year will not be repeated but will be followed by advanced courses in related lines. Agricultural Economics will be followed by an advanced course in Prices and that, by other advanced courses. Genetics, which is intended to be a foundation course for all workers, will be followed by advanced work in Animal Breeding and Plant Breeding. Other general courses, such, for example, as Soil Physics and Animal Physiology, will be offered.

Teachers. The Graduate Committee feels that it has been exceptionally fortunate in securing strong teachers for this year. Dr. H. C. Taylor built up a strong graduate department in the University of Wisconsin from which he was called to the Department. Mr. H. R. Tolley has had teaching experience in mathematics, followed by wide statistical training in governmental bureaus. Dr. C. O. Appleman took his graduate work in the University of Chicago. He is Dean of the Graduate School and Professor of Plant Physiology and Biochemistry in Maryland University. Dr. L. R. Jones has made the Plant Pathology Department of Wisconsin the Mecca of graduate students. He is in Washington as Chairman of the Division of Biology and Agriculture of the National Research Council. Dr. Burton E. Livingston brings a wealth of information from his experience at Michigan, Chicago, the Desert Laboratory and Johns Hopkins University. Dr. Sewall Wright has worked and taught under Dr. Castle at Harvard and since that time has had charge of Genetics in the Bureau of Animal Industry. Dr. W. J. Humphreys has had long teaching experience and was chosen to give the work on Physics of the Air to the aviation schools during the war period. Dr. R. C. Tolman taught in the Massachusetts Institute of Technology and other institutions before becoming Director of the Fixed Nitrogen Laboratory.

UNITED STATES DEPARTMENT OF AGRICULTURE

OUTLINE OF EDUCATIONAL COURSES FOR 1921-1922.

1. Agricultural Economics (hf.Yr.).--Dr. H. C. Taylor, Mon. and Wed., 4:30 P.M., 411 Bieber Bldg. An advanced review course covering a discussion of forces and conditions which influence prices; the economics of production; the economics of marketing, including marketing functions, cooperation, regulation, standardization and education, and the division of the consumer's dollar; land ownership and tenancy; agricultural labor and wages. Texts: Taylor's "Agricultural Economics" and Macklin's "Efficient Marketing for Agriculture."

2. Statistical Methods (Yr.).--Mr. H. R. Tolley and special lectures by Messrs. Murray, Andrews and Holmes. Tues. and Fri., 4:30 P.M., 411 Bieber Bldg. A review course in the underlying principles, development and application of statistical methods, including application of averages, frequency distributions, measures of deviation, dispersion, association, and correlation. Methods of collection, tabulation, analyses, and preparation for publication will be illustrated. Text: Kings' "Elements of Statistical Methods".

3. Biochemistry (Yr.).--Dr. C. O. Appleman. Mon. and Thurs., 4:30 P.M. An advanced course in chemical biology treated from the point of view of both animal and plant life. It embraces a study of colloid principles as applied to biology; cell organization from the standpoint of the substratum in which living processes occur; energetics; catalysis; enzymes, conditions and laws of action; chemistry of protoplasm and its products; electrolytes and their action; cell metabolism including hydrations, dehydrations, condensations, oxidations and reductions, fermentations and respiration; food requirements of animals and plants, vitamins, and a general consideration of digestion, absorption, secretion and excretion. The relation of primary syntheses and transformations of materials in plants to animal food and the problems of nutrition is especially emphasized. Text: Matthews' "Physiological Chemistry", third edition, advised but not required.

4. Plant Pathology (hf.Yr.).--Dr. L. R. Jones (assisted by others), Mon. and Wed., 4:30 P.M., Room 32, West Wing. An advanced course presenting the history of plant pathology, discussing its origin in mycology and parasitism, its underlying principles, and subsequent development down to the present day; causes of disease in plants; primary, secondary; factors affecting growth of parasitic bacteria and fungi; factors contributing to disease; inherent, external; inhibiting factors. Discussion of common types of plant diseases, e.g., bacterial, fungous, "physiologic"; examples of each and presentation of methods of procedure in the investigation of a disease of each type. Methods of control: fungicides; soil sanitation; seed selection, curing, and storage; breeding and selection for resistance; field trips. Texts: Duggar's "Fungous Diseases"; Smith's "Bacterial Diseases of Plants".

5. Plant Physiology (Yr.).--Dr. Burton E. Livingston. Thurs. and Fri., 4:30 P.M., Room 32, West Wing. An advanced course discussing the plant body with reference to retention of form, entrance movement and exit of material, material changes within the body growth under symmetrical and unsymmetrical conditions (bending). The environmental control of plant activity and the application to agricultural operations will be considered. Reference texts: Coulter, Barnes and Cowles' "Textbook of Botany", Vol.I, Part II. Physiology (sold separately); Palladin's "Plant Physiology".

6. Genetics (Yr.).-Dr. Sewall Wright. Tues. and Thurs., 4:30 P.M., An advanced course discussing scope and methods; early theories; the cell, mitosis, gametogenesis, fertilization and development; the chromosome theory; accessory chromosomes; the nature of Mendelian factors; linkage relations; sex determination; irregular modes of inheritance; variation and mutation - modification of the germ plasm; biometric methods; systems of mating; inbreeding and cross-breeding; pure lines; heredity and environment; selection. Reference Text: Babcock and Clausen's "Genetics in Relation to Agriculture".

7. Physics of the Air (Yr.).-Dr. W. J. Humphreys. An advanced course discussing temperature, pressure, density, and humidity of the atmosphere at all explored levels; insolation; winds of all kinds; evaporation; condensation; cloud types; the thunderstorm; atmospheric electricity; weather sounds and the effect of weather on sounds; atmospheric optics, including the theory of the rainbow, coronas, halos, sky colors, and other like phenomena; and the factors that control climate.

Registration for the course will be through the George Washington University; time, as arranged; place, Weather Bureau; textbook, Humphreys' "Physics of the Air".

8. Statistical Chemistry.- Dr. R. C. Tolman, Fixed Nitrogen Lab. First Class 4:00 P.M., Fri., Oct. 14. Hamilton's Principle and the Canonical Equations as starting point for dynamical investigations, representation of ensemble of systems by points in $2N$ -dimensional space, Liouville's Theorem; probability of a given microscopic state and of a given statistical state; statistical state of maximum probability; Maxwell-Boltzmann distribution law, energy partition in statistical systems; applications to perfect monatomic gases, the hohlraum, rate of chemical reaction, concentrated systems (e.g., imperfect gases), two phase systems; relations to quantum theory and third law of thermodynamics.

9. Special graduate courses in various lines will be arranged. The investigations to be supervised by specialists under the direction of the graduate committee.

UNITED STATES DEPARTMENT OF AGRICULTURE

ANNOUNCEMENT OF EDUCATIONAL COURSES FOR TERM BEGINNING FEB. 13, 1922.

Date of Opening. Courses will start on the designated days in the week beginning Monday, Feb. 13, 1922. Full-year courses will continue to the completion of 30 weeks; new half-year courses for 15 weeks.

Registration will be at the office of the Director of Scientific Work.

Tuition for one full-year course or two half-year courses taken in the same year is \$25.00, of which the last \$10.00 is due at the beginning of the second half-year. For a half-year course the tuition is \$15.00, payable in advance.

Courses. Full year courses will be continued during the second term. New courses offered for this term are The Economics of Commodity Marketing, Agricultural Prices, and Crystallography.

Short Period Students. Field men in Washington for several weeks may be allowed to enter classes for a shorter period than the semester through arrangements with the teacher and the Director of Scientific Work. The charge for such work will be \$1.00 per week, but credits will not be granted to these short time students. Students desiring to enter full year classes in the second term may do so only by permission of the instructors.

Teachers. In addition to the teachers of the first term, Dr. Alexander E. Cance, Professor of Agricultural Economics, Massachusetts Agricultural College, now temporarily on leave for service in the Bureau of Markets, will be in charge of the course in Economics of Commodity Marketing. Dr. Oscar E. Stine of the Office of Farm Management will be in charge of the course in Agricultural Prices, and Dr. Edgar T. Wherry, formerly Instructor at Lehigh University, and now with the Bureau of Chemistry, will be in charge of the course in Crystallography.

COURSES.

1 - b. Economics of Commodity Marketing (Hf.Yr.).- Dr. Alexander E. Cance, Mon. and Wed., 4:30 P.M., Room 411, Bieber Bldg. This course will involve a careful study of the geography of agricultural production, the locations of regions of surplus and deficit, the principal currents of trade, foreign and domestic, and the study of the mechanism of marketing, including an analysis of marketing functions, agencies and processes. Two lectures a week for one semester, supplemented by study of text book and collateral readings. Students who have completed the first semester's work in Dr. Taylor's course, or who have had the equivalent of this course or sufficient training in general economics, will be admitted. The course may be rated as one for graduates and under-graduates, and course credit would therefore depend on the academic status of the student as well as on his efficiency in class work.

2. Statistical Methods (Yr., 2nd Term).- Mr. H. R. Tolley and special lecturers. Tues. and Fri., 4:30 P. M., Room 411, Bieber Bldg. A continuation of the first term course. Text: Kings' "Elements of Statistical Methods".

3. Biochemistry (Yr., 2nd Term).- Dr. C. O. Appleman. Mon. and Tues., 4:30 P. M., Room 223, East Wing. A continuation of the first term course. Text: Matthews' "Physiological Chemistry", third edition, advised but not required.

4. Mycology (Yr., 2nd Term).- Dr. C. L. Shear, with special lectures on various groups, Mon. and Wed., 8:00 A. M., Room 315, West Wing. A continuation of the first term course. Text: DeBary's "Comparative Morphology and Biology of the Fungi Mycetoza and Bacteria", with reading from more recent special texts.

5. Plant Physiology (Yr., 2nd Term). - Dr. Burton E. Livingston, Thurs. and Fri., 4:30 P. M., Room 32, West Wing. A continuation of the first term course. Reference texts: Coulter, Barnes and Cowles' "Textbook of Botany", Vol. I, Part II, Physiology (sold separately); Palladin's "Plant Physiology".

6. Genetics (Yr., 2nd Term).- Dr. Sewall Wright. Tues. and Thurs., 4:30 P.M., Room 104, Office of Cereal Investigations, 1306 B Street., S. W. A continuation of the first term course. Reference text: Babcock and Clausen's "Genetics in Relation to Agriculture".

7. Physics of the Air (Yr., 2nd Term).- Dr. W. J. Humphreys. A continuation of the first term course. Registration for the course is through the George Washington University; time, as arranged, place, Weather Bureau; textbook, Humphreys' "Physics of the Air".

8. Agricultural Prices (Hf. Yr.). - Dr. Oscar E. Stine. Time and place to be arranged. This course involves a study of price relations and trends, and analysis of the forces affecting or determining prices. Attention will be given to the differences in the price movements of various commodities and the causes for these differences. The relation of the prices of agricultural products to the general price level and the influence of foreign market conditions will also receive some attention. While this is essentially a graduate course, students with considerable experience in the study of price data may be admitted even though they have not fulfilled all the academic prerequisites for graduate work.

9. Crystallography (One-half Yr.).- Dr. Edgar T. Wherry. Tues. and Wed., 4:30 P.M., Room 415, Bureau of Chemistry. The application of crystallographic optical methods to the identification of crystalline chemical substances. Students must have access to microscopes equipped with Nicol prisms and revolving stages.

Further information may be had at the office of the Director of Scientific Work.