



Cornell University

Announcements

New York State
College of
Agriculture

1971-72

A Statutory College of the State University,
At Cornell University, Ithaca, New York



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Cornell Academic Calendar

	1971-72*
Registration, new and rejoining students	Th, Sept. 2
Registration, continuing students	F, Sept. 3
Fall term instruction begins, 7:30 a.m.	M, Sept. 6
Thanksgiving recess:	
Instruction suspended, 1:10 p.m.	W, Nov. 24
Instruction resumed, 7:30 a.m.	M, Nov. 29
Fall term instruction ends, 1:10 p.m.	S, Dec. 11
Independent study period begins, 2:00 p.m.	S, Dec. 11
Final examinations begin	Th, Dec. 16
Final examinations end	Th, Dec. 23
Christmas recess and intersession	
Registration, new and rejoining students	Th, Jan. 20
Registration, continuing students	F, Jan. 21
Spring term instruction begins, 7:30 a.m.	M, Jan. 24
Spring recess:	
Instruction suspended, 1:10 p.m.	S, Mar. 18
Instruction resumed, 7:30 a.m.	M, Mar. 27
Spring term instruction ends, 1:10 p.m.	S, May 6
Independent study period begins, 2:00 p.m.	S, May 6
Final examinations begin	M, May 15
Final examinations end	M, May 22
Commencement Day	F, May 26

* The dates shown in the Academic Calendar are subject to change at any time by official action of Cornell University.

CORNELL UNIVERSITY ANNOUNCEMENTS

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- William Norman McFarland, Ph.D., Zoology
- Richard Jerome McNeil, Ph.D., Conservation
- Alexander Millar Meek, Ph.D., Animal Science
- William George Merrill, Ph.D., Animal Science
- Robert Rising Morrow, Jr., Ph.D., Forestry
- Robert Glenn Mower, Ph.D., Ornamental Horticulture
- Arthur Leslie Neal, Ph.D., Biochemistry
- Gene Herman Oberly, Ph.D., Pomology
- Ray Thurmond Oglesby, Ph.D., Aquatic Sciences
- Charles Evans Ostrander, M.S., Poultry Science
- Donald Kenneth Ourecky, Ph.D., Pomology, Geneva
- Daniel Ivan Padberg, Ph.D., Marketing
- LaVerne LeRoy Pechuman, Ph.D., Entomology and Curator of Insects
- Nathan Hiram Peck, Ph.D., Vegetable Crops, Geneva
- Ellis Andine Pierce, Ph.D., Animal Science
- Thomas Theobald Poleman, Jr., Ph.D., Agricultural Economics
- Norman N. Potter, Ph.D., Food Science
- Lloyd Earl Powell, Jr., Ph.D., Pomology
- Donald Ray Price, M.S., Agricultural Engineering
- Edgar Merrow Raffensperger, Ph.D., Economic Entomology
- Gerald Edwin Rehkugler, Ph.D., Agricultural Engineering
- Richard Warren Robinson, Ph.D., Vegetable Crops, Geneva
- Wendell Lee Roelofs, Ph.D., Chemistry, Geneva
- Richard Bruce Root, Ph.D., Insect Ecology
- Samuel Waybright Sabin, Ph.D., Animal Science
- Roger France Sandsted, Ph.D., Vegetable Crops
- Robert John Scannell, M.L.A., Landscape Architecture
- George Albert Schaefers, Ph.D., Entomology, Geneva
- Edward Arthur Schano, M.S., Poultry Science
- Ernest Frederick Schaufler, M.S.A., Ornamental Horticulture
- Glen Henry Schmidt, Ph.D., Animal Science
- Herbert Francis Schryver, Ph.D., Animal Science
- Otto Ernst Schultz, Ph.D., Plant Pathology
- Bernice Margaret Scott, M.A., Rural Sociology
- Norman Roy Scott, Ph.D., Agricultural Engineering
- Thomas Walter Scott, Ph.D., Soil Science
- Maurie Semel, Ph.D., Entomology
- Stanton Shannon, Ph.D., Vegetable Crops, Geneva
- John Walter Sherbon, Ph.D., Food Chemistry
- Wayne Alfred Sinclair, Ph.D., Plant Pathology
- Daniel Gene Sisler, Ph.D., Agricultural Economics
- John Richard Stamer, Ph.D., Bacteriology, Geneva
- Victor Russell Stephen, M.A., Communication Arts
- James Ray Stouffer, Ph.D., Animal Science
- Phyllis Eloise Stout, M.S., Cooperative Extension and Extension Leader
- Harold Barber Sweet, B.S., Cooperative Extension and Assistant to the Director
- Glen Hanna Thacker, M.S., Poultry Science
- Daniel Quale Thompson, Ph.D., Wildlife Management
- John Fanning Thompson, Ph.D., Botany
- John Preston Tomkins, Ph.D., Pomology
- Leonard Daniel Topoleski, Ph.D., Vegetable Crops
- Kenneth Trammel, Ph.D., Entomology, Geneva
- Hugh Farrant Travis, Ph.D., Animal Science
- Charles Harrison Uhl, Ph.D., Botany
- Peter John VanSoest, Ph.D., Animal Nutrition
- Lloyd Dale VanVleck, Ph.D., Animal Science
- Donald Howard Wallace, Ph.D., Vegetable Crops and Plant Breeding
- Roger Darlington Way, Ph.D., Pomology, Geneva
- Robert Elzworth Wilkinson, Ph.D., Plant Pathology¹

12 Faculty and Staff

Charles Edward Williamson, Ph.D., Plant Pathology
Ray Wu, Ph.D., Biochemistry

Roger Grierson Young, Ph.D., Insect Biochemistry
Stanley Arnold Zahler, Ph.D., Microbiology

Assistant Professors

Terry Edward Acree, Ph.D., Biochemistry, Geneva
Herbert Sanders Aldwinkle, Ph.D., Botany
Harrison William Ambrose III, Ph.D., Biology
Heinrich Arn, Ph.D., Insecticide Assay, Geneva
Richard Edward Austic, Ph.D., Poultry Science
Steven Vincent Beer, Ph.D., Plant Pathology
Arthur Lee Berkey, Ph.D., Agricultural Education
Stephen Earl Bloom, Ph.D., Cytogenetics
John Butts Bourke, Ph.D., Chemistry, Geneva
George John Broadwell, Ph.D., Cooperative Extension and Associate Director
Wallace Dale Brown, M.S., Cooperative Extension and Extension Leader
Peter John Bruns, Ph.D., Genetics
Harry William Burry, M.F., Forestry
Jeffrey Martin Camhi, Ph.D., Biology
Joseph Kearns Campbell, M.S., Agricultural Engineering
Clarence Albert Carlson, Jr., Ph.D., Fishery Biology
Jot David Carpenter, M.L.A., Landscape Architecture
Pierre Clavel, Ph.D., Rural Sociology
James Robert Cooke, Ph.D., Agricultural Engineering
Robert Henry Crawford, Ph.D., Communication Arts
Mrs. Stella Ann Crossley, Ph.D., Neurobiology and Behavior
James Nelson Cummins, Ph.D., Pomology, Geneva
Charles Howard Cuykendall, Ph.D., Agronomy
Peter John Davies, Ph.D., Plant Physiology
Thomas Edward Devine, Ph.D., Plant Breeding
Donald Leonard Downing, Ph.D., Food Processing, Geneva
William Bryant Duke, Ph.D., Crop Science
John Malcolm Duxbury, Ph.D., Soil Science
Charles Joseph Eckenrode, Ph.D., Insect Toxicology, Geneva
George Campbell Eickwort, Ph.D., Insect Morphology
Doyle Allen Eiler, Ph.D., Agricultural Economics
Paul Patrick Feeny, Ph.D., Entomology
Gary Warren Fick, Ph.D., Plant Physiology
Gerald Ralph Fink, Ph.D., Genetics
Bart John Fiori, Ph.D., Entomology, Geneva
Richard Henry Fox, Ph.D., Soil Science
Joe Douglas Francis, Ph.D., Rural Sociology
Daniel Dale Fritton, Ph.D., Soil Physics
Mrs. Audrey Jane Gibson, Ph.D., Microbiology, and Acting Chairman in the Section of Microbiology
John Daniel Gilpatrick, Ph.D., Plant Pathology, Geneva

George Lawrence Good, Ph.D., Ornamental Horticulture
Carl Frank Gortzig, M.S., Floriculture¹
Emil Jost Haller, Ph.D., Educational Administration
Gary Elvan Harman, Ph.D., Seed Microbiology, Geneva
Abdossanad Hedayat, Ph.D., Biometry
Dalva Eugene Hedlund, Ph.D., Occupational Psychology and Guidance
Robert Gordon Helgesen, Ph.D., Floriculture
Harold Franklin Hintz, Ph.D., Animal Nutrition
Lamartine Frain Hood, Ph.D., Food Science
R. Kenneth Horst, Ph.D., Plant Pathology
Geza Hrazdina, Ph.D., Biochemistry, Geneva
Frederick David Judge, Ph.D., Entomology, Geneva
Robert John Kalter, Ph.D., Resource Economics
Elizabeth Beach Keller, Ph.D., Biochemistry
John William Kelly, Ph.D., Natural Resources
Anwar Ahmad Khan, Ph.D., Food Science
Holim Kim, Ph.D., Journalism
John Edward Kinsella, Ph.D., Food Science
Warren Willard Knapp, Ph.D., Meteorology
Ronald John Kuhr, Ph.D., Insect Toxicology, Geneva
Miss Anne LaBastille, Ph.D., Science Education
L. L. Larson, Ph.D., Physiology of Reproduction
Chang Yong Lee, Ph.D., Food Science, Geneva
Uma Jayant Lele, Ph.D., Agricultural Economics
Ross Joseph MacIntyre, Ph.D., Genetics
Richard N. McCarty, Ph.D., Biochemistry
Keith Allen Miller, Ph.D., Hotel Administration
Paul Dean Miller, Ph.D., Animal Breeding
Peter Lee Minotti, Ph.D., Vegetable Crops
Aaron Nathan Moen, Ph.D., Wildlife Ecology
John Keith Moffat, Ph.D., Molecular Biology
Timothy Douglas Mount, Ph.D., Agricultural Economics
Roger Paul Natzke, Ph.D., Animal Science
Ralph Louis Obendorf, Ph.D., Field Crops Science
Gerald Walter Olson, Ph.D., Soil Science
Albert Boyd Pack, Ph.D., Meteorology
Frederick Harvey Pough, Ph.D., Herpetology
James Clarence Preston, Ed.D., Extension Administration
William Shaw Reid, Ph.D., Soil Science
Milo Eugene Richmond, Ph.D., Wildlife Management
George Demetrius Saravacos, Sc.D., Food Science, Geneva
Lawrence Ira Slobin, Ph.D., Immunochemistry
Daniel Lester Solomon, Ph.D., Biometry

Faculty and Staff 13

Roger Morgan Spanswick, Ph.D., Plant Physiology
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Peter Leo Steponkus, Ph.D., Ornamental Horticulture
Jerry Dean Stockdale, Ph.D., Rural Sociology
Gilbert Saari Stoewsand, Ph.D., Toxicology, Geneva
Fred Nicholas Swader, Ph.D., Soil Science
Bert Harrison Swift, Ph.D., Political Science

Instructors

Maria Elana Colby, M.S., Chemistry
Wayne Anthony Gillis, M.S., Animal Science
James Rowland Joiner, Ed.M., Plant Breeding
Susan Murray, M.S., Botany

Senior Extension Associates

Harold Edison Carley, M.S., Extension Leader
Charles Frank Dvorak, Jr., M.S., Extension Leader
Russell Clair Hodnett, M.S., Extension Leader
Ruth A. Klein, M.A., Education
Harvey Mason Lincoln, M.P.A., Extension Personnel
Roger Gregg Murphy, Ph.D., Food Marketing

Senior Research Associates

William Foster Dean, Jr., Ph.D., Poultry Science
Herbert William Israel, Ph.D., Soil Physiology
Mohyee E. Eldefrawi, Ph.D., Neurobiology
Elizabeth May McClintock, Ph.D., Botany
David B. Peakall, Ph.D., Ecology and Systematics

Emeritus Professors

Raymond Albrechtsen, M.S., Animal Science
Sydney Arthur Asdell, Ph.D., Animal Physiology
Alfred Williams Avens, Ph.D., Chemistry, Geneva
Maurice Chester Bond, Ph.D., Marketing
Richard Bradfield, Ph.D., D.Sc., Soil Technology
James Chester Bradley, Ph.D., Entomology
Clarence Greenfield Bradt, B.S., Animal Husbandry
Stanley J. Brownell, M.A., M.S., Animal Husbandry
Walter H. Burkholder, Ph.D., Plant Pathology
Ferdinand Hinckley Butt, Ph.D., Insect Morphology
George Samuel Butts, B.S., Extension Teaching and Information
Paul Jones Chapman, Ph.D., Entomology, Geneva
Reginald Clifton Collison, M.S., Pomology, Geneva

Maurice Tauber, Ph.D., Entomology
Jerry Kazumitsu Uyemoto, Ph.D., Plant Pathology, Geneva
Dharam Vir Vadehra, Ph.D., Food Science
Darrell Robert VanCampen, Ph.D., Animal Nutrition
Hans D. VanEtten, Ph.D., Plant Pathology
Bruce Tabor Wilkins, Ph.D., Conservation
Christopher Foster Wilkinson, Ph.D., Insect Toxicology

Enid C. Schantz, M.S., Plant Breeding
William Hutchinson Swallow, M.S., Plant Breeding
Robert Emmett Zollinhofer, M.S., Biology

Douglas Robinson Pickett, Ph.D., Acting Extension Representative
Larry Lee Rhonemus, M.S., Extension Leader
James Sterling Spero, M.S., Extension Leader
John Carl Sterling, M.A., 4-H Resource Leader
Harold Peter Warnock, M.P.A., Extension Representative

Oscar Harris Pearson, Ph.D., Vegetable Crops
Abraham Benedict Soans, Ph.D., Entomology
Natalie Whitford Uhl, Ph.D., L. H. Bailey Hortorium
Ruth Cunniff Young, Ph.D., Rural Sociology

Harold Joel Conn, Ph.D., Bacteriology, Geneva
William Francis Crosier, Ph.D., Seed Investigations, Geneva
Lowell Clem Cunningham, Ph.D., Farm Management
Ralph Willard Dean, Ph.D., Entomology, Geneva
Henry Dietrich, Ph.D., Entomology
Mary Eva Duthie, Ph.D., Rural Sociology
Elton James Dyce, Ph.D., Apiculture
William Robert Eadie, Ph.D., Zoology
Karl Herman Fernow, Ph.D., Plant Pathology
Richard Felix Fricke, B.S., Extension Service
Anson Wright Gibson, M.S., Personnel Administration
Cedric Hay Guise, M.F., Forestry
James Morton Hamilton, Ph.D., Plant Pathology, Geneva
William John Hamilton, Jr., Ph.D., Zoology
David Birney Hand, Ph.D., Biochemistry, Geneva

14 Faculty and Staff

- Leigh H. Harden, M.S., Personnel Administration
Van Breed Hart, Ph.D., Farm Management
Arthur John Heinicke, Ph.D., Pomology
Barbour Lawson Herrington, Ph.D., Dairy Chemistry
Gustave Frederick Heuser, Ph.D., Poultry Husbandry
Albert Hoefer, B.S., Extension Service
Melvin B. Hoffman, Ph.D., Pomology
Edwin Raymond Hoskins, Ph.D., Education
Frank Bonar Howe, M.S., Soil Technology
George James Hucker, Ph.D., Bacteriology, Geneva
Hugh Cecil Hockett, Ph.D., Entomology, Geneva
Frederick Bruce Hutt, Ph.D., D.Sc., Animal Genetics
Philip Gustav Johnson, Ph.D., Science Education
Louis William Kaiser, B.E.A. in Radio, Communication Arts
Peter Paul Kellogg, Ph.D., Ornithology and Biological Statistics
Myron Slade Kendrick, Ph.D., Public Finance
Georges Abdallah Knaysi, Ph.D., D.Sc., Microbiology
Paul J. Kruse, Ph.D., Extension Education
Frank Andrew Lee, Ph.D., Chemistry, Geneva
Josiah Randall Livermore, Ph.D., Plant Breeding
Laurence Howland MacDaniels, Ph.D., Horticulture
Leonard Amby Maynard, Ph.D., Nutrition and Biochemistry
John Clarence McCurdy, B.S., C.E., Agricultural Engineering
Clyde B. Moore, Ph.D., Education
Fred Bishop Morris, B.S., Extension Service
Frederick George Munding, M.S., Entomology, Geneva
William Irving Myers, Ph.D., Farm Finance
Allan Goodrich Newhall, Ph.D., Plant Pathology
Leo Chandler Norris, Ph.D., Nutrition
E. Laurence Palmer, Ph.D., Education
DeForest Harold Palmiter, Ph.D., Plant Pathology, Geneva
Frank Ashmore Pearson, Ph.D., Prices and Statistics
Carl Severin Pederson, Ph.D., Bacteriology, Geneva
Elmer Strobel Phillips, B.S., Communication Arts
Joseph Pullman Porter, M.S.A., M.L.D., Ornamental Horticulture
Whiton Powell, Ph.D., Business Management
Alfred M. S. Pridham, Ph.D., Ornamental Horticulture
George Joseph Raleigh, Ph.D., Vegetable Crops
Lowell Fitz Randolph, Ph.D., Botany
Clinton Beaumont Raymond, B.S., Vegetable Crops
Juan Estevan Reyna, E.E., M.A., Drawing
Howard Wait Riley, M.E., Agricultural Engineering
Alexis Lawrence Romanoff, Ph.D., Chemical Embryology
Charles Bovett Sayre, M.S., Vegetable Crops, Geneva
Gad Parker Scoville, M.A., Farm Management
Lloyd R. Simons, B.S., Extension Service
George Lewis Slate, M.S., Pomology, Geneva
Ora Smith, Ph.D., Vegetable Crops
William Arthur Smith, Ph.D., Education
Leland Spencer, Ph.D., Marketing
Clifford Nicks Stark, Ph.D., Bacteriology
William Thorpe Tapley, M.S., Vegetable Crops, Geneva
Homer Columbus Thompson, Ph.D., Vegetable Crops
Clesson Nathan Turner, M.S., Agricultural Engineering
Leon John Tyler, Ph.D., Plant Pathology
Ernest Van Alstine, Ph.D., Soil Technology
Leland Eugene Weaver, M.S., Poultry Husbandry
Donald Stuart Welch, Ph.D., Plant Pathology
Richard Wellington, M.S., Pomology, Geneva
Roy Glenn Wiggans, Ph.D., Plant Breeding
Harold Anthony Willman, M.S., Animal Husbandry
Forrest Blythe Wright, Ph.D., Agricultural Engineering
William Joseph Wright, M.S., Extension Service

Cornell University

The New York State College of Agriculture

Cornell University, the land-grant institution for New York State, was chartered by the Legislature of the State of New York in 1865. By the terms of the Land-Grant Act of 1862, teaching in agriculture has been, from the beginning, a regular part of the University program. In 1904 the Legislature established the College of Agriculture as a state institution under the title, "The New York State College of Agriculture at Cornell University," and made an appropriation for the erection of buildings for the College. In 1906 an administration act was passed by the Legislature defining the purpose and activities of the College of Agriculture thus: "The object of said College of Agriculture shall be to improve the agricultural methods of the state; to develop the agricultural resources of the state in the production of crops of all kinds, in the rearing and breeding of livestock, in the manufacture of dairy and other products, in determining better methods of handling and marketing such products, and in other ways; and to increase intelligence and elevate the standards of living in the rural districts. For the attainment of these objects the College is authorized to give instruction in the sciences, arts, and practices relating thereto, in such courses and in such manner as shall best serve the interests of the state; to conduct extension work in disseminating agricultural knowledge throughout the state by means of experiments and demonstrations on farms and gardens, investigations of the economic and social status of agriculture, lectures, publication of bulletins and reports, and in such other ways as may be deemed advisable in the furtherance of the aforesaid objects; to make researchers in the physical, chemical, biological, and other problems of agriculture, the application of such investigations to the agriculture of New York, and the publication of the results thereof."

With the creation of the State University of New York in 1948, the College of Agriculture, as one of the four statutory colleges at Cornell University, became an integral part of this new State University. "Created to provide a comprehensive and adequate program of higher education," the State University now includes more than fifty educational institutions. The College of Agriculture, functioning in this broad context, offers teaching and research facilities to serve the agricultural needs of the state.

16 Four-Year Course

Curricula

The resident instruction in the College of Agriculture is planned for those who desire an education in agriculture and in the sciences most closely related to agriculture. It is organized, for the most part, in a course of four years, or eight terms, leading to the degree of Bachelor of Science. Those who want instruction in a special field may register for one or more terms as special students, provided they are qualified by education and experience to pursue the courses they want to take (see page 25).

Organized curricula for students with special interests include one-year courses for missionaries and for students in food distribution.

Graduate work in the various fields of agriculture is under the jurisdiction of the Graduate School of Cornell University to which questions about admission should be addressed. A new professional degree program has been introduced in the College of Agriculture which leads to the Master of Professional Studies in several fields.

In addition to the above, there is regularly a summer school designed especially for teachers, school principals, and superintendents.

There are also one-week and two-week courses with specific purposes.

The Four-Year Course

The four-year course provides an education in science with emphasis upon applications in agriculture. Graduates of the College are found in such a wide variety of occupations and situations, that only a broad and basic education can give many of them the foundation needed in adjusting to the changes and responsibilities that will come their way. While it is literally correct to think of "agriculture" as applying to crop and livestock production on farms, the four-year course is organized and functions in a much broader educational context.

The requirements for a degree, as outlined on page 25, are extremely flexible, with only a few specific courses demanded of all students. The major part of the program for any individual student is chosen from three large groups of courses. This opportunity for election may result in a broad, general program or one in which basic sciences or, to the other extreme, the more applied subjects, are emphasized almost exclusively.

Programs, arranged with the help of a faculty adviser, are available in the following fields:

Agricultural Economics

- Agricultural Business Management and Marketing
- Agricultural Economics
- Farm Finance and Farm Management
- Food Distribution
- Resource Economics

Agricultural Engineering

- Agricultural Technology
- Agricultural Engineering Technology
- Agricultural Engineering*

Agricultural Sciences

Agronomy

- Crop Science
- Field Crops
- Soil Science
- Soils (Including Soil Conservation)

Animal Science

- Animal Genetics (Breeding)
- Animal Nutrition
- Animal Physiology
- Dairy Production

* See the *Announcement of the College of Engineering.*

Livestock Production
Meat Science

Biological Sciences—Fields of
Concentration:

Animal Physiology and Anatomy
Biochemistry
Botany
Ecology and Evolution
Genetics and Development
Microbiology
Neurobiology and Behavior

Communication Arts

Cooperative Extension

Education

Conservation Education
Teaching Agriculture in High School
Teaching Science in High School

Entomology

Floriculture and Ornamental Horticulture

Floriculture
Greenhouse Crop Production
Landscape Architecture
Landscape Horticulture
Nursery Crop Production
Turfgrass Management

Food Science

International Agriculture

(Students must also complete the
requirement for another specialization.)

Natural Resources (Conservation)

Conservation
Fishery Science
Forest Science
Outdoor Recreation
Wildlife Science

Plant Breeding

Plant Pathology

Pomology

Fruit Production
Pomology

Poultry Science

Poultry Production
Poultry Science

Rural Sociology

Statistics and Biometry

Vegetable Crops

Production and Marketing

Combination Programs

Students may qualify for programs in combination with other divisions in the University: Veterinary College, College of Engineering, Graduate School of Nutrition, and Graduate School of Business and Public Administration. For further information see pp. 32.

Employment Opportunities

The employment opportunities described in the paragraphs which follow are in fields of work in which graduates of the College currently are engaged. It would be possible to compile a long list of specific jobs held by graduates; instead, it has seemed more desirable to name only a few broad fields which include these specific jobs. Experience shows that students should not prepare too narrowly, because unforeseen circumstances may have an important bearing on the specific jobs which they accept initially. Preparation appropriate for a broad vocational field will qualify graduates for more than one job opening within that field or even for openings in more than one field.

FARMING. A first responsibility of the College is to the young men who plan to enter farming. A good living at satisfying work and an opportunity to contribute to community life await the graduates with the necessary farm experience and enough capital to operate a desirable farm. These young men take a general course in agriculture, with emphasis on the type

18 Employment Opportunities

of farming they plan to follow. A general course likewise fills the needs of others who may enter related fields until they have enough capital to buy or rent a farm.

BUSINESS AND INDUSTRY. Leaders in business and industry, particularly in those businesses or industries that market farm products or serve the production needs of farmers, are continually seeking competent young persons with an agricultural college education.

The food industry is concerned with the movement of agricultural products, such as eggs, milk, meat, fruits, and vegetables, through processing plants and distribution channels to the consumer. To perform these varied services requires men and women with diverse kinds of preparation and personal characteristics. For instance, the milk industry provides opportunities in plant and laboratory work for graduates with educational and practical experience in the handling and processing of milk and milk products; in sales, business management, and regulatory jobs for graduates whose education has emphasized marketing and related courses in agricultural economics.

In the fruit and vegetable processing and marketing fields, there are jobs for fieldmen, buyers, raw-products inspectors, laboratory quality control workers, plant managers, wholesale distributors, and retail store managers. Most of these positions are with food processing companies and with retail food chains.

The business of supplying feed for New York livestock and poultry is of major importance. It requires men who know New York agriculture and, more particularly, who know feeds and the feed requirements of the various types of livestock. The production and the delivery of fertilizers, machinery, pesticides, and all other supplies used on our farms require the services of qualified men. They may need to be well trained scientists, technicians, salesmen, promotional specialists, or plant operators. Some may serve eventually as managers or in other administrative capacities.

All businesses in agriculture require employees with a knowledge of financing, advertising, insurance, and other specialized services. Credit organizations, both private and governmental, advertising concerns, and insurance companies have employed graduates of the College. Farm-loan representatives have been employed by local banks, insurance companies, and the various branches of the Farm Credit Administration. Farm experience and the ability to work with people are valuable assets as qualifications for employment, along with a general education in agriculture, including agricultural economics.

The production and sale of flowers and ornamental shrubs in New York is an important and large business. Many students who specialize in floriculture and ornamental horticulture are sons and daughters of persons in the greenhouse or nursery business. Others who do not have that background but combine practical experience with their college education find satisfactory opportunities upon graduation.

The College does not have a school of journalism, but it offers several courses in oral, written, broadcasting, visual, and international communi-

cation as well as in communications theory. Job opportunities include editorial and staff positions on newspapers, farm papers, and farm magazines. Agricultural college graduates occupy positions as farm program directors and farm news writers for radio and television services in the state colleges throughout the nation. Some graduates have entered the advertising field.

HIGH SCHOOL TEACHING. Two kinds of secondary-school teachers are prepared at the College—teachers of agriculture and teachers of science.

There are more than 300 teachers of agriculture in the secondary schools of New York State. The agricultural instruction in high school includes specialized course offerings in agricultural business, agricultural mechanics, conservation and forestry, farm operation and management, and ornamental horticulture. Newly graduated teachers are continually needed to serve new departments being organized in schools and to replace teachers who retire or change to other occupations. Young men who have a vital interest in youth who desire to study agriculture, and an understanding of the importance of agriculture in the total economy will find the teaching of agriculture a challenging and rewarding field of service. Moreover, the experience gained as a teacher provides an excellent background for related positions in the public schools as administrators or counselors; as teachers in post-high-school institutions offering instruction in agriculture; and in agricultural agencies and businesses, including farming.

The high birth rate of the 1940s and early 1950s and the increasing number of boys and girls who complete high school have created a strong demand with improved salaries for high school teachers in all fields. Because of the need for scientists in industry as well as in education, the demand for science teachers is particularly acute. This demand is certain to become even greater as boys and girls in the lower grades move on into high school. The young man or young woman who has both an interest in and aptitude for science courses and mathematics, as well as a sincere interest in the welfare of young people, will find rewarding experiences in preparing for and later in serving as a teacher of high school science.

RESEARCH AND COLLEGE TEACHING. Research related to agriculture is concerned with adding to the fund of knowledge bearing on the production, processing, or distribution of farm products. It may be of an economic, social, physical, biological, or chemical nature, depending on the particular kind of problem being studied. The majority of those responsible for research have had advanced, specialized study in a graduate school. Graduates of the four-year course in the College who have superior records and a sound background in basic subject matter have the opportunity to pursue graduate study, often with the help of a graduate assistantship or fellowship to defray part of the costs. In recent years, about one-half of the graduates of the College of Agriculture have continued with graduate or professional study. Positions available upon completion of graduate study are both within and outside the agricultural field.

College teaching involves preparation of the same kind as is needed for research. Whether one engages in research or in teaching depends on

20 Employment Opportunities

personal interests and abilities as well as on opportunities available at the time graduate study is completed. In many cases, graduates hold positions which combine teaching and research.

AGRICULTURAL EXTENSION. The term "agricultural extension" refers to the extending of agricultural knowledge in an out-of-school situation. Co-operative extension, as a part of the University, has agricultural extension agents and 4-H extension agents in most counties of the state. College department staff members with extension responsibilities provide leadership for instigating adoption of new knowledge. Cooperative extension, agricultural missionary, and commercial extension opportunities are open to those who are competent in subject matter and in communication.

CONSERVATION. Opportunities in conservation, outdoor recreation, and the management of fish and wildlife are found principally in employment with either the state or federal government. Occasionally, there are openings with museums and private foundations. The preparation in college emphasizes the biological sciences. The work is likely to consist chiefly of survey and research, but in recent years many management and administrative positions have been established. The work is exacting but of great interest to those scientists with a desire to develop and conserve our natural resources and to help the people to understand them.

SOCIAL SERVICES AND RURAL ORGANIZATIONS. Students may elect a social science concentration as applied to agriculture and rural life. Graduates with this kind of education find opportunities with farm organizations, as caseworkers in local public welfare departments, as camp directors, and with youth organizations and community centers. To fill community development positions in the United States and abroad, competent persons with specialized preparation in the rural social sciences at the graduate level are in increasing demand by agricultural business firms for research; by colleges for extension, research and teaching; and by government research and action agencies. The undergraduate concentration in the rural social sciences provides an excellent foundation for later professional study in preparation for the many opportunities with community planning councils and health and welfare councils; for the professional positions in agencies providing health and welfare services; and for the rural ministry.

FOREIGN SERVICE. In recent years, the international aspect of American agricultural activities, interests, and problems has received increased emphasis. In 1963, the New York State College of Agriculture established a program in International Agricultural Development as a part of Cornell University's contribution toward helping other countries in their efforts to improve agricultural production and standards of living. This added a fourth dimension to the three other divisions of the College of Agriculture—resident instruction, research, and extension.

One part of this new division is an undergraduate program in the vital and rewarding area of international agriculture. Graduates of this program will find opportunities with International Voluntary Services, the Peace Corps, and similar organizations. After gaining overseas experience, they may

qualify for foreign assignments with agencies of the United States Government, the Food and Agriculture Organization of the United Nations, or one of the foundations. Occasionally, requests are received for graduates to work for governments of foreign countries.

STATE AND FEDERAL CIVIL SERVICE. Several agricultural agencies, both state and federal, employ their personnel from registers established by the New York State Department of Civil Service or the United States Civil Service Commission. Positions with these organizations may be of a research, extension, or administrative nature. To gain a place on civil service registers, seniors or graduates take the appropriate examinations which are announced from time to time.

Placement Services

Placement services for graduating seniors and alumni are on a decentralized but coordinated basis. The University Career, Summer Plans, and Placement Center is available to all students and alumni of the University and is of most value to those students of the College of Agriculture who are seeking positions in business, industry, government, or teaching. It serves all students and alumni of the University who are qualified for and interested in teaching or related positions in elementary and secondary schools and in colleges. College of Agriculture graduates in the fields of science teaching and vocational agriculture teaching may be placed through the Center.

The Office of Resident Instruction of the College provides a service which combines vocational guidance and placement and is available to both students and alumni. Those interested in graduate study are referred to the appropriate departmental offices for further information and assistance. Placement in the Cooperative Extension Service is a function of the personnel officer in 4-H and agriculture extension.

Students and alumni also learn informally of employment opportunities through individual professors to whom requests may come because of their wide contacts with prospective employers throughout New York State.

Admission

Admission to the College involves more than presenting specified entrance units. In choosing its students, the College considers not only the secondary school record, but also other available indications of success in the curriculum the applicant proposes to undertake. Therefore, the applicant should submit full information regarding his high school record, background, work experience, school and community activities, resources for financing a college education, and the purpose in seeking it. Such information provides a basis for full consideration of the application. Correspondence regarding these matters is welcome. Applicants are not required to come to the College for interviews, but those who wish to do so should write two or three weeks in advance for appointments. Conference hours are 10:00 a.m. until 12 noon and 2:00 until 4:00 p.m. during the week, and 9:00 a.m. until

22 Admission

12 noon on Saturdays during the school year. The College admissions office is closed on Saturdays during June, July, and August. Requests for Saturday appointments should be avoided if at all possible.

Candidates for admission to the four-year course must be at least sixteen years of age. The academic requirements may be satisfied by presentation of satisfactory scores in the Scholastic Aptitude Tests of the College Entrance Examination Board combined with acceptable secondary school grades which, for residents of New York State, should include scores on Regents examinations.

Admission to the four-year course is possible only in the fall term, except for students who enter with advanced standing. Applications should be filed during the fall term of the senior year in high school, with the Office of the Director of Admissions of Cornell University, Edmund Ezra Day Hall. Applications will be received until January 15 and after that date only if places in the class remain to be filled.

Requests for applications for admission to the freshman class, to a special course, or to advanced standing from other colleges and universities should be addressed to the Director of Admissions of Cornell University, Edmund Ezra Day Hall, Ithaca, New York 14850.

For admission to graduate work in agriculture and candidacy for advanced degrees, including the new professional Master's degrees, communications should be addressed to the Dean of the Graduate School, Sage Graduate Center, Cornell University, Ithaca, New York 14850.

The *Announcement of General Information*, which gives details concerning admission, expenses, scholarships, and related subjects, may be obtained by writing to Cornell University Announcements, Edmund Ezra Day Hall. Announcements of the other colleges, schools, and departments of the University may also be obtained by writing to that address.

For answers to specific questions regarding the College of Agriculture's programs, admissions policies, and interview arrangements, write to the appropriate person in the Admissions Office, New York State College of Agriculture, 163 Roberts Hall, Ithaca, New York 14850, or telephone the Admissions Office at 607/256-2057 or 607/256-2036. Professor Leonard W. Feddema, Director of Admissions, is in charge of overall policy and transfer student admission; Dr. Donald C. Burgett, Associate Director of Admissions, is in charge of freshmen admissions; Mr. Gordon L. Peck, Assistant Director of Admissions, is in charge of recruitment.

It is the policy of Cornell University actively to support the American ideal of equality of opportunity for all, and no student shall be denied admission or be otherwise discriminated against because of race, color, creed, religion, or national origin.

Entrance Requirements for the Four-Year Course

The subjects that may be offered for admission to the College of Agriculture are named in the following list. The figures following each subject indicate the value in entrance units and show the maximum and the minimum amount of credit allowed in the subject. A unit represents five recitations a week

for one year in a subject. In drawing and industrial arts, 240 hours are required to earn one unit and 120 hours to earn one-half unit.

ENGLISH, 4 YEARS (required of all entering students) 4

FOREIGN LANGUAGES (modern and ancient)1,2,3,4
(If a foreign language is offered for entrance, it is desirable to present at least two years of study although credit will be granted for a single year of study in not more than two languages.)

MATHEMATICS

Elementary Algebra	1	Plane Geometry	1
Intermediate Algebra	1	Solid Geometry	½
Advanced Algebra	½	Plane Trigonometry	½

Or (for schools following the recommendations of the College Board Commission on Mathematics):

College Preparatory Mathematics1,2, 3, or 4

SCIENCES

Biology	1	Earth Science	½-1
Botany	½-1	Physics	1
Chemistry	1	Zoology	½-1
General Science	1		

(If a unit in biology is offered, a half-unit in botany and a half-unit in zoology may not also be counted.)

SOCIAL STUDIES, including history (each course) ½-1

VOCATIONAL SUBJECTS

Agriculture	1-6	Human Ecology	½-2
Bookkeeping	½-1	Industrial Arts	½-1
Drawing	½-1		

ELECTIVES—any high school subject or subjects not already used and acceptable to the University ½-2

For admission to the College of Agriculture, an applicant must have completed a secondary-school curriculum and must offer both A and B as follows:

A. A *minimum* of sixteen units which must include four in English and three in mathematics. Remaining units must be selected from the list above.

B. Scores of the Scholastic Aptitude Test of the College Entrance Examination Board. Transfer applicants are urged to present scores on a test taken within one year prior to the date of anticipated matriculation. They are not required of applicants for adult special registration.

Applicants to the degree curriculum are encouraged to complete College Board Achievement Tests in two of the following: English composition, mathematics, science.

24 Admission

It is strongly recommended that high school students carry enough courses to offer eighteen entrance units and that these include biology, chemistry, physics, and at least three and one-half units in mathematics. Students who wish to major in one of the sciences or to become research workers should offer adequate training in foreign languages.

A committee on admissions in the College of Agriculture reviews the credentials of each applicant. In making its decision, the committee considers not only the nature of the subjects offered for admission and the quality of the work done in those subjects, and all available indications of ability for an interest in the work of the course to be undertaken in the College, but also the background, experience, and interests of the applicant.

Health Requirements

Each entering student, graduate or undergraduate, is expected to assume personal responsibility for the health requirements adopted by the Board of Trustees of Cornell University. Prospective undergraduate students should consult the *Announcement of General Information*. Graduate students should consult the *Announcement of the Graduate School: Biological Sciences*. Permission to register for a new semester will not be granted unless all health requirements pertaining to the previous semester have been fulfilled.

Advanced Placement

Prospective entering freshmen who have taken college-level courses in secondary school have the opportunity to qualify for advanced placement (and often for advanced standing credit) in these areas of study: biological sciences, chemistry, English, history, Latin, literature, mathematics, modern foreign languages, music, and physics.

In general those who wish to be considered for advanced placement or credit should plan to take the appropriate advanced placement examination(s) of the College Entrance Examination Board in May. Some of the departments listed above offer their own examinations at entrance, however, as an alternative or supplementary method of seeking advanced placement or credit.

Advanced Standing

A student admitted to the College of Agriculture from another college in Cornell University, or from any other institution of collegiate rank, is regarded as having completed the number of terms and hours to which his records entitle him, and receives all the privileges of students who have completed the same number of terms and hours by residence in the College. He must furnish a transcript and certificate of honorable dismissal from the institution from which he transfers. No more than fifteen semester hours of credit are allowed for one semester of work at another institution. To obtain the degree of Bachelor of Science, however, a student must have completed the prescribed subjects in the four-year course and the requisite number of elective hours in agricultural subjects. He must also have been in residence in the College of Agriculture for his past two terms and have

completed no less than fifteen hours a term, of which two-thirds at least must be in subjects taught by the staff of the College of Agriculture.

Credit toward a degree for preparatory school work, beyond that used in satisfying entrance requirements, may be obtained through a satisfactory grade received in an Advanced Placement Test of the College Entrance Examination Board, in each subject.

College Proficiency Examination Program

Anyone wishing to obtain college credit through the College Proficiency Examination Program of the State Education Department should, prior to the taking of examinations, consult the director of resident instruction, Roberts Hall, as to conditions under which credit may be granted. Each application for credit assignment is considered on its own merits of purpose and preparation. The field in which credit is sought must be appropriate to the graduation requirements of the College, and the intent of the applicant must be clearly to use such credit toward meeting these requirements.

Special Students

Adult special student status is extended to a limited number of students who wish instruction in selected agricultural courses in preparation for employment in agriculture. This avenue of admission should not be viewed as a method for improving a previous collegiate record for purposes of entry to graduate schools. Applicants for admission to such special standing must present entrance credentials as other students do, and in addition, they must present a detailed statement of the program they desire to follow. They must show that they have had recent farm experience or other experience qualifying them for the special work they plan to do, and, unless they meet the regular entrance requirements they must be twenty-one years of age.

Special students are assigned to faculty advisers who help them arrange a course of study which will contribute directly to their vocational objective and not necessarily to the requirements of the degree course. They may not elect more than one-third of their hours in any semester outside of the College of Agriculture. Transfer to the degree course is sometimes possible for those whose record is considerably better than average and who otherwise give evidence of ability to carry advanced work.

Students having a first degree and desiring further undergraduate work may be admitted as special students. The work of such students is ordinarily limited to courses in the College of Agriculture; for work taken outside, tuition is charged at the rate prevailing in the college where the work is done.

Requirements for the Degree of Bachelor of Science

The requirements for the degree of Bachelor of Science are residence for eight terms, except for those who make an average of C (2.0 quality points) or above, and, in addition to the prescribed work in physical education

26 Degree Requirements

(outlined on page 30), the completion of 120 hours required and elective work, as outlined on page 29.

A student whose first enrollment in the College was in the fall of 1964 or thereafter must pass a written English Proficiency Examination, administered by a faculty committee, in order to qualify for the degree. The examination is given twice during each academic year, usually in December and May.

To be eligible for the degree, the student must maintain an average grade of at least C (1.7 quality points) for the entire course and must have an average of C (1.7 quality points) or above in the last term. The "last term" is that semester or summer session at the end of which the student is to be recommended by the faculty for a degree.

Work Experience Program

On May 8, 1969, the faculty of the College of Agriculture voted to discontinue the practice requirement as a College requirement for the B.S. degree. However, the departments and fields of specialization may require work experience of students in their fields.

There are eight departments or fields of specialization which require their undergraduate students to obtain appropriate work experience prior to the senior year.

In the following specializations, students may satisfy the work experience requirement by earning ten units of acceptable practice credit either through farm work experience or nonfarm work experience of a professional nature; or through an acceptable combination of farm and nonfarm work experience directly related to their fields of specialization. The students' advisers will designate the type of work experience.

Agricultural Education
Agronomy
General Agriculture

Pomology
Vegetable Crops

In the following specializations students satisfy the work experience requirement through ten units of appropriate experience of a professional nature in their fields of specialization.

Communication Arts
Floriculture

Plant Breeding and Biometry

The following departments and fields of specialization do not require work experience but recommend that their students obtain work experience appropriate for their fields of specialization.

Agricultural Economics
Agricultural Engineering
Agricultural Sciences
Animal Science
Biological Sciences
Cooperative Extension
Entomology

Food Science
Natural Resources (Conservation)
Plant Pathology
Poultry Science
Rural Sociology
Science Education

The Student Practice Office is responsible for evaluating *all* farm experience and at the time of matriculation evaluates the farm experience of all students regardless of their field of specialization. This is done because a number of students change their field of specialization after matriculation and because the information that is obtained enables the Office of Resident Instruction to continue basic records and to make studies based on the work experience backgrounds of students. Considerations involved in establishing the farm experience credits at entrance are (1) desirability of the farm from the standpoint of obtaining good experience; (2) the student's report on his farm experience; (3) reports from the farmer on the student's work; (4) the length of time of the work experience; (5) the results of a practical farm experience test.

In some fields of specialization, the type of experience required may vary with the qualifications or interest of the individual student. In certain instances, experience of a specific type is expected early in the college career, while in others it is preferred that the experience be delayed until the junior year. Because of these variations, it is desirable for students to discuss the question of specialization and the experience required, if any, with their advisers as soon as possible. The responsibility for doing this rests with the students. Students may find that it is helpful to talk with advisers in several fields, with other counselors, and with members of the Student Practice Office so that their decisions may be based on the best information obtainable.

The interests and objectives of students are subject to change. When a change occurs, the student may need to change advisers. For such a change to become official, the new adviser must submit a Specialization Designation Form which reports the new specialization and corresponding work experience, if any. A change which occurs late in the student's college course may delay the time for graduation. Every student is obliged to satisfy the experience requirement of the specialization for which he or she is enrolled at the beginning of the senior year.

Adult special students must meet certain experience standards to qualify for admission. Should such students transfer to a specialization in the degree course, they must meet the appropriate experience requirement.

Members of the faculty and the Student Practice Office will make suggestions and be of whatever assistance they can to students who are seeking suitable work experience. However, the College can assume no responsibility for assuring the student that appropriate employment will be found and no responsibility for acceptability to the student of particular working or living conditions.

Prospective students and students who desire information about any aspect of the work experience program or wish assistance in finding employment, should write to or consult Professor S. R. Shapley, Student Practice Office, Room 16, Roberts Hall, Ithaca, New York 14850. The department concerned sometimes assists in finding employment for specialization experience.

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PROCEDURES. The Student Practice Office will assist both those students who are required to have work experience for their field of specialization and those who desire to obtain such experience. Students who wish assistance in obtaining appropriate employment should file a work assistance application with the Student Practice Office, Room 16, Roberts Hall. For some fields of work civil service examinations are required. For employment the following summer, these examinations need to be taken in December or January.

Students who wish to have work experience evaluated so credits may be included in their college record should: (1) report their position either before they start work or at the time their job begins, and (2) prepare a report on their work experience and submit it to the Student Practice Office or Specialization Adviser. Forms for this purpose are available at the Student Practice Office.

A representative of the Student Practice Office or a Specialization Representative will visit most students whose employment location is in New York State or neighboring areas. A report on the student and his work will be requested from the employer. The work experience will be evaluated and reported to the student. Pertinent information on the work experience will be kept in the student's folder and reported to the Office of Resident Instruction so it may be entered on the student's college record.

Distribution Requirements

Following is an outline of the course requirements for graduation. Required courses given in the College of Arts and Sciences are described in the *Announcement* of that College.

<i>Requirement</i>	<i>Credit hours</i>
Physical sciences, biological sciences, social sciences, and humanities	45
Group A. Physical sciences. A minimum of twelve hours in at least two subject areas, including six hours of chemistry or physics. Subject areas: Astronomy 201, 202; chemistry; geology; mathematics; Meteorology 201, 202; physics.	
Group B. Biological sciences. A minimum of twelve hours to include six hours of introductory botany, biology and/or zoology with the remaining hours in at least two subject areas. All undergraduate courses offered by the Division of Biological Sciences may be credited. Subject areas: animal physiology and anatomy including Vet. Medicine 310; biochemistry; botany; ecology, evolution and systematics; entomology 210, 212, and 351; genetics and development, including Animal Science 220; microbiology including Vet. Medicine 390; neurobiology and behavior; organic chemistry; Plant Pathology 301, 309 and 401; physical biology including Vet. Medicine 920.	

Group C. Social sciences and humanities. A minimum of fifteen hours in at least two subject areas, including six hours of freshman humanities. Subjects: American studies; economics; freshman humanities; government; history; history of art; comparative literature; modern foreign language; philosophy; psychology or Education 110; Child Development 115; Rural Sociology 100 or anthropology or sociology; Industrial and Labor Relations 408, 409.

Elective in the statutory colleges. At least 45 hours must be taken in the College of Agriculture	55
Electives (either in Agriculture or in any other college in the University)	20
Total	120

ELECTIVES. Below is a partial list of general courses offered by the various departments and recommended to the student choosing electives outside his major field.

Agricultural Economics 150	Food Science 100
Agronomy 111 (Crop Science)	Landscape Architecture 102
Agronomy 200 (Soil Science)	Meteorology 201
Animal Science 100, 112, 220	Natural Resources (Conservation) 110, 201, 202
Biological Sciences 101, 102, 107-108	Plant Pathology 301
Biological Sciences 431 (Biochemistry)	Pomology 101
Biological Sciences 280, 281 (Genetics)	Poultry Science 100
Biological Sciences 290 (Microbiology)	Rural Sociology 100
Education 110	Vegetable Crops 103
Entomology 210, 212, 260	
Floriculture 101	

Many of the above courses are open to freshmen. For a listing of these courses, see p. 32.

OFFICER EDUCATION. As a land-grant institution chartered under the Morrill Act of 1862, Cornell has offered instruction in military science for more than a century. This instruction is provided through the ROTC programs of the three Military Departments, Military Science, Naval Science, and Aerospace Studies.

These programs offer a male student the opportunity to earn a commission while he is completing his education, thus enabling him to fulfill his military commitment as an officer rather than through the draft. To obtain a commission in one of the armed services, a student must complete a specified course of study in an ROTC program and must meet certain physical and mental requirements. Upon graduation he receives a commission and serves a required tour of active military service.

Participation in ROTC is voluntary. Interested students may enroll in the fall of the freshman year. For further details, see the *Announcement of Officer Education*.

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PHYSICAL EDUCATION. All undergraduates must complete four terms of work in physical education. Ordinarily, this requirement must be completed in the first two years of residence; postponement is to be allowed only by consent of the University Faculty Committee on Requirements for Graduation. Exemption from this requirement may be made by the Committee when it is recommended by the University Health Services, or because of unusual conditions of age, residence, or outside responsibility. Students who have been discharged from the armed services may be exempted.

For students entering with advanced standing, the number of terms of physical education required is to be reduced by the number of terms which the student has satisfactorily completed (whether or not physical education was included in his program) in a college of recognized standing.

Materials describing the courses offered in physical education will be made available to entering students by the Department of Physical Education.

Bachelor of Science with Distinction

The degree of Bachelor of Science with distinction will be conferred upon those students who, in addition to having completed all of the requirements for the Bachelor of Science degree, shall have done all of their undergraduate work at Cornell University and have cumulative averages of B+ (3.3 quality points) or above; and upon those transfer students who have been in residence for at least two years and have cumulative averages of A- (3.5 quality points) or above at Cornell.

Bachelor of Science with Honors

The Honors program in the College is guided by five broad area committees in the plant sciences, animal sciences, social sciences, physical sciences, and biology. Each participant carries out independent research under the direction of a faculty member when the student has received written acceptance into the Honors program. Requirements for entering the Honors program include completion of fifty-five semester credit hours, of which at least thirty hours have been at Cornell University, and a cumulative grade point average at the time of entrance into the Honors program of at least 3.0. Exceptions may be made for the thirty hours required at Cornell for transfer students with exceptional qualifications.

Each report on independent research will be reviewed by the Honors committee having appropriate jurisdiction. The chairman of each Honors committee will recommend, in writing, to the Office of Resident Instruction those students who are expected to be graduated with Honors. These recommendations must be received before the date on which midterm grades are due in the semester at the end of which the student expects to graduate. Students so recommended will have diplomas ordered for them with the notation "With Honors."

Dean's List

Excellence in scholarship is recognized twice a year by publishing as a Dean's List the names of those students who have completed at least

twelve hours of course work for letter grades, who are in good standing, and whose semester averages in academic courses are B+ (3.3 quality points) or above.

Registration for Courses

The standard schedule for the freshman year must include the following courses:

<i>Course</i>	<i>Credit Hours</i>
Physical Education	0
Freshman Humanities	6
Biological Sciences 101-102 (or equivalent) or 107-108	6
Chemistry or Physics	6
Elective courses in the College of Agriculture	6
Elective courses in the basic sciences, in social sciences and humani- ties, or in the College of Agriculture	3-6

In making his program, the student has the assistance of a faculty adviser, preferably from the field in which he expects to specialize. The adviser is ordinarily assigned to the new student for the first term, but following that he is chosen by the student. Other counselors to assist students on personal matters, vocational guidance, and placement are available in the Office of Resident Instruction, Roberts 192.

A student must register for at least twelve hours each term, and no new student may register for more than eighteen hours per term in addition to the regular work in physical education.

Failures in courses, either required or elective, taken outside the College of Agriculture are counted against the allotment of the twenty free hours that may be taken in any college.

Senior students who have met all college requirements and desire to take courses outside the College of Agriculture, in addition to those required or allowed free, may do so upon paying for the additional hours at the rate of tuition prevailing in the colleges in which the courses are taken. Other students are not allowed to exceed, even by paying for the excess hours, the twenty hours of endowed college courses charged to this category unless they have met, or at the same time are meeting, the minimum agricultural elective requirement. Senior students whose cumulative averages are 3.0 or above, and who are recommended by the department in which their major work is done, may be permitted to elect, without additional payment, up to ten hours outside the College of Agriculture beyond the twenty hours normally allowed for election in any college.

Courses in advanced ROTC may be taken, in addition to the twenty hours of free electives outside the College, without payment for those excess hours.

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Courses in Agriculture Open to Freshmen

Agricultural Economics 150, 240
Agricultural Engineering 104, 106, 107, 152, 153, 204, 205, 222, 233, 234
Agronomy 111
Animal Science 100, 112, 250, 260, 265
Biological Sciences 101-102, 107-108
Drawing (freehand) 109-110, 111
Education 110
Entomology 260
Floriculture and Ornamental Horticulture 101
Food Science 100
Landscape Architecture 102
Meteorology 201
Natural Resources (Conservation) 110, 201, 202
Orientation 1, 5, 7, 101, 110
Pomology 101, 102
Poultry Science 100
Rural Sociology 100
Vegetable Crops 103, 210, 222

Combined Courses

With the College of Engineering (Agricultural Engineering)

A joint program of the Colleges of Agriculture and Engineering at Cornell University leads to the degree of Bachelor of Science at the end of four years. Students in this program register in the College of Agriculture during the first three years but take courses in the Colleges of Engineering, Arts and Sciences, and Agriculture. In the fourth year the registration is in the College of Engineering, which recommends the candidates to the trustees of the University for the degree.

Applicants for admission must meet the academic entrance requirements for the College of Engineering. These are sixteen units including: English, four units; one foreign language, two units; history, two units; elementary and intermediate algebra, two units; plane geometry, one unit; trigonometry, one-half unit; either advanced algebra, one-half unit, or solid geometry, one-half unit; chemistry, one unit, or physics, one unit (preferably both). It is recommended that the candidate offer advanced algebra, if possible, and that at least three of the elective units offered be in further study in language or history. The mathematics courses listed above may be taken as separate courses or may be included within four units of comprehensive college preparatory mathematics.

Each candidate for admission is required to take the Scholastic Aptitude Test of the College Entrance Examination Board and to request the Board to report the results to the Director of Admissions, Cornell University. Candidates are urged to take the tests in January of their senior year.

Each applicant must also take the College Entrance Examination Board achievement tests in advanced mathematics and either physics or chemistry. These tests should be taken not later than March of the year of the applicant's entrance to college.

Since it is the purpose of this curriculum to prepare engineers for a variety of agricultural specializations such as buildings, soil and water management, machinery, manufacturing and processing of agricultural products and supplies, drainage, irrigation, etc., evidence of interest in and background for engineering work in agriculture is a qualification for admission that is given careful consideration.

The curriculum includes basic work in biology, mathematics, physics, and chemistry; a well-rounded selection of courses in engineering science and technology, including agricultural engineering; courses in soils, crops, farm management, and other subjects in agriculture; and general studies to provide a broad and useful training.

Charges for tuition and fees, during the first three years in the curriculum, are the same as outlined on page 35, except that students in this combined course are required to take more courses outside the College of Agriculture than are permitted to other students, for which they must pay, on a credit-hour basis, as soon as the regular allowance has been used up. The amount of the charge depends upon the specific courses that are taken but is approximately a total of \$1,650 for the first three years. Payment for the excess hours begins in the second year, but the major part is paid in the third year. In the fourth year these students are subject to the tuition and General Fee charged in the College of Engineering, which at present totals approximately \$1,400 each term.

In applying for admission the applicant should indicate in the application, which should be sent to the Director of Admissions at Cornell University, that he wants to enter the College of Agriculture for agricultural engineering.

The amount, time, and manner of payment of tuition, fees, or other charges may be changed by the Board of Trustees at any time without notice.

With Business and Public Administration

Properly qualified students of the College of Agriculture may, during their third year, apply for admission to a joint program between the College of Agriculture and the Graduate School of Business and Public Administration. Under this program, the student who is admitted may complete the requirements for the Bachelor of Science degree for the College of Agriculture at the end of his fourth year and for the degree of Master of Business Administration or the degree of Master of Public Administration at the end of his fifth year. The student in this program must successfully complete a minimum of thirty hours of course work in the Graduate School of Business and Public Administration during the fifth year.

A careful selection of courses is necessary if the two degrees are to be earned in five years; therefore, a student who is interested should plan his program with the help of the designated faculty adviser, beginning with the sophomore year. If the decision to apply is not made until later, con-

34 Combined Courses

sultation with the adviser is necessary to determine whether the requirements for the two degrees can be met in five years or if a longer time is needed.

The opportunity to receive these two degrees in five years, when the normal time is six years, is made possible by the inclusion of certain courses from the Department of Agricultural Economics that may be acceptable in lieu of certain first-year requirements by the Graduate School of Business and Public Administration. Similarly, the faculty of the College of Agriculture accepts up to twenty-nine hours of courses in the School of Business and Public Administration in the fourth year. These substitutions are allowed only to those who have been accepted for admission by the Graduate School of Business and Public Administration and who have their schedules approved by the College of Agriculture faculty adviser for this program.

In the fifth year the student registers only in the Graduate School of Business and Public Administration. The program of that year includes the remaining core subjects required of all students in business and public administration, together with elective courses. The specific courses to be taken depend upon the career interests of the student and are determined in consultation with his adviser. At the beginning of this fifth year the student will select a concentration from such areas as: industrial accounting, professional accounting, finance, international business operations, managerial economics, marketing, personnel management, production and operations management, quantitative analysis for managerial decision making, transportation, organizational theory and behavior, and agricultural management. Options within the agricultural management area include: management of farm cooperatives, agricultural credit administration, agricultural industries, agricultural marketing, public policy and the administration of government agricultural programs, and management of natural resources.

During the first four years these students are subject to the tuition requirements of the College of Agriculture and in the fifth year to those of the Graduate School of Business and Public Administration.

For further details about this joint program and its admissions requirements reference should be made to the *Announcement of the Graduate School of Business and Public Administration*.

The College of Agriculture and the Graduate School of Business and Public Administration also cooperate in a special program in food industry management. This joint effort carries the sponsorship of the National Association of Food Chains. The majority of the students have been employed in the food distribution industry, but the program also attracts others. Qualified degree holders may enroll in the Graduate School as candidates for the Master of Science or Doctor of Philosophy degree, or in the Graduate School of Business and Public Administration as candidates for the Master of Business Administration degree (which requires two years of residence). Undergraduates register in the College of Agriculture as candidates for the Bachelor of Science degree. Others who are not interested in a degree enroll as special students in the College of Agriculture and are granted a certificate at the successful completion of one year of work.

With the Graduate School of Nutrition

A plan of the College of Agriculture and the Graduate School of Nutrition permits students of agriculture, who qualify, to follow a curriculum that leads to the regular degree of the College of Agriculture at the end of the fourth year, and the degree of Master of Nutritional Science at the end of the fifth year. To meet the requirements for the two degrees in five years, instead of the normal time of six years, the student in agriculture should start planning his program with his adviser for students of nutrition not later than the end of the freshman year. During the first four years of this program, students are subject to the tuition requirements of the College of Agriculture and in the fifth year to those of the School of Nutrition.

With the Veterinary College

Students who do their preveterinary work in the College of Agriculture and are accepted by the Veterinary College at Cornell University sometimes qualify for degrees from both colleges. This takes about seven years and is ordinarily done by spending the first three years in Agriculture followed by four in the Veterinary College, including a combined registration in the College of Agriculture during the semester in which the requirements for the B.S. degree are completed. The candidate must petition for combined registration prior to the beginning of the semester in which he qualifies for the degree.

Payments to the University

Tuition

Tuition is \$200 per term for undergraduate and special students registered in the New York State College of Agriculture who are and have been bona fide residents of the State of New York for at least twelve months immediately prior to the registration day of each term of the academic year.

Tuition is \$300 per term for students who do not qualify as New York State residents.

Since physical presence in the State, especially for persons under age, by no means constitutes legal residence, applicants who are at all doubtful of their right to qualify as New York State residents should address inquiries to the Director of Resident Instruction in the College of Agriculture. Changes in residence status are handled by the Director of Resident Instruction.

Students transferring from the College of Agriculture to other colleges in the University must first make payment for the difference in tuition for the credit transferred.

Students desiring to take, while registered in the College of Agriculture, courses in other colleges in the University beyond those specifically required and also beyond the twenty hours allowed free may do so upon payment of tuition for the additional hours at the rate of tuition in the college in which the work is taken.

36 Payments to the University

The University treasurer mails the student a statement of tuition and fees prior to the beginning of each term. The charges are payable before registration in the University.

Any student, graduate or undergraduate, who fails to pay his tuition, fees, and other indebtedness within the time prescribed by the University is thereby dropped from the University. A reinstatement fee of \$10 is assessed in case of default in payments. For reasons satisfactory to the Treasurer and the Registrar, which must be presented in writing, the above assessment may be waived in any individual case.

If the student withdraws, or takes a leave of absence, tuition and fees are charged at the rate of 10 percent for each week or fraction thereof from the registration day.

The amount, time, and manner of payment of tuition, fees, or other charges may be changed by the Board of Trustees at any time without notice.

Fees and Instructional Expenses

A DEPOSIT OF \$50 must be paid after the applicant has received notice of provisional acceptance. At the time of the first registration in the University, the deposit is used to cover matriculation charges, provides for certain graduation expenses, and establishes a fund for undergraduate and alumni class activities. The deposit is not refundable.

A DEPOSIT OF \$30 is required for a uniform, payable at registration in the first term, for students who enroll in the basic course in military science. Most of this deposit is returned as earned uniform allowance upon completion of the basic course.

A GENERAL FEE OF \$250 for New York State residents, and \$350 for non-residents, is required at the beginning of each term. This Fee contributes toward the services provided by the libraries, The Gannett Clinic and Sage Infirmary, and the student unions in Willard Straight Hall and Noyes Student Center. It also pays part of the extra costs of laboratory courses and general administration, as well as programs of physical recreation and student activities.

BOOKS, instruments, and instructional supplies cost approximately \$100 a term.

Miscellaneous Rules and Assessments

Every student is held personally responsible for any injury done by him to any of the University's property.

Assessments, charged to the student's account and payable at the Treasurer's office, are levied upon the student in certain circumstances, under the following rules of the University: (1) A matriculated student desiring to register after the close of registration day must first pay a fee of \$10. (2) A student desiring to take an examination or other test for the completion of a course in which the grade "incomplete" was reported must first pay a fee of \$10 for each examination or other test.

For reasons satisfactory to the proper authority, any of the above-mentioned assessments may be waived in any individual case if the student's failure to comply with the regulation was due to ill health or to any other reason beyond his control.

Facilities

Buildings

The buildings and land of Cornell University are valued at more than \$100,000,000 and the equipment at well over \$40,000,000. On that portion of the campus devoted principally to the College of Agriculture, and frequently referred to as the "upper campus," there are sixteen buildings containing classrooms. Around the "Ag quadrangle" are the following buildings which house the departments indicated:

Comstock Hall, entomology	Roberts Hall, communication arts
Caldwell Hall, entomology	East Roberts Hall, extension
Warren Hall, agricultural economics and rural sociology	Plant Science Building, floriculture and ornamental horticulture, pomology, plant pathology, and vegetable crops
Stone Hall, education	

Slightly northwest of the quadrangle is Savage Hall in which are centered some of the activities in nutrition. In succession to the east of the quadrangle are:

Bradfield Hall, agronomy, plant breeding, genetics and development	Stocking Hall, food science and microbiology
Emerson Hall, agronomy, plant breeding	Riley-Robb Hall, agricultural engineering
Fernow Hall, natural resources (conservation)	Morrison Hall, animal science
Rice Hall, poultry science	Wing Hall, biochemistry and molecular biology

As far as possible, classes and laboratory exercises for courses offered in the sixteen departments of the College are conducted in the buildings in which the offices of the departments are located. However, in many instances this is impossible. The student should, therefore, consult the course descriptions in this *Announcement* in order to determine the exact location of each class or laboratory exercise.

In addition to the foregoing classroom buildings, on the campus of the College are an auditorium (Bailey Hall), a fine modern library (Mann Library), new bioclimatic laboratories, sixteen greenhouses, a judging pavilion, and numerous special laboratories and barns.

Students in the College of Agriculture take many courses in other colleges of the University, particularly in the College of Arts and Sciences. There the most frequently visited buildings are Goldwin Smith Hall for English and the humanities, Baker Laboratory for chemistry, Rockefeller Hall for physics, Sibley Hall for government and history, Stimson Hall for ecology and systematics, and White Hall for mathematics.

Of interest to all students in the University are such buildings as the Uris Library for undergraduate study; Olin Library for graduate research; Gannett Medical Clinic; Willard Straight Hall and Noyes Student Center for social activities; Anabel Taylor Hall for interfaith activities; Barton Hall,

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Helen Newman Hall, and Teagle Hall for physical education; Lynah Hall for ice skating; and Sage Chapel for interdenominational church services.

The offices of administration for the College of Agriculture are located in Roberts Hall, and those for the general administration of the entire University are situated in Day Hall. The administrative center of student life in the College of Agriculture is the Office of Resident Instruction located in Roberts Hall. All students, both prospective and already enrolled, are urged to visit this office for guidance on questions pertaining to undergraduate activities.

Lands for Research and Instruction

The New York State College of Agriculture uses about 13,500 acres of land for its research program and for instructional purposes. About 71 percent of this land is owned by Cornell University, 25 percent is owned by New York State; the balance is leased or owned by other agencies or is on grower farms. Of the land owned by Cornell University, some 6,900 acres are in Tompkins County and about 2,700 acres outside the county. Of the state-owned land 1,073 acres are in Tompkins County and 2,280 acres outside the county. The land is used primarily by research workers of the Cornell University Agricultural Experiment Station (Ithaca) and the New York State Agricultural Experiment Station (Geneva), both of which are a part of the New York State College of Agriculture.

The type and amount of land assigned to each department varies according to its needs. Some Departments, such as Agronomy, Plant Breeding and Biometry, Floriculture and Ornamental Horticulture, Pomology, and Vegetable Crops, need tillable land with certain types of soil on which to conduct field experiments. The Animal Science Department needs large areas suitable for pasture and for the production of hay, grain, and corn for silage to feed experimental animals in the dairy and beef cattle herds, sheep, and swine.

Arable land not immediately needed by the individual departments for research and instruction is operated by the Office of Farm Services on an extensive basis. This office also acts as a service department, plowing and fitting some of the land used by other departments for experimental purposes. This system avoids the duplication of expensive machinery and uses the farm labor efficiently. The Departments of Animal Science, Agronomy, Plant Breeding and Biometry, Pomology, and Vegetable Crops, because they have such large acreage under cultivation, own their own equipment.

Of the 12,500 acres available for use by the Cornell University Agricultural Experiment Station at Ithaca, about 4,200 acres are in cropland and about 1,000 acres in pasture. There are more than 4,100 acres in woods used for research purposes and there are about 3,200 acres in other woods, non-cropland, roads, etc.

In addition to the land area located around Ithaca, there are research farms located as follows: the Long Island Vegetable Research Farm at Riverhead, a foundation seed potato farm near Lake Placid, a fruit farm at Sodus, an agronomy farm at Aurora, and a 389-acre Biological Field

Station on Oneida Lake. Also, test plots are located in a number of counties to evaluate the results of research under a variety of environmental conditions.

Of the 700 acres of land at Geneva for the New York State Agricultural Experiment Station there, some 320 acres are in fruit and 175 acres in vegetables. In addition to this, there are 28 acres of experimental grape vineyards and laboratory facilities at Fredonia in Chautauqua County and 19 acres of experimental land and laboratory facilities at Highland in Ulster County for research serving the fruit and vegetable industry in the Hudson Valley. In addition to these, research is conducted on growers' farms in a number of different counties.

Libraries

The Colleges of Agriculture and Human Ecology are served by the Albert R. Mann Library of about 400,000 volumes. This is supplemented by the other libraries of Cornell University, containing over 3,500,000 volumes, many of which also relate directly to agricultural and human ecology subjects. In addition to materials on applied agriculture and human ecology, the Mann Library contains extensive collections dealing with such related sciences as botany, biochemistry, microbiology, genetics, entomology, and nutrition. It also includes large collections in economics, sociology, psychology, and education, and smaller collections on a variety of other subjects. Of major importance are the numerous complete files of foreign and domestic periodicals and government publications, of which some 11,000 are received currently.

The principal collection on entomology and limnology is in Comstock Hall. Small collections of reprints, bulletins, and duplicate books and journals are provided by several departments in their own buildings for use by their faculty and graduate students.

The Albert R. Mann Library building, completed in 1952, has a capacity of 500,000 volumes and 750 reading-room seats. The first floor is devoted primarily to books assigned for class reading, with rooms seating 425 persons. On this floor is a room for small groups studying together, and also the Ellis Room containing books and periodicals for leisure reading. On the second floor are the reference and bibliography rooms, periodical reading rooms, offices and work rooms, the main loan desk, and the card catalog. The catalog provides a record of the library materials in all libraries and departmental collections of the Colleges. The library has a comprehensive collection of bibliographies.

When the University is in session, the library is open, with librarians on duty to assist readers, from 8:00 a.m. to 11:30 p.m. daily except Saturday, when it closes at 5:00 p.m., and Sunday, when it opens at 1:00 p.m. Students must present identification cards when borrowing books. Information on library regulations and suggestions for use of the library are provided all new students in orientation meetings each fall. More detailed information appears in booklets distributed at that time.

Student Housing and Dining

On Campus

UNDERGRADUATE STUDENTS. Cornell University provides on the campus, dormitory facilities for about 5,000 students. Dining service is provided in Willard Straight Hall, Noyes Lodge, Noyes Center, Martha Van Rensselaer cafeteria, Hughes Hall Dining and Sage Cafeteria (graduate students), and Stocking Hall (Dairy Bar) Cafeteria. Application forms for dormitory accommodations and housing policy information will be mailed to each candidate for admission as a freshman or a transfer student at the time of notification of provisional acceptance to the University.

All freshman students are required to live in University housing. Transfer students are not subject to this requirement. Applications for housing from transfer students are assigned to available space in order of their receipt. The University will make every effort to fill all requests for University housing from transfer students as space permits, but accommodation of all applicants cannot be guaranteed.

GRADUATE STUDENTS. University dormitory housing is available to single graduate students upon application to the Department of Housing, Day Hall. Married graduate students may apply to the Department of Housing, Hasbrouck Apartments, Pleasant Grove Road, Ithaca, New York 14850, for University-operated housing. Applications for all University housing should be made as soon as possible after January 1 for all fall matriculants; after October 1 for spring matriculants. Detailed information concerning University housing may be obtained by writing to the Department of Housing, Day Hall.

Sage Graduate Center provides dormitory housing for approximately 200 men and women. Situated in the center of the campus, it is convenient to all colleges. Cascadilla Hall, located at the southwest entrance to the Campus, is a graduate dormitory for men and women housing 160 students.

MARRIED STUDENTS. The University, through the Department of Housing Services, maintains apartment accommodations for some of its married students and their families. These are Cornell Quarters, Pleasant Grove Apartments, and Hasbrouck Apartments, with total housing for more than 400 families. All apartments are unfurnished. For further information and application, write the Department of Housing, Hasbrouck Apartments, Pleasant Grove Road, Ithaca, New York 14850.

Off Campus

Off-campus housing is available in apartment buildings, in private homes, and in rooming houses. The University, as a service to students, maintains a bulletin-board listing of available rooms and apartments. Because available accommodations change daily, it is not possible to provide lists. Inquiries should be addressed to the Off-Campus Housing Office, 223 Day Hall.

Health Services and Medical Care

Health Services and medical care for students are centered in two Cornell facilities: the Gannett Medical Clinic (out-patient department) and the Sage Infirmary. Students are entitled to unlimited visits at the Clinic. Appointments with individual doctors at the Clinic may be made, if desired, by calling or coming in person; an acutely ill student will be seen promptly whether he has an appointment or not. Students are also entitled to laboratory and x-ray examinations indicated for diagnosis and treatment, hospitalization in the Sage Infirmary with medical care for a maximum of fourteen days each term, and emergency surgical care. The cost of these services is covered in the General Fee.

On a voluntary basis, insurance is available to supplement the services provided by the General Fee. For further details, including charges for special services, see the *Announcement of General Information*.

If, in the opinion of the University authorities, the student's health makes it unwise for him to remain in the University, he may be required to withdraw.

Departments of Instruction

With Outlines of Courses That May Be Chosen by Regular or Special Students as Agricultural Electives

Special notice. Unless otherwise noted, all courses are given in the buildings of the College of Agriculture. Courses enclosed in brackets will not be given in 1971-72.

Courses numbered 100 through 199 are introductory courses primarily for freshmen and sophomores; courses numbered 200 through 299 are intermediate courses primarily for underclassmen; courses numbered 300 through 399 are advanced courses primarily for juniors and seniors; courses numbered 400 through 499 are primarily for seniors and graduate students; courses numbered 500 through 599 are primarily for graduate students; and courses numbered 600 through 699 are seminar courses.

Grades A—F are used in the College. Also, S (Satisfactory) and U (Unsatisfactory) grades are given in courses where specified. College legislation restricts the use of S-U grades to upperclassmen who may receive one S-U grade per semester. Courses designated for S-U grade may not be in the student's specialization, nor may they be used to satisfy specific course and distribution requirements.

Orientation

1 English Tutorial. Fall or spring term. Noncredit. S-U grades only. Required of juniors who have not met the English Proficiency Requirement of the College. Open to sophomores and selected freshmen on advice of their faculty adviser. M W F 11:15, 12:20, Warren 101; or 1:25, Warren 231.

Group tutorial course to help students write correct and effective English. Writing an acceptable composition at the time of the English Proficiency Examination will constitute successful completion of this course.

5 Orientation. Fall or spring term. Credit three hours. The credit is not counted toward the 120 hours required for the degree. Fall term: for entering students only. M W F 8 or 9:05, or T Th S 8 or 9:05. Warren 160. Spring term: may be elected by first-year students only. M W F 12:20. Warren 260. Professor to be appointed.

Emphasis on the analysis and reasoning involved in the solution of verbal problems which have been drawn mainly from College of Agriculture courses requiring the use of mathematics.

7 College Reading and Study Skills Program. Twice each term. Noncredit. S-U grades only. Program 1 starts at the beginning of fall term; Program 2, directly after Thanksgiving recess; Program 3, at begin-

ning of spring term; and Program 4, directly after spring recess. The initial fall Program is reserved for freshmen. The other three Programs are open to all registered students. Registration takes place in Olin 304 during the insession week preceding the beginning of each program. Professor Pauk.

Principles and techniques for more effective reading and studying are explained, demonstrated, and practiced in class. The reading laboratory provides an opportunity for increasing one's rate of reading.

101 Orientation. Fall term. Credit one hour. Required of one-year curriculum students in agriculture. One lecture-discussion period a week. To be arranged. Professors Hertel and Tyler.

110 Introductory College Mathematics. Fall or spring term. Credit four hours. T Th S 8, M W F 8, 12:20. Laboratory, T or Th 12:20. Warren 231. Professor Geiselmann.

Designed to give students with sound high school mathematics backgrounds a unified treatment of the basic concepts of college algebra, trigonometry, analytic geometry, and the elements of calculus. Considerable emphasis will be placed upon the concept of function, graphing, problem solving, and methods of proof. The Cornell University Computing Language (CUPL) will be taught and used to strengthen and integrate the mathematical topics covered in the course.

Agricultural Economics

The Department offers courses covering a wide range of subjects. Undergraduates interested in this field may specialize in agricultural business management and marketing, agricultural economics, farm management and farm finance, food industry management, international agriculture, or resource economics. Course programs arranged with the help of faculty advisers may lead to employment on farms or in related industries or in public agencies serving agriculture in the United States or abroad, or prepare the student for advanced work beyond the B.S. degree.

Specialization in this Department may enable qualified students to enter the combined program with the College of Agriculture and the Graduate School of Business and Public Administration leading to the M.B.A. or M.P.A. degree at the end of the fifth year. Undergraduates meeting college requirements may participate in the Honors program in the social sciences under the direction of a faculty member.

Farm Management

302 Farm Management. Spring term. Credit five hours. Not open to freshmen. Lectures: M W F 10:10. Caldwell 100. Laboratory: T W or Th 1:25-4:25. Warren 101. On days when farms are visited, the laboratory period is 1:25-5:30. Professor Warren.

A study of the organization and operation of the farm from the point of view of efficiency and continuous profit; farm records, farm business analysis, factors affecting profits, size of business, choice of enterprises, partnership arrangements, getting started in farming, planning the organization and management of specific farms. One all-day trip and four half-day trips are taken to visit farms in nearby regions.

402 Advanced Farm Business Management. Spring term. Credit three hours. Prerequisite: Course 302, or its equivalent. Lecture: M W 10:10. Warren 201. Laboratory: W 1:25-5:30. Warren 260. On days farms are visited, the laboratory period is 1:25-5:30; one all-day field trip is taken. Professor Conneman.

Emphasis is placed on management analysis and decision making. Principal topics considered include management information systems, business analysis, economic principles, budgeting, linear programming, capital budgeting; acquisition, organization and management of capital, labor, land, and machinery; the influence of change on farm organization and management.

403 Cost Accounting for Farm Business Management. Fall term. Credit three hours. Prerequisite: Course 302. Lectures: M W

10:10. Laboratory: W 2:30-4:25. Warren 160. Professor Kearl.

Cost-accounting methods and procedures for use in managing farms. Topics considered are the organization of accounts, methods of cost determination and allocation, summarization and analysis of accounts, making financial and operating statements, and using enterprise cost accounts to study the farm business and make management decisions.

405 Farm Finance. Spring term. Credit three hours. Prerequisite: 302. Lectures: T Th 10:10. Discussion: T 1:25-3:25. Warren 145. Professor Smith.

A study of sound financial arrangements for farmers and the credit institutions which serve them. Emphasis is placed on problems of capital management associated with organizing and operating a commercial farm. Alternative sources of capital are analyzed and consideration given to safe and profitable debt levels and selection of alternative investment opportunities. Tax management, insurance programs, and retirement and estate planning for farmers are also studied.

406 Farm Appraisal. Fall term. Credit three hours. Prerequisite: 302. Lecture: T 10:10. Laboratory: T 1:25-4:25. Warren 101. On days when farms are visited, laboratory period is 1:25-5:30. Professor Warren.

A study of factors governing the price of farms, methods of farm valuation, and practice in the appraisal of farms.

508 Production Economics with Quantitative Applications. Spring term. Credit three hours. Primarily for graduate students but open to seniors with permission of the instructor. Lectures: T Th 11:15 and W 1:25. Warren 160. Professor to be appointed.

A review of economic theory and quantitative methods of analysis with emphasis on applications to agriculture. Topics covered include the derivation and use of production, cost and supply functions from experimental and cross-section data.

Business Management

Attention is directed to courses in economics and mathematics in the College of Arts and Sciences and in administration in the Schools of Hotel Administration, Business and Public Administration, and Industrial and Labor Relations.

221 Accounting. Fall term. Credit three hours. Lectures: M F 10:10. Warren 45. Laboratory: T or Th 8-9:55. M T W or Th 2:30-4:25. Warren 201. Assistant Professor Eiler.

A comprehensive survey of basic accounting principles. Some analysis and interpretations of financial statements with special emphasis on agricultural business.

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222 Managerial Accounting and Financial Management. Spring term. Credit three hours. Prerequisite: 221 or its equivalent. Lectures: T Th 10:10. Bradfield 101. Laboratory: T 2:30-4:25; W 12:20-2:15; W 2:30-4:25. Warren 201. Professor Brown.

Emphasis is on problem solving and decision making. Covers concepts and techniques for accumulating, modifying and analyzing financial data used in the management of business firms. Includes topics such as: cost accounting, financial statements, financial planning, managing assets and liabilities, valuing business enterprises, and effect of taxes.

320 Business Law. Fall term. Credit three hours. Limited to upperclassmen. M W F 9:05. Plant Science 233. Associate Professor Bugliari.

Consideration is given chiefly to legal problems of particular interest to persons who expect to engage in business, with emphasis on the fields of personal property, contracts, agency real property, partnerships and corporations.

320H Business Law. Fall term. Credit four hours. Limited to upperclassmen with permission of the instructor. Lectures M W F 9:05. Plant Science 233. Discussion M 3:20. Malott 405. Associate Professor Bugliari.

The lecture portion of this course will cover the same material as 320. The discussion portion will deal with practical applications of certain of the legal principals covered in the course such as contract formation, real property transactions, incorporation and management of business enterprises, and attempt also to give some deeper insight into the role and function of the lawyer and the judiciary in our society.

321 Advanced Business Law. Spring term. Credit three hours. Prerequisite: 320 or its equivalent. T Th 8:30-9:55. Warren 45. Associate Professor Bugliari.

Designed for those students who plan business careers in which a more detailed and comprehensive legal background could be utilized. Selected areas covered in 320 will be further developed, and particular consideration will be given to the law pertaining to bailments, sales, secured transactions, bankruptcy, negotiable instruments, insurance, and trusts and estates.

321H Advanced Business Law. Spring term. Credit four hours. Limited to upperclassmen with permission of the instructor. Lectures: T Th 8:30-9:55. Warren 45. Discussion M 3:20. Malott 405. Associate Professor Bugliari.

The lecture portion of this course will cover the same material as 321. The discussion portion will deal with practical application of certain of the legal principals covered in the course, such as sales contracts, con-

sumer protection, mortgage transactions, bankruptcy proceedings, negotiable paper, insurance, and drawing a will.

326 Farmers' Cooperatives. Spring term. Credit three hours. Not open to freshmen. M W F 9:05. Warren 145. Professor Hedlund.

What cooperatives are, what they have tried to do, and what they have done; their legal status and special problems of organization, finance, and control.

327 Business Organization and Management. Fall term. Credit three hours. Limited to upperclassmen. Lectures: T Th 10:10. Bradfield 101. Discussion: T or Th 2:30-4:25. Bradfield 101. Assistant Professor Belden.

An introductory course on how business activities are organized and managed. Lectures are devoted to a description and analysis of the structure of business activity, external forces affecting business activity, financing business operations, and managing business firms. Discussion periods are used to discuss important current issues and the application of management principles. A stock investment project provides an opportunity to study the stock market and the investment potential of common stocks.

328 Economics of Managerial Decisions.

Spring term. Credit three hours. Prerequisite: Economics 102 and course 221 or their equivalents. Lectures: M W F 9:05. Warren 45. Discussion: W 2:30-4:25. Warren 160; Th 8-9:55, 10:10-12:05, Warren 201; Th 12:20-2:15, Warren 245; F 9:05-11 or 12:20-2:15, Warren 201. In weeks when discussions are held there will be no Friday lecture. Professor Aplin.

Emphasis is placed on identifying problems in a business, recognizing alternatives, and using economic data as guides to making decisions. Principal topics considered include cost analysis with emphasis on identifying costs relevant for various decisions within the firm; pricing policies of firms; planning capital investments, and sales forecasting. Class discussion is supplemented by case studies to illustrate concepts and techniques available to management to assist in making sound decisions.

425 Personal Financial Management. Spring term. Credit one hour. Primarily for seniors. F 12:20. Bradfield 101. Professors R. S. Smith and E. H. Brown.

Identification and analysis of problems in personal financial management common to young families. A study of income flows into the budget and financial demands on family resources. Personal income and budgeting, income tax management, consumer credit, asset acquisition, personal insurance programs, savings and investments, basic elements of retirement and estate planning.

425A Personal Financial Management Discussion. Spring term. Credit one hour. Must be taken concurrently with 425. Meets one hour each week. Time and place to be arranged.

Discussion of problems and case studies in financial planning for students and young families.

626 Seminar in Agricultural Cooperation. Spring term. Credit two hours. S-U grades optional. Open only to graduate students. Time and place to be arranged. Professor Hedlund.

A discussion of the economic theory and function of farmer cooperatives. The place and contribution of cooperatives in developing and developed economies will be considered along with problems of structure, finance, management, and control.

Marketing and Food Industry Management

240 Marketing. Fall or spring term. Credit three hours. Lecture: M W F 11:15. One discussion period only, during the first week of the term: M T W Th or F 2:30-4:25 or S 9:05-11. Warren 45. Professor Goodrich.

A study of how food products are marketed. Special attention is given to the consumption of food products, factors that affect consumption, market channels, operation of different marketing agencies, storage transportation, packaging, product identification, advertising and promotion, buying, selling, and costs.

346 Marketing Milk and Dairy Products. Fall term. Credit three hours. Lectures: M W F 11:15. Discussion: F 12:20. Warren 261. Professor Story.

A review of the economic characteristics of the dairy industry, and an analysis of the marketing and pricing systems for market milk. Particular attention will be given to problems and resulting government programs, including marketing orders, price support operations, and public regulation of competition.

441 Food Distribution. Fall term. Credit three hours. Open to juniors, seniors, and graduate students. M W F 10:10. Warren 245. Mr. German.

A study of the structure and the competitive nature of the food industry. Particular attention is given to an analysis of the gross margin, expenses, earnings, and performance of food retailers. Government regulations with regard to mergers and buying and selling activities are examined. Leading food industry authorities frequently join the discussion session.

443 Food Industry Management. Spring term. Credit four hours. Open to juniors, seniors, and graduate students. M W F 10:10 and W 2-4:25. Warren 245. Professor Earle.

A case study approach is used to examine the application of management principles and concepts to operating problems of food retailers. Areas included are site selection, buying, merchandising, personnel administration, private label products, and financing expansion programs. Leading food industry specialists frequently join the discussion session on Wednesday afternoons.

446 Economics of Food Marketing. Spring term. Credit three hours. Open only to seniors. Sections limited to 30 students. Prerequisite: 240 and Economics 311, or permission of instructor. M W F 9:05 or 11:15. Warren 260. Associate Professor Padberg.

A study of the organization of the agricultural marketing system and the nature of competition developing therein. Food industry structure and performance are appraised in light of current economic theory. Public regulation of competition in food marketing is also covered.

447 Field Study of Marketing Institutions. Spring term. Credit two hours. Registration by permission. M 12:20. Warren 245. Mr. German and Professor Dominick.

Economic functions performed by various types of specialized marketing agencies, with emphasis on their physical operating patterns. Observations are made of the organization and operation of businesses in the food industry. Five days of spring vacation are spent in New York City and/or Boston visiting food distribution firms and marketing institutions.

540 Marketing Research. Spring term. Credit two hours. Permission of instructor. Th 2:30-4:25. Warren 261. Professor Brunk.

Objectives of marketing research, organization and management of research agencies, problem identification, selecting and planning projects. Special attention is given to the designing and use of research in the management of the marketing function.

541 Food Merchandising. Fall term. Credit two hours. Permission of instructor. Th 2:30-4:25. Warren 261. Professor Brunk.

A seminar exploring alternative merchandising and promotional devices for food industry retailers and manufacturers. Special attention is given to identification and measurement of basic forces having an impact on consumer buying behavior.

641 Marketing Economics. Fall term. Credit three hours. Open only to graduate students. Registration by permission. T Th 12:20-2:15. Warren 261. Associate Professor Forker.

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A study of marketing economics with special reference to agriculture. Designed to cover social as well as efficiency issues and criteria with respect to price and market organization. The application of economic theory (production and consumption economics) and quantitative methods to adjustment problems in the agricultural subsector. Includes topics on reformulation of the theory of the firm, economies of scale, theory of markets, economies of distribution, measurement of relative economic efficiencies, pricing in an imperfectly competitive market, market and price manipulation, marketing orders, simulation and systems analysis.

642 Social Responsibility in Marketing. Spring term. Credit three hours. Open only to graduate students. T Th 1-2:15. Warren 260. Associate Professor Padberg.

A seminar course concerned with public policy in marketing. Concepts from industrial organization, consumer economics, and anti-trust are integrated in appraising public decisions in the marketing area. Examples are drawn primarily from analyses of the food marketing system.

Economics of Agricultural Development

464 Economics of Agricultural Development. Spring term. Credit four hours. S-U grades optional. Prerequisite: 150 or Economics 101-102, or consent of the instructor. T Th 9:05 and W 7:00-8:30 p.m. Warren 345. Professor Mellor.

A discussion of the special problems of agricultural development in low-per-capita-income areas and countries. Attention will be devoted to the relationship between development in agriculture and other sectors of the economy, capital and capital formation, the role of land and land reform, increasing efficiency in resource use, coordination problems in agricultural development, and the like.

560 World Food Economics. Fall term. Credit four hours. Primarily for graduate students, but open to seniors with permission of the instructor. Prerequisite: at least two courses in economics. M W 1:30-3:30, plus an individual weekly meeting with the instructor. Warren 101. Associate Professor Poleman.

Designed to introduce students in the social and biological sciences to food economics as it applies to developing countries—that is, to measurement of the food problem in specific situations and to identification of remedial measures consistent with economic reality. Examined are human food requirements, the major food groups and their economic characteristics (including least-cost diet

analysis and historical trends in food consumption), techniques of national food accounting (including data collection and evaluation), the projection of demand, and the disaggregation of data for analysis of particular problem groups and areas. Although policy implications are drawn primarily for low-income, tropical countries, a portion of the empirical evidence necessarily relates to more advanced economies. A major research paper is required.

665 Seminar on Latin American Agricultural Policy. Fall term. Credit three hours. Prerequisite: basic economics. Knowledge of Spanish or Portuguese is desirable. T 2:30-4:25, plus a weekly meeting with the instructor. Bradfield 105. Associate Professor Freebairn.

An examination of policies for the development of the agricultural sector in Latin America, including an identification of policy objectives and a review of the instruments of public policy implementation. Particular attention is paid to the contribution of research studies in agricultural policy formation and accomplishment.

668 Seminar in the Economics of Agricultural Development. Fall term. Credit two hours. S-U grades only. Open only to graduate students with permission. Time to be arranged. Professors Call and Conklin, and Associate Professors Freebairn, Poleman, Sisler, and other staff.

A joint exploration by the departmental staff in international agriculture of current topics in economic development with respect to agriculture. Intended primarily to facilitate the exchange of ideas among staff members, the seminar will be open to a limited number of advanced graduate students. Each student participant will be expected to prepare and defend a paper on a topic associated with his dissertation research.

669 Seminar on Agriculture and Economic Planning Models. Spring term. Credit three hours. Prerequisite: basic macro-economics and quantitative methods. T 1:00-3:00. Warren 361. Professor Mellor.

The seminar will deal with planning models as applied to less developed economies and will emphasize the interaction between the agricultural and the nonagricultural sectors. The course will begin with discussion of one sector models of the Harrod-Domar type, proceed to deal with the labor surplus models such as the Lewis, the Fei-Ranis, and the Jorgensen models and then to the multi-sectoral models of the linear programming type. Finally, it will examine the models in the light of various questions related to planning such as balanced vs. unbalanced growth, choice of techniques, foreign trade, etc.

Public Policy

Attention is directed to course offerings in the Departments of Economics, Government, City and Regional Planning, Conservation, Civil Engineering, Consumer Economics and Public Policy, and the School of Business and Public Administration.

150 The Economics of Agricultural Geography. Fall term. Credit four hours. Lectures: M W F 9:05, Warren 45, or M W F 11:15, Warren 131. Discussion; T W Th or F 2:30-4:25. Warren 145 and 345. Professor Sisler.

The economics and geography of the world's agriculture, providing a basis for understanding past development and future changes in agriculture. Elementary economic principles, historical development, physical geography, and population growth are studied in their relation to agricultural development and the economic problems of farmers. Particular emphasis is placed upon study of the agriculture of various farming regions of the United States, their economic problems, and competitive situation.

330 Local Government. Fall term. Credit three hours. S-U grades optional. Lectures: T Th 9:05. Warren 145. Discussion: T or Th 2:30-4:25. Warren 260. Professor Lutz.

Government in the United States with emphasis upon examination analysis, and resolution of public issues confronting leadership in areas of New York Government organization, administration, functions, and finance are discussed in this context.

351 Agricultural Policy. Fall term. Credit three hours. S-U grades optional. Two lectures plus one discussion section each week. Lectures: T Th 9:05. Bradfield 101. Discussion sections, Th 11:15 or 1:25 or F 10:10. Warren 201. Professor Robinson.

A review of the history of public policies affecting agriculture in the United States and an analysis of the economic effects of alternative farm policies or programs, either proposed or adopted. Among the topics discussed are farm price support and surplus disposal programs, trade policies affecting agriculture, alternative measures to alleviate rural poverty, and farm politics.

450 Resource Economics. Fall term. Credit three hours. Suggested prerequisite: Conservation 201 or consent of the instructor. Lectures: T Th 10:10. Bradfield 105. Discussion: T 1:25-3:25 and as arranged. E. Roberts 223. Associate Professor Allee.

A review of the application of economic concepts to problems in the use of natural resources including, but not restricted to, water, land, forests, and fisheries, with emphasis on the public management of the

environment. Attention will be given to concepts of regional growth and the impact of urban growth and public decision making in the resources area.

452 Studies in Regional Agricultural Development. Spring term. Credit four hours. Lecture: M W F 9:05. Warren 345. Discussion and field trips: T or Th 2-4:25. Warren 160. Professor Conklin.

Practical procedures for assembling information on agricultural resources, farm businesses, agribusinesses, people, and public institutions in farming areas or areas having farming possibilities, and methods for using this information to generate ideas for agricultural improvement. Field trips to a selected nearby area provide opportunities for practice and observation.

550 Economic Analysis of Public Investment. Spring term. Credit four hours. Primarily for graduate students, but open to seniors. Prerequisite: Economics 311 or 511, or consent of instructor. T Th 9:05-11. Warren 261. Assistant Professor Kalter.

The application of economic theory and analysis to the governmental budgeting and expenditure process with emphasis on the welfare criteria of economic efficiency and income distribution. Techniques of benefit-cost analysis, equity analysis, systems analysis, and programming-planning-budgeting systems will be stressed. Discount rates, benefit estimation, externalities, multipliers, risk and uncertainty, and social welfare functions will be covered. Attention will be also focused on issues of cost sharing and reimbursement, and the way and means of intergovernmental payments.

552 Special Problems in Land Economics. Fall or spring term. Credit one or more hours. Open only to graduate students. Prerequisite: 452 and permission of the instructor. Professor Conklin and Associate Professor Allee.

Special work on any subject in the field of land economics that is of particular interest to the student. The student normally is expected to prepare a report on his work that is suitable for mimeograph reproduction and distribution.

637 Administration of Public Agricultural Programs. Spring term. Credit two hours. S-U grades optional. Primarily for graduate students. Undergraduate registration by permission of the instructor. F 2:30-4:25. Warren 260. Professor Lutz.

An examination of government organizations for administering and financing public agricultural programs; a study of some problems of administration and finance, including organization of agencies, management of personnel, budgetary management, inter-

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agency relationships (national, state, and local), and relationships among national, state, and local levels of government. Course 330 or one or more courses in government and public administration are desirable before taking this course.

650 Workshop on Resource Economics. Fall term. Credit variable, two to six hours. Open only to graduate students. Prerequisite: 550 or consent of instructor. T 3-5:30. Warren 261. Assistant Professor Kalter.

The application of economic theory and analysis to governmental decision making with emphasis upon graduate students' research.

651 Seminar on Agricultural Policy. Spring term. Credit two hours. S-U grades optional. Open only to graduate students. M 1:30-3:30. Warren 245. Professor Robinson.

A discussion of agricultural trade, price, and income-support policies and techniques appropriate to the analysis of policy issues.

652 Readings in Philosophy. Spring term. Credit three hours. Open only to Ph.D. candidates. S 9:05-12. Warren 260. Professor Conklin.

Readings are selected for their relevance to research in agricultural economics and are chosen from among such books as *Structure of Scientific Revolutions*, *The Theory of Experimental Inference*, *The Nerves of Government*, *The Structure of Economic Science*, *Economic Philosophy*, and *Probability Statistics and Truth*.

Quantitative Methods

Attention is directed to related courses in Economics, Economic and Social Statistics (ILR), Industrial Engineering and Operations Research, Mathematics, and Statistics and Biometry; selected courses particularly relevant to agricultural economics are dual listed.

310 Introductory Statistics. Fall term. Credit three hours. Prerequisite: Orientation 110 or equivalent. Lecture: T Th 11:15. Warren 45. Discussion: M W or Th 1:25. Warren 145. Computing period of one hour in the afternoon or morning following discussion section, M W Th 2:30, T 10:10, W 3:35, or F 11:15. Warren 360. Assistant Professor Mount.

An introduction to statistical inference including probability concepts, estimation, hypothesis testing, simple linear regression analysis, and one-way analysis of variance.

Statistics II (Industrial and Labor Relations 311). Fall term. Second term of elementary statistics providing students with further basic training in statistical method. This course provides the necessary foundation for statis-

tical inference and includes a treatment of confidence limits and tests of significance. Application is made to problems involving percentages, means, variances, and correlation coefficients with an introduction to non-parametric methods, analysis of variance, and multiple regression and correlation. Two lectures and one laboratory period each week.

315 Prices. Spring term. Credit three hours. Prerequisite: 310 and Economics 101-102. Lectures: T Th 10:10 and W 12:20. Warren 160. Professor Tomek.

Emphasizes the study of agricultural product prices. Reading assignments provide a survey of topics, including price determination, price variation, price discovery institutions such as futures markets, and introductory price analysis; lectures cover selected topics in depth. A term project permits the student to apply selected tools of price analysis and to become acquainted with a library program for the Cornell computer system.

412 Introduction to Quantitative Methods. Spring term. Credit three hours. Prerequisite: 310 or equivalent. Lecture: T Th 11:15. Warren 145. Discussion: to be arranged. Professor to be appointed.

An introduction to decision making under uncertainty, decision rules, inventory control, game theory, linear programming, and special linear programming problems. Primarily for seniors and M. S. candidates; Ph.D. students should take course 512.

Matrix Algebra (Statistics and Biometry 417). Fall term. Credit three hours. Prerequisite: the equivalent of one year of college algebra. Lecture: M W F 9:05. Warren 201. Professor Searle.

Basic matrix algebra with applications in biology, business, economics, and statistics. Arithmetic procedures and other matrix operations; determinants, rank and linear independence, latent roots and vectors, solving linear equations, generalized inverses, direct sums and products. Use of matrices in regression analysis and linear statistical models.

510 Econometrics I. Spring term. Credit four hours. Prerequisite: ILR 311 (Statistics II) or equivalent; Statistics and Biometry 417 or equivalent suggested though not required. Lectures: T Th 2:30-3:45. Warren 245. Professor Tomek.

A comprehensive treatment of the classical regression model with selected extensions, including an introduction to simultaneous equations models and estimation methods, about at the level of *Econometric Methods* by J. Johnston. Applications made to demand, supply, and consumption functions for agricultural products.

511 Econometrics II. Fall term. Credit four hours. Prerequisite: 510; Statistics and Biometry 417 or equivalent suggested. T 2:30-5:00. Warren 160. Assistant Professor Mount.

An extension of the first course, including generalized least squares, estimation with stochastic parameters, analysis of covariance models, and principal components analysis with applications in demand and production theory.

512 Quantitative Methods I. Fall term. Credit four hours. Course 417 or equivalent suggested though not required. M W F 11:15. Warren 160. Professor Robinson.

Linear programming with extensions, including postoptimality analysis, the transportation, transshipment, and assignment models, game theory, and input-output models. Applications made to a variety of problems in agricultural economics.

513 Quantitative Methods II. Spring term. Credit three hours. Prerequisite: 512; an introduction to probability theory useful. M W F 10:10. Warren 261. Professor How.

Probabilistic models and methods including queuing theory, inventory theory, Markov chains, dynamic programming, and simulation. Applications to a variety of problems in agricultural economics and business management are used to explore and evaluate the techniques.

Other

380H Independent Honors Research in Social Science. Throughout the year. Credit one to six hours. Open only to candidates who have met the requirements for the Honors program listed on page 30. A maximum of six credits may be earned in the Honors program.

499 Undergraduate Research. Fall and spring terms. Credit one to three hours depending upon the problem undertaken and the extent and quality of work done. A student desiring to register must attach to preregistration material, the written permission of the staff member who will supervise the work and assign the grade. Open to seniors with quality point averages of 2.7 or higher. Designed to afford opportunities for outstanding undergraduates to carry out independent studies of suitable problems under appropriate supervision.

507 Introduction to Research in Agricultural Economics. Fall term. Credit two hours. Open only to graduate students. W 1:25-3:20. Warren 361. Professor Stanton.

A discussion of problems and methods used in doing research. Emphasis is placed on the organization of research projects,

sources and methods of obtaining data, sampling, and the different methods of analyzing data commonly used by research workers in this field.

Agricultural Engineering

Students in the College of Agriculture with a major interest in a semitechnical agricultural engineering program may elect a varied sequence of courses that will prepare them for opportunities with many of the industries, organizations, and agencies serving agriculture, or for farming enterprises which increasingly require understanding and application of engineering principles. A suggested sequence of courses may be obtained directly from the Department.

Students interested in a professional career in agricultural engineering for research, teaching, extension, design, product development, and manufacturing must take a prescribed sequence of courses that leads to a degree granted by the College of Engineering. The detailed curriculum may be found in the *Announcement of the College of Engineering*.

104 Energy Application in Agriculture. Fall term. Credit three hours. Limited to 25 students per laboratory section. Lectures: T Th 10:10. Riley-Robb 125. Recitation period: F 11:15 or 12:20. Riley-Robb 307. Laboratory: T W or Th 1:25-4. Riley-Robb 160. Associate Professor Black.

An introduction to technology in agricultural engineering, with primary emphasis on applications in the home. The basic principles of water and waste water systems, electrical wiring, lighting, electrical motors, heating, refrigeration, and ventilation will be covered.

106 Mechanical Drawing. Fall term. Credit three hours. Lectures: T Th 8. Riley-Robb 105. Laboratory limited to 40 students per section. Laboratory: W 1:25-4:25. Riley-Robb 425. Mr. Longhouse.

Graphic presentation, including lettering, use of instruments; orthographic projection of multiview drawings including sections, auxiliaries, plans and elevations; pictorial drawing, graphs and charts; elementary descriptive geometry; and the practical applications of these principles to simple problems. Both machine drawing and architectural drawing conventions and practices are discussed and employed in the solving of drawing problems.

107 Advanced Mechanical Drawing. Spring term. Credit three hours. Prerequisite: 106 or sufficient high school drawing. Lectures: W F 8. Laboratories limited to 40 students.

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Laboratory: Th 1:25-4:25. Riley-Robb 425. Mr. Longhouse.

A continuation of course 106 with work on machine drawing, including assembly drawings; intersections; developments; descriptive geometry; sectional and auxiliary views; and the use of conventional practices and symbols. Also studied are graphical methods related to other engineering courses and practical engineering problems; these include engineering graphs and charts; nomography; vector geometry and graphical calculus.

The student will be allowed to perform much of his drawing work with aid of drafting machines. Advanced drafting techniques are also discussed, illustrated, and employed as time permits.

152 Introduction to Agricultural Engineering Measurements. Spring term. Credit three hours. Prerequisite: one term of calculus or concurrent registration. Lecture: T 8. Laboratories: W and F 1:25-4:25. Riley-Robb 160. Professor Levine.

A study of the principles and methods of engineering measurements. Fundamentals of measurement, sources of errors, and measurement systems will be considered, including surveying measurements. Special attention will be given to methods for obtaining measurements that are required in a variety of agricultural engineering problems. An appropriate computing language will be taught and used in the solution of these problems.

153 Engineering Drawing. Fall term. Credit three hours. Open only to plan A and professional engineering students. Lectures: M W 9:05. Riley-Robb 105. Laboratory: M or T 1:25-4:25. Riley-Robb 425. Mr. Longhouse.

Designed to promote an understanding of the engineer's universal graphic language. The lectures will deal primarily with spatial relationships involving the problem-solving techniques of descriptive geometry. The laboratories will develop a working knowledge of drawing conventions, standard and advanced drafting techniques, and their application to machine, architectural, and pictorial drawing problems. Graphs and engineering graphics (nomography and graphical calculus) will also be included. Students will accomplish their work with drafting machines as well as the standard T-square and board. The first half hour of the laboratory will be utilized as in instruction-recitation period.

204 Farm Carpentry. Fall term. Credit two hours. Lecture: T 9:05. Riley-Robb 125. Laboratories limited to 15 students per section. Laboratory: T W or Th 1:25-4:25. Riley-Robb 70. Associate Professor Lechner.

Course includes instruction and skill practice in basic farm carpentry topics, including concrete work, woodworking, building construction, wood preserving and painting, and tool fitting. Each student is required to plan and construct a carpentry project. Indoor furniture projects are not acceptable.

205 Farm Metal Work. Fall or spring term. Credit two hours. Lecture: Th 9:05. Riley-Robb 125. Laboratory: including metal lathe work, M 1:25-4:25 (limited to 24 students); not including metal lathe, fall term, T; spring term, T or Th 1:25-4:25 (limited to 20 students). Riley-Robb 60 and 64. Associate Professor Lechner.

Instruction and practice in fundamentals of electric arc welding, oxyacetylene welding, sheet metal work, pipe fitting, hot and cold metal work, and metal lathe work as they apply to farm shop work for both repair and construction jobs.

222 Farm Surveying. Spring term. Credit three hours. S-U grades optional. Lectures: T Th 9:05. Riley-Robb 105. Laboratory: M T or W 1:25-4:25. Riley-Robb 15 (limited to 16 students per section). Associate Professor Black.

An introduction to plane surveying. The use and care of surveying equipment is stressed, with particular reference to problems in agriculture.

233 Farm Structures. Fall term. Credit three hours. S-U grades optional. Lecture: M W F 8. Riley-Robb 105. Associate Professor Lorenzen.

A study of the facilities and equipment associated with agricultural production on the farmstead, with emphasis on buildings from the viewpoint of structural, environmental, operational, and bio-intrinsic design.

234 Farm Structures Laboratory. Fall term. Credit two hours. Limited to 15 students per section. Open only to students who are currently taking or have previously taken 233, Drawing 106 or Drawing 153. Laboratory: Th or F 1:25-4:25. Riley-Robb 307. (Friday section open only when numbers require.) Associate Professor Lorenzen.

Practice in layout of farmstead production facilities including problems in structural design, insulation, ventilation, and materials handling. Studies of wood, concrete, and other structural materials.

305 Advanced Farm Metal Work. Fall or spring term. Credit one or two hours. Fall term, machine shop instruction; spring term, advanced welding and metal projects. Spring term prerequisite: 205, its equivalent, or permission of instructor. Laboratory: one credit, F 1:25-4; for two credits: one additional 2½ hour laboratory to be arranged.

Riley-Robb 60 and 64. Associate Professor Lechner.

311 Farm Machinery. Spring term. Credit three hours. S-U grades optional. Not open to freshmen. Lecture: T Th 11:15. Riley-Robb 125. One recitation-laboratory each week: T W or Th 1:25-4:25. Riley Robb 74. Limited to 15 students. Professor Millier.

A study of the operating principles, use, selection, and methods of estimating costs of owning and operating farm machines. The laboratory work will include practice in the calibration of planting, fertilizing and pesticide application machinery, plus study of the functional characteristics of agricultural machines and machine components.

312 Farm Power. Fall term. Credit three hours. Prerequisite, 104 or Physics 102, or the equivalent. Lectures: T Th 11:15. Riley-Robb 125. Laboratory, M T or Th 1:25-4:25. Riley-Robb 74. Associate Professor Rehkugler.

A study of the use of power in agriculture, with emphasis on the principles of operation and adjustment of internal combustion engines and their use in farm tractors. Some of the topics covered are: power utilization in the U.S. and world agriculture, Nebraska Tractor Tests, tractor stability and traction, economics of power unit selection, and human factors in tractor design.

313 Electricity on the Farm. Spring term. Credit three hours. Given in alternate years. Prerequisite: 104 or Physics 102 or the equivalent. Lectures: T Th 10:10. Riley-Robb 105. Laboratory: T or Th 1:25-4:25. Riley-Robb 164. Professor Shepardson.

The application of electricity for light, heat, and power on farms, with emphasis on the principles of operation, selection, and installation of electrical equipment for the farmstead. Laboratory sections are combined for one half-day field trip.

[314 Farm Machinery Laboratory. Spring term. Credit two hours. Open to agricultural engineering students, or others only by permission of the instructor. Prerequisite: Physics 102 or equivalent, and coregistration in course 311. Laboratory: T or W 1:25-4:25. Riley-Robb 74. Limited to 12 students per laboratory. Professor Millier. Not given in 1971-72.

Designed to give the student practice in the calibration of seeding, fertilizing, and pesticide application machinery and to study the functional characteristics of agricultural machines and machine components.]

321 Soil and Water Conservation. Fall term. Credit two hours. S-U grades optional.

Must be taken with Agronomy 321. Prerequisite: Agronomy 200 or equivalent, course 222 is recommended. Lecture: F 8. Riley-Robb 15. Laboratory: M or T 1:25-4:25. Riley-Robb 15. Professor Levine.

A study of the principles and practices used in soil and water conservation. Engineering aspects of erosion control, water management and storage, drainage, and irrigation receive primary consideration.

401 Special Problems in Agricultural Engineering. Fall or spring term. Credit one or more hours. Normally reserved for seniors in upper two-fifths of class; undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade. Prerequisite: adequate ability and training for the work proposed. Staff.

Special work in any area of agricultural engineering on problems under investigation by the department or of special interest to the student, provided in the latter case, that adequate facilities can be obtained.

421 Introduction to Environmental Pollution. Spring term. Credit three hours. S-U grades optional. M W F 11:15. Riley-Robb 125. Associate Professor Ludington.

A general course dealing with impairment of the environment by the wastes of man. The cause and effects of air, water, and soil pollution will be discussed. Fundamental factors underlying the waste production, abatement, treatment, and control will be included. A selected number of wastes from urban, rural, and industrial areas will be used to illustrate the factors.

450 Special Topics in Agricultural Engineering. Spring term. Credit one hour. S-U grades optional. Open only to seniors. T 12:20 Riley-Robb 225. Professor French.

Presentation and discussion of the opportunities, qualifications, and responsibilities for positions of service in the various fields of agricultural engineering.

[461 Agricultural Machinery Design. Spring term. Credit three hours. Given in alternate years. Prerequisite: kinematics and components of machines. Two lectures, one laboratory. Time and place to be arranged. Professor Gunkel. Not given in 1971-72.

The principles of design and development of agricultural machines to meet functional requirements. Emphasis is given to computer-aided analysis and design, stress analysis, selection of construction materials, and testing procedures involved in agricultural machine development. Engineering creativity and agricultural machine systems are also stressed.]

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462 Agricultural Power. Fall term. Credit three hours. Given in alternate years. Prerequisite: engineering mechanics (dynamics), or equivalent. Two lectures, one laboratory. Time and place to be arranged. Associate Professor Rehkugler.

Utilization of internal combustion engine energy and other forms of energy in agriculture. Basic theory analysis and testing of internal combustion engines for use in farm tractors and other agricultural power applications. Specific study of tractor transmissions, Nebraska Tractor Tests, and soil mechanics related to traction and vehicle mobility. Economics and human factors in power use and application will be considered.

[463 Processing and Handling Systems for Agricultural Materials. Spring term. Credit four hours. Given in alternate years. Three lectures and one laboratory. Time and place to be arranged. Associate Professor Furry. Not given in 1971-72.

Processes such as size reduction, separation, metering, and drying will be studied. Psychometrics, fluid flow measurement, and an introduction to dimensional analysis and controls for agricultural applications are included. Problem solutions will employ both the analog and digital computers.]

471 Soil and Water Engineering. Spring term. Credit three hours. Given in alternate years. Prerequisite: fluid mechanics and soils, or concurrent registration. Three lectures, one laboratory every other week. Time and place to be arranged. Associate Professor Black.

The application of engineering principles to the problems of soil and water control in agriculture. Includes design and construction of drainage systems and farm ponds, design and operation of sprinkler systems for irrigation.

481 Agricultural Structures and Environment. Spring term. Credit three hours. Given in alternate years. Prerequisite: structural engineering and thermodynamics. Lecture: T Th 11:15. Laboratory: W 1:25-4:25. Riley-Robb 307. Associate Professor Scott.

Synthesis of complete farmstead production units including structures, equipment, and management techniques. Integrated application of structural theory, thermodynamics, machine design, and methods engineering to satisfy biological and economic requirements.

491 Highway Engineering. Credit three hours. S-U grades optional. Offered upon sufficient demand, usually in fall term. Prerequisite: consent of instructor. Principally directed study and individual or team investigations with one 2½ hour class session

per week to be arranged. Professor Spencer.

Emphasis is on secondary roads in study of: economic considerations in road system improvement; road improvement planning and programming; road location and geometric design; engineering soil characteristics and classification; design of roadbed thickness; drainage; stabilization methods and materials; dust palliatives; wearing surfaces.

501 Similitude Methodology. Spring term. Credit three hours. Two lectures, one laboratory. Time and place to be arranged. Associate Professor Furry.

Similitude methodology, including the use of dimensional analysis to develop general equations to define physical phenomena, model theory, distorted models and analogies with an introduction to a variety of applications in engineering. Problem solutions will employ both analog and digital computers.

502 Instrumentation. Spring term. Credit three hours. Prerequisite: consent of instructor. Two lectures, one laboratory. Time and place to be arranged. Associate Professor Scott and staff.

Emphasis on the application of instrumentation concepts and systems to physical and biological measurements. Characteristics of instruments, signal conditioning, shielding and grounding; transducers for measurement of force, pressure, displacement, velocity, acceleration, temperature, humidity, flow; and data acquisition systems, including telemetry, are covered.

504 Biological Engineering Analysis. Fall term. Credit four hours. Prerequisite: consent of instructor, or Engineering 1151. M W F 9:05. Riley-Robb 225. Assistant Professor Cooke.

Engineering problem-solving techniques will be treated. Particular attention will be given to the formulation of biological problems in an engineering context. Experience will be gained in problem definition, mathematical formulation, and interpretation of results. Principles of feedback control theory will be studied and applied to biological systems.

[505 Solid Waste Management. Spring term. Credit three hours. Given in alternate years upon sufficient demand. Prerequisite: permission of instructor. M F 1:25-3. Professor Loehr. Not given 1971-72.

Study of municipal, industrial, and agricultural solid waste. Emphasis on waste characteristics, method of treatment and disposal, and interrelationship with air, water, and land environment. Discussion of economic and political aspects. Intended primarily for graduate students but open to qualified undergraduates.]

506 Industrial Waste Management. Spring term. Credit three hours. Given in alternate years. Prerequisite: permission of the instructor. M F 1:30-3. Riley-Robb 105. Professor Loehr.

Legal aspects, assimilatory capacity of receiving waters, waste sampling and analysis, treatment processes, waste reduction possibilities, waste quantity and quality, reuse and recovery, joint industry-municipal treatment of wastes, sewerage, service charges, case studies. Intended primarily for graduate students but open to qualified undergraduates.

551-552 Agricultural Engineering Project. Fall and spring term. Total credit six hours. Required for M. Eng. degree. Staff.

Comprehensive design projects utilizing real engineering problems. Emphasis on formulation of alternate design proposals, including economics and nontechnical factors, and complete design of the best alternative.

601 General Seminar. Fall and spring term. M 12:20. Riley-Robb 400. Fall term required of all graduate students majoring in the field. Spring term optional. Staff.

602 Power and Machinery Seminar. Spring term. Credit one hour. Prerequisite: graduate status and permission of the instructor. Time and place to be arranged. Staff.

Study and discussions of research and new developments in agricultural power and machinery.

603 Soils and Water Engineering Seminar. Spring term. Credit one or two hours. Prerequisite: graduate status and permission of instructor. Time and place to be arranged. Staff.

Study and discussion of research on selected topics in Irrigation, drainage, erosion control, and agricultural hydrology.

604 Agricultural Structures and Related Systems Seminar. Spring term. Credit one hour. Prerequisite: graduate status and permission of instructor. Time and place to be arranged. Staff.

Study and discussion of farmstead production problems, with emphasis on biological, economic, environmental, and structural requirements.

605 Agricultural Waste Management Seminar. Fall and spring terms. Credit one hour. Prerequisite: graduate status and permission of instructor. F 3:30-5. Riley-Robb 105. Staff.

Study and discussion of the management of agricultural waste, with emphasis on the physical, chemical, biological, economic, and aesthetic requirements.

606 Biological Engineering Seminar. Spring term. Credit one hour. Prerequisite: graduate status and permission of instructor. Time and place to be arranged. Associate Professor N. R. Scott and Assistant Professor Cooke.

The interaction of engineering and biology will be examined, especially the environmental aspects of plant, animal, and human physiology in order to improve communications between engineers and biologists.

Agronomy

The Department of Agronomy offers instruction in both soils and field crops. It accepts as majors both students who are preparing for scientific professions and those who are interested primarily in applications of soil and crops subjects to practical problems. To accommodate all of these interests, the Department offers four areas of specialization: (1) crop science; (2) soil science; (3) crops; and (4) soils (including soil conservation). In addition to College requirements, all of these specializations require a minimum of fifteen semester hours of agronomy, an elementary course in plant physiology, and demonstrated interest in the field. Agronomy majors are required to satisfy a ten-unit practice requirement. This can be accomplished by either farm practice or practice in the specialization.

Students preparing for graduate studies or scientific careers should choose the crop science or soil science specialization. Both require, in addition to the general requirements listed, a minimum of two semesters of calculus and fourteen semester hours chosen from among designated advanced courses in chemistry and physics. Emphasis is placed on the basic physical and biological sciences, and work in agronomy and related fields is selected to complement that training. The soil science curriculum satisfies requirements for professional certification by the Soil Science Society of America.

Students concerned primarily with applications of technical soil and crop subject matter to practical problems should specialize in soils or crops. Minimum departmental requirements are those common to all agronomy students. Curricula emphasize applied courses in agronomy and related fields, supported by those courses in basic physical and biological sciences essential for technical competence in the specialty.

Soil Science

200 Nature and Properties of Soils. Fall or spring term. Credit four hours. S-U grades optional. Prerequisite: Chemistry 103, 107, 115, or Biological Science 131. Lectures: M W F 9:05. Bradfield 101. Laboratory: fall term,

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M T W Th or F 2-4:25; spring term, M T W Th or F 2-4:25; or S 10:10-12:35. Bradfield 102. Fall term, Professor Lathwell. Spring term, Associate Professor T. W. Scott.

A comprehensive introduction to the field of soil science with emphasis on scientific principles and their application in solutions of practical soil management problems.

301 Identification, Appraisal, and Geography of Soils. Spring term. Credit four hours. S-U grades optional. Prerequisite: course 200 or permission of the instructor. Lectures: M W F 11:15. Laboratory: M 2-4:25. Bradfield 105. Associate Professor Arnold.

The soil as a natural body. Principles of identification and classification of geographic units of soil and interpretation of such units for applied objectives. Geography of major kinds of soil of North America in relation to environment and cultural patterns. Field practice characterizing, mapping, and interpreting geographical soil units.

306 Soil Microbiology (lectures). Spring term. Credit three hours. Given in alternate years. Prerequisite: 200 or Biological Science 290. M W F 8. Bradfield 108. Professor Martin Alexander.

A study of the major groups of soil microorganisms, their ecological interrelationships, and the biochemical functions of soil organisms.

307 Soil Microbiology (laboratory). Spring term. Credit one hour. Given in alternate years. Prerequisite: concurrent registration in 306. T 2-4:25. Bradfield 502. Professor Martin Alexander.

Laboratory exercises concerned with the ecology and biochemical activities of soil microorganisms.

310 Agronomy Literature. Fall term. Credit one hour. S-U grades optional. Prerequisite: 200 and 111 or their equivalents. Beginning graduate students accepted by permission of the instructor. Th 12:20. Bradfield 105. Staff.

In addition to study of research and extension periodicals reporting work in agronomy, each student will review several scientific articles and prepare an essay on an appropriate subject in agronomy.

321 Soil and Water Conservation. Fall term. Credit two hours. S-U grades optional. Prerequisite: 200 or equivalent; course 111 is recommended. Must be taken with Agricultural Engineering 321. M W 8 Riley-Robb 15. Professor Zwerman.

A study of the principles and practices used in soil and water conservation. Agonomic aspects of erosion control, water management and storage, drainage, and irrigation receive primary consideration.

324 Soil Fertility and Fertilizers. Fall term. Credit three hours. Prerequisite: 200 or permission of the instructor. M W F 9:05. Bradfield 108. Professor Bouldin.

An integrated discussion of soil-plant relationships with emphasis on the soil as a medium for root growth, the soil as a source of mineral nutrients for plants, resources required for fertilizer production, and the role of fertilizers in crop production.

401 Geography and Appraisal of Soils of the Tropics. Spring term. Credit three hours. S-U grades optional. Lectures: W F 12:20. Discussion: F 2:30-4:25. Bradfield 105. Professor Drosdoff.

Character, production potential, and management requirements of soils of tropical rain forests, tropical savannahs, tropical deserts, and tropical highlands, including soils under paddy culture. Emphasis is on soil properties associated with the principal kinds of soil and bases for their interpretation in terms of production potential and management requirements. Lectures are used to introduce principles whose applications are treated by problem solving, discussion, and independent study of the literature. Individuals who have not had the equivalent of course 200 will be expected to become familiar with elementary principles of soil on their own.

402 Chemical Methods of Soil Analysis. Spring term. Credit three hours. Prerequisite: course 200 and Chemistry 236 or their equivalent. T Th 1:25-3:30. Bradfield 108. Professor Peech.

403 Organic Soils. Fall term. Credit two hours. Given in alternate years. Prerequisite: course 200. T Th 9:05. Bradfield 105. Assistant Professor Duxbury.

A study of organic soils and soil organic matter with emphasis on the physical and chemical properties of organic soils.

[404 Forest Soils. Fall term. Credit two hours. Given in alternate years. Prerequisite: course 200. T Th 8. Bradfield 105. Professor Stone. Not given in 1971-72.

Ecology of forest and wildland soils, including relationships to soil development, vegetation, and land use. Occasional field trips to be arranged.]

406 Use of Soil Information and Maps as Resource Inventories. Fall term. Credit two hours. S-U grades optional. Given in alternate years. T Th. 11:15. Bradfield 105. Assistant Professor Olson.

Principles, practices, and research techniques in interpreting soil information and maps for planning, developing, and using areas of land.

408 Soil Physics, Laboratory. Fall term. Credit two hours. Prerequisite: course 200. Lecture: 11:15. Laboratory: Th 1:25-4:25, or as arranged. Bradfield 502. Professor R. D. Miller.

Experimental methods used in soil physics.

[410 Microbial Ecology. Spring term. Credit two hours. Given in alternate years. Prerequisite: an elementary course in some facet of microbiology. M W 8. Bradfield 108. Professor Martin Alexander. Not given in 1971-72.

An introduction to the basic principles of microbial ecology. Attention is given to the behavior, activity, and interrelationships of bacteria, fungi, algae, and protozoa in natural ecosystems. (Also listed as Biological Sciences 492.)]

450 Special Topics in Soil Science. Fall and spring terms. Credit one to six hours. S-U grades optional. Undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade. The topics to be treated will be arranged at the beginning of each term for individual self-study or for group discussions. Time to be arranged. Staff.

461 Regional Agronomy Studies. Fall term. Credit for hours. Enrollment limited and must be approved by instructor in charge during preregistration. Prerequisite: 111 and 200 or equivalent and permission of the instructor. Discussion: two hours per week. W 12:20-2:00. Bradfield 105. Three-week field-study trip during August 1971. Associate Professor Krenzlin.

Study of soils, crops, agricultural institutions, and industries of Western United States. The purpose is to give breadth of understanding of the field of agronomy and related fields. During the summer field study-trip, each student will be required to keep complete notes of basic subject matter for seminars, discussions, and assignments during the fall semester. Round-trip transportation will be provided from Ithaca to the Western region. Students must finance meals and lodging, costs of which will be held to a minimum.

470 Undergraduate Research in Soil Science. Fall and spring terms. Credit to be arranged. Written permission from the staff member who will supervise the work and assign the grade must be attached to preregistered material. Time to be arranged. Staff.

Independent research on current problems selected from any phase of soil science.

481 Special Studies in Soils of the Tropics. Spring term. Credit three hours. S-U grades optional. Enrollment limited. Prerequisite:

200 and 301 or equivalent and approval of the professor. Lectures and discussion time to be arranged. Eight- to ten-day field trip to tropical area during January intercession. Preregistration required by December 1. Consult professor in charge regarding financial arrangements. Professor Drosdoff.

Designed for advanced students having a primary interest in the tropics. In depth studies of the physical, chemical, and biological characteristics of the soils of the tropics with emphasis on problems of soil fertility, soil-crop management systems, soil classification, etc. The student in independent study of the literature will have an opportunity to concentrate on subject matter and geographic areas of particular interest to him.

501 Soil Chemistry. Fall term. Credit three hours. Given in alternate years. Prerequisite: course 200 and a one-year course in introductory physical chemistry, or consent of the instructor. T Th S 10:10. Bradfield 108. Professor Peech.

Chemical composition and chemical properties of soils, with emphasis on ionic equilibria in soils.

[503 Morphology, Genesis, and Classification of Soils. Spring term. Credit three hours. Given alternate years. Prerequisite: graduate status or permission of the instructor. T Th S 10:10. Bradfield 105. Associate Professor Arnold. Not given in 1971-72.

Principles of soil classification, reactions and processes of soil genesis, and development and significance of major groups of soils of the world. One all-day field trip on a date to be arranged.]

506 Advanced Soil Microbiology. Fall term. Credit one hour. S-U grades optional for graduate students only. Prerequisite: 306 or permission to register. T 12:20. Bradfield 105. Professor Martin Alexander.

Discussions of current topics in special areas of soil microbiology. Particular attention is given to biochemical problems in microbial ecology.

[507 Soil Physics, Lectures. Fall term. Credit three hours. Given in alternate years. Prerequisite: 200 and one year of college physics or permission of the instructor. M W F 11:15. Emerson 334. Professor R. D. Miller. Not given 1971-72.

A study of physical properties and processes of soil, with emphasis on basic principles.]

524 Soil Fertility, Advanced Course. Spring term. Given in alternate years. Prerequisite: graduate status, major or minor in agronomy

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or permission of instructor. T Th S 9:05. Bradfield 105. Professor Bouldin.

A study of selected topics in soil-plant fertilizer relationships with emphasis on concepts of soil fertility, interpretation of experimental data, and soil-fertilizer chemistry.

550 Research Orientation and Perspective. S-U grades optional.

See Agronomy—Crop Science.

560 Graduate Research in Soil Science. Fall and spring terms. By arrangement. Not open to undergraduates. All members of the graduate field.

690 General Agronomy Seminar. Fall and spring terms. S-U grades only. Required of graduate students majoring or minoring in the department. Alternate weeks. T 4:30. Emerson 135.

691 Soil Science Seminar. Fall and spring terms. S-U grades only. Required of students whose major or minor subject is soil science. Alternate weeks with the general department seminar. Time to be arranged. Emerson 135.

Crop Science

111 Introduction to Crop Science. Fall or spring term. Credit four hours. Open to all classes beginning with first semester freshmen. Lectures: M W F 10:10. Bradfield 101. Laboratory: M T W or Th 2-4:25. Emerson 338. Fall term, Assistant Professor Obendorf; spring term, Professor Lucey.

Principles of field crop growth, development and maturation, species recognition, soil and climatic adaptations, liming and mineral nutrition, weed and pest control, cropping sequences, management systems, and crop improvement are considered. Feed crops for livestock and food and fiber crops including hay, silage, pasture, grain, protein and oil crops are emphasized. Field trips to observe and study experimental methods and procedures and/or farm operations are held during laboratory periods.

312 Feed Crops. Spring term. Credit four hours. Prerequisite: an introductory course in crop production. A course in livestock feeding is desirable but not essential preparation. M W F 8. Bradfield 101. Discussion: F 11:15 or 12:20. Emerson 334. Assistant Professor Fick.

The production of field crops with reference to their value for livestock in terms of energy, protein, and other nutritional components. Consideration is given to establishment, management, harvesting, and preservation practices that influence yield and nutritive value. Forage grasses, forage legumes, and corn are emphasized.

[313 Physiological Ecology of Crop Plants. Fall term. Credit three hours. Prerequisite: 200 and 111 or their equivalents. T Th S 9:05. Emerson 334. Professor Musgrave. Not given 1971-72.

Fundamental principles of plant physiology applied to the analysis of the effects of environmental factors on temperature and light reactions, nutrient uptake, and water requirements of crop plants during growth, maturation and dormancy.]

315 Weed Science. Spring term. Credit three hours. Graduate students may register only by permission. Prerequisite: 111 and 200, Biological Sciences 103-104 or the equivalent. Prior or simultaneous courses in organic chemistry or plant physiology would be desirable. Lectures: T Th 8. Bradfield 108. Laboratory: M 2-4:25. Emerson 334. Assistant Professor Duke.

Principles of weed science are examined. Emphasis is given to (a) weed ecology; (b) chemistry of herbicides in relation to effects on plant growth; and (c) control of weeds in all crops. Laboratory covers identification of weeds and physiology of herbicide action.

422 Tropical Agriculture. Spring term. Credit three hours. Prerequisite: a course covering elementary botany and permission of instructor. M W F 10:10. Bradfield 105. Professor H. A. MacDonald.

Designed to provide some knowledge and understanding of the tropical environment and its agriculture. Topics covered include the agriculture, principal crops, cropping practices, and problems of the tropics and subtropics. Particular stress is given to (a) agricultural ecology; (b) agricultural patterns, traditions, and problems; (c) economic crops, their botany, adaptation, cultural requirement, improvement, management, protection production, and use, and (d) resources, limitations, and opportunities for tropical agricultural development and improvement. Independent study in special areas of interest is encouraged and facilitated. Lectures supplemented by illustrations, demonstrations, and discussions.

451 Special Topics in Crop Science. Fall and spring terms. Credit one to six hours. S-U grades optional. Undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade. The topic to be treated will be arranged at the beginning of each term for individual self-study or for group discussions. Time to be arranged. Staff.

461 Regional Agronomy Studies.

See Agronomy—Soil Science.

471 Undergraduate Research in Crop Science. Fall and spring terms. Credit to be arranged. Written permission from the staff member who will supervise the work and assign the grade must be attached to preregistration material. Time to be arranged. Staff.

Independent research on current problems selected from any phase of crop science.

513 Crop Ecology. Fall term. Credit two hours. Given in alternate years. Prerequisite: 111, 200, and Biological Sciences 240. Class meetings to be twice weekly for last ten weeks of semester for two hours per meeting. Times to be arranged. Professor Musgrave.

An extension of course 313 and a study of special techniques used to obtain and analyze physiological data on crop plant responses to environmental conditions occurring in the field.

514 Grasslands and Grassland Research. Fall term. Credit three hours. Given in alternate years. Prerequisite: 111, 200, and Biological Sciences 240, or their equivalents, and permission of instructor to register. M W F 9:05. Bradfield 105. Professor H. A. MacDonald.

A study of ecological factors underlying the development, maintenance, production, and management of different grassland types for various uses, and the principles and practices of grassland and forage crop investigations. Grassland species, types, and associations will be discussed in relation to adaptation, production, and use. Emphasis will be on research methods and techniques in the study of temperature, arid regions, and tropical grasslands.

522 Special Studies in Tropical Agriculture. Spring term. Credit three hours. S-U grades optional. Prerequisite: 111 and 313 or equivalent and permission of instructor. Field laboratory trip to tropical area held during preceding January intersession but, because of limitation on participation, the field trip is not a prerequisite or a requirement of the course. Consult professor in charge regarding laboratory prior to December 1. Professor H. A. MacDonald.

A study and discussion course designed for advanced students having special interest in tropical and world agriculture. Study and discussion of systems of agricultural production, ecological influences, and cultural practices of tropical and arid areas. Special attention will be given to tropical crops, their improvement, production, and management. The application of modern technology to tropical and arid region agriculture and the influence of change will be discussed. Independent study in areas or subjects of

particular interest is encouraged and facilitated.

550 Research Orientation and Perspective. Fall term. Credit two hours. S-U grades optional. T Th 10:10. Emerson 334. Professor H. A. MacDonald.

A course to familiarize students with the philosophy, organization, method, and conduct of research; and to provide information and practice in planning, organizing, writing, and oral presentation of results. The latter part of the course will deal with the reporting of research progress and results in relation to graduate study, seminar presentation, and thesis preparation. Active student participation is required.

561 Graduate Research in Crop Science. Fall, spring, and summer terms. By arrangement. Not open to undergraduates. All members of the graduate field.

690 General Agronomy Seminar. S-U grades only.

See Agronomy—Soil Science.

692 Crop Science Seminar. Fall and spring terms. S-U grades only. Required of students whose major or minor subject is crop science. Time to be arranged. Emerson 135.

Animal Science

A comprehensive program of courses is available to students interested in almost any phase of animal science. In consultation with an adviser, a student may select a sequence of courses that would prepare him for (1) livestock farming—dairy cattle, beef cattle, sheep, swine, horses, and laboratory animals; (2) positions in the feed and meat packing industries; (3) service in extension; (4) a variety of agricultural businesses; (5) entry into a veterinary college; or (6) graduate work. In the latter case, the usual program is modified to include the necessary physical and biological sciences that would permit following the more specialized fields of animal nutrition, animal physiology, animal breeding, animal genetics, or meat processing.

Students are generally advised to register for courses 100, 112, and 220 before electing the more advanced courses.

100 Introductory Animal Science. Fall term. Credit three hours. S-U grades optional. Lectures: W F 10:10. Morrison 146. Laboratory: T Th or F 2-4:25. Livestock Pavilion. Associate Professor Elliot.

Designed to acquaint the beginning student with the development, scope, economic importance, problems, and language of the

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livestock industry. All commercially important classes of farm animals are considered with emphasis on dairy cattle, beef cattle, sheep, and swine. The place of the biological sciences in a rapidly changing animal agriculture is stressed. The intent is to give insight into opportunities in the field and to serve as an introduction to subsequent specialized courses.

101 Livestock Management. Fall term. Credit three hours. For veterinary students only. Lectures: T Th 8. Morrison 163. Laboratory: T 10:10-12:35. Livestock Pavilion. Associate Professor Elliot.

Distribution, significance, problems, and practical management of commercially important classes of farm animals.

105 Contemporary Perspectives of Animal Science. Spring term. Credit one hour. Prerequisite: an interest in animal science. Taught by the entire faculty of the Department of Animal Science, Paul Miller in charge. T 1:25, W 10:10, W 12:20.

A forum for students and faculty to discuss the contemporary and future role of animals in relation to the needs of man. Sections containing about 15 students will meet weekly with one faculty member. Informal discussion will be emphasized following short presentations by faculty and graduate students with special competence in the topic of the week.

241 Applied Livestock Selection and Meat Evaluation: Beef Cattle, Sheep, and Swine. Fall term. Credit two hours. Prerequisite: 100 or permission to register. Lecture and laboratory period: W 2-4:25. Livestock Pavilion, Barns, and Morrison 82. Professors J. I. Miller and Wellington.

Practical application of the various methods used in determining the utility value of market and breeding classes of meat animals and carcasses. Grading standards, meat quality and yield factors, breeding records, performance, and progeny tests are considered. A one-day field trip is taken to study market and consumer acceptability of meat products.

260 Beef Cattle. Spring term. Credit three hours. Prerequisite: 100 or permission to register. Lectures: T Th 10:10. Morrison 163. Laboratory: F 2-4:25. Livestock Pavilion and Beef Cattle Barns. Professor J. I. Miller.

A general course in beef-cattle production. The management, feeding, breeding, selection, and marketing problems involved in the beef-cattle enterprise are emphasized. A one-day field trip is taken to study successful beef production methods.

265 Horses. Spring term. Credit two hours. Prerequisite: 100 or permission to register. Lecture: Th 9:05. Morrison 146. Laboratory:

Th 1:25-4:25. Livestock Pavilion. Associate Professor Lowe and Assistant Professor Hintz (in charge).

A course in selection, management, feeding, breeding, training, and marketing of light horses.

365 Seminar on Horse Production. Spring term. Credit two hours. Prerequisite: 112, 220, 221, and 265, or equivalent. Enrollment limited to 18 students. F 2-4:35. Morrison 163. Associate Professor Lowe and Assistant Professor Hintz (in charge).

Discussion of the management of various types of horse enterprises such as the breeding farm, training stable, and riding stable. One all-day field trip will be taken.

370 Swine. Fall term. Credit three hours. Prerequisite: 100, 112, 220 and 221 also recommended. Lectures: T Th 11:15. Morrison 163. Laboratory and discussion periods alternate M 1:25-4:25. Morrison 164 and Swine Barns. The laboratory and discussion period is given on alternate Mondays arranged so students can take 380 concurrently. Professor Pond.

A general course in the characteristics of swine and their breeding, feeding, management, and selection. Laboratory and discussion periods are designed to give the student a practical knowledge of the pig as an animal and of commercial swine production practices.

380 Sheep. Fall term. Credit three hours. Prerequisite: 100; courses 112, 220, and 221 also recommended. Lectures: T Th 10:10. Morrison 163. Laboratory and discussion periods alternate M 1:25-4:25. Morrison 164 and Sheep Barns. The laboratory is given on alternate Mondays arranged so students can take 370 concurrently. Professor Hogue.

A general course in the breeding, feeding, management, and selection of sheep. Lectures and laboratory are designed to give the student a practical knowledge of sheep production as well as the scientific background for improved practices.

400 Livestock Production in Warm Climates. Spring term. Credit three hours. Prerequisite: 112, 220, and 221 or permission of the instructor. Lectures and discussions: T Th 10:10-12:05. Morrison 342. Professor McDowell.

A discussion of problems and potential role of animals as a source of food, power, and fiber in the North-South 30° latitude region of the world. The influence of the physical environmental conditions; problems in feed production, economic considerations for livestock production, cultural traditions as factors in livestock production, and planning for livestock improvement programs will be discussed.

401 Special Studies on Problems of Livestock Production in the Tropics. Spring term. Credit three hours. Prerequisite: 400. Enrollment limited and must be approved by instructor. Lecture and discussion time to be arranged. Professor McDowell.

Initial meetings will be in early January followed by an eleven-day field trip to a tropical area during January intersession. The purpose is to give a breadth of understanding of problems of livestock and related areas of agricultural production in a tropical environment for foreign students and U.S. students interested in careers overseas. Observations made during the field trip will be utilized for in-depth studies by individual students of specific problems. Preregistration required by December 1. Consult professor in charge regarding financial arrangements for travel and requirements.

403 Forages of the Tropics for Livestock Production. Spring term. Credit three hours. Prerequisite: a course in crop production and in livestock nutrition and permission of the instructor. Lectures: M Th 12:20. Discussion M 1:25. Professors Crowder (in charge), McDowell, Reid, MacDonald, Associate Professor Van Soest.

A review of the agronomic characteristics and production of grasses suitable for tropical areas, relationship to regions of adaptation, and utility for grazing and livestock feeding. Attention will be given to the occurrence of natural grasslands, and to native and sown pastures. Methods of establishment, fertilizer requirements and plant responses, weed control measures, irrigation, and cultural practices will be considered. Aspects of grass-legume combinations under tropical conditions are examined. The influence of soil conditions and the importance of elements of the tropical environment on plant growth cycles and nutritive value are stressed. Systems of management for livestock use will be emphasized. Methods of determining nutritive value and digestibility studies are included.

Animal Physiology (Veterinary 310). Spring term. Credit three hours. Prerequisite: one year of biology or zoology and college courses in chemistry. Lectures and demonstrations arranged especially for students of agriculture but open to others. M W F 10:10. Veterinary College D-105. Professor Sellers.

Health and Diseases of Animals (Veterinary 470). Spring term. Credit three hours. Not open to first-year students or to those who have had no course in animal science. M W F 11:15. Veterinary College C-207. Dr. Loomis and collaborators.

The causes and the nature of the common diseases of livestock are discussed. Emphasis is placed on the prevention and control of animal diseases.

Meats

290 Meat and Meat Products. Fall or spring term. Credit three hours. Lectures: T Th 9:05. Laboratory: fall term, M T or Th 1:25-4:25; spring term, M T or W 1:25-4:25. Morrison 82. Associate Professor Stouffer.

The course deals with the handling of red meat and poultry following slaughter. Composition, postmortem changes, and organoleptic changes of meat will be discussed. The course will also include packaging, preservation, development of new products, and merchandising of meat, poultry, eggs, and fish. Field trips to commercial plants will be taken.

[293 Meat Cutting. Fall or spring term. Credit one hour. Enrollment limited to 5 students each term. Prerequisite: 290 and permission to register. One laboratory each week, time to be arranged with instructor. Morrison 91. Mr. Holley. Not given in 1971-72.

Supervised practice in meat selection, cutting, and merchandising for students with a special interest in meats.]

490 Meat Technology. Spring term. Credit three hours. Prerequisite: 290 or permission. Lecture: T Th 11:15. Morrison 82. Laboratory: Th 1:25-4:25. Professor Wellington.

The character of muscle as a food, muscle structure, meat product formulations and production, methods for meat-product quality control, product testing, and improved meat packaging. The basic principles of meat preservation, processing, and meat-product development through laboratory demonstration and practice in the pilot meat plant in Morrison Hall.

Dairy Husbandry

250 Dairy Cattle. Fall term. Credit three hours. S-U grades optional. Lecture: T Th 9:05. Laboratory: M 2-4:25. Morrison 163. Associate Professors Merrill and Schmidt.

Designed for students with a general interest in dairy cattle and who do not have the prerequisites for course 350. Students with a major interest in dairy production should take 350.

Characteristics and trends of the dairy industry; study of dairy breeds; factors in breeding and development of dairy cattle; milking methods and milk production problems; efficient feeding; and care, management, formulating rations, planning breeding program, and record keeping.

251 Dairy Cattle Selection and Type Evaluation. Spring term. Credit three hours. Laboratory: W 2-4:25 throughout the term, S 10:10-12:35 during first half of term, and

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all day Saturday during last half of term. Livestock Pavilion. Professor Trimberger.

A beginning course in the selection and type evaluation of all breeds of dairy cattle. Emphasis on herd improvement through high production and conformation characteristics for practical type to achieve wearability for high lifetime production. Educational lectures, demonstrations, and practice sessions include all-day trips to outstanding herds in the state.

350 Dairy Cattle Production and Management. Spring term. Credit three hours. (Credit one hour if course 250 taken previously). Prerequisite: 112, 220, and 221. (Course 221 may be taken concurrently.) Lectures: T Th 11:15-12:05. Laboratory and discussion: T 1:25-4:25. Morrison 163. Associate Professors Merrill and Schmidt.

Designed for students who have an extensive interest in dairy cattle production and management. Analysis of dairy cattle breeding, housing, and management systems; development of feeding systems for economical production; and study of the principles of milk secretion and milking procedures, including evaluation of milking systems. Consideration will be given to the application of modern technology in these areas including farm visits to observe this technology in operation.

352 Advanced Dairy Cattle Selection. Fall term. Credit one hour. Prerequisite: 251. Registration by permission. Practice hours to be arranged. Professor Trimberger.

Intended primarily to give additional training in comparative judging to successful students of 251. Members of the class are selected to represent the institution in intercollegiate judging competitions.

451 Physiology and Biochemistry of Lactation. Spring term. Credit three hours. Given if ten or more students register. Prerequisite: 427 or a course in physiology. Lecture: T Th 9:05. Morrison 163. Laboratory: Th 2-4:25. Morrison 174. Associate Professor Schmidt.

An advanced course in the anatomy of the mammary gland, the physiological mechanisms of milk secretion, and biochemical synthesis of milk constituents in laboratory and farm animals.

455 Dairy Cattle Nutrition. Fall or spring term. Credit three hours. Prerequisite: a course in animal nutrition or permission of instructor. Given if eight or more students register. Given under the extramural program at regional locations to be arranged. Lectures and laboratory. Associate Professor Coppock and staff.

Designed to provide Cooperation Extension agents and vocational agricultural instructors

with in-depth training which relates to the nutrition of the dairy cow. Areas of emphasis will include the anatomy and physiology of the digestive tract, biochemical relationships important in ruminant nutrition, metabolic diseases, and systems of feed analysis and feed formulation. The most recent research findings will be related to practical problems faced by Extension agents.

456 Dairy Cattle Physiology and Management. Fall or spring terms. Credit three hours. Prerequisite: a course in physiology or permission of instructor. Given if eight or more students register. Given under the extramural program at regional locations to be arranged. Lectures and laboratory. Assistant Professor Natzke and staff.

Designed for in-depth training in physiology of location and reproduction, and dairy cattle management for Cooperative Extension agents and vocational agricultural instructors. Aspects of anatomy, physiology, and endocrinology will be discussed as they relate to milking, mastitis, housing, calf raising, and other management factors.

Animal Breeding and Physiology

220 Animal Reproduction and Development. Fall term. Credit three hours. Prerequisite: Biological Sciences 101 and 102 or 103 and 104. Limited to 40 students per laboratory section. Lectures: T Th 9:05. Morrison 146. Demonstration and laboratory: M T W Th F 2-4:25, or T 10:10-12:35. Morrison 174. Professor Foote.

An introduction to the comparative anatomy and physiology of reproduction of farm animals. The life cycle from fertilization of ova through development and growth of sexually mature individuals will be studied, with emphasis on physiological mechanisms involved, relevant genetic control, and the application to fertility regulation and improvement of animal populations. An audio-tutorial laboratory is available for independent study and to prepare for laboratory experiments.

221 Introductory Animal Genetics. Spring term. Credit three hours. Prerequisite: Biological Sciences 101 and 104. Lectures: M W 10:10. Morrison 146. Laboratory W Th or F 2-4:25 or Th 11:15-1:35. Morrison 342. Assistant Professor P. D. Miller.

An introductory course in the breeding of large animals. Basic genetic principles, heritability of quantitative traits, estimation of breeding value, progeny testing, inbreeding, crossbreeding, lethal genes, genetic resistance to disease.

420 Quantitative Animal Genetics. Fall term. Credit three hours. Lecture: T Th 11:15.

Laboratory: W or F 2-4:25. Morrison 342. Associate Professor Van Vleck.

A consideration of the problems involved in the improvement of animals, especially farm animals, through the application of the theory of quantitative genetics with emphasis on the selection index.

421 Seminar in Animal Genetics. Fall term. Credit one hour. Must be taken concurrently with 420. Time and place to be arranged. Associate Professor Van Vleck and staff.

422 Research Techniques in Quantitative Animal Genetics. Fall term. Credit one hour. Prerequisite or concurrent with 420. Time and place to be arranged. Associate Professor Van Vleck.

An introduction to methods of research in quantitative genetics and animal breeding including estimation of heritability, repeatability, and genetic and phenotypic correlations.

424 Animal Genetics. Fall term. Credit two hours. For veterinary students only. Lecture: M 8. Morrison 163. Laboratory: W 10:10-12:35. Morrison 164 and 174. Associate Professor Van Vleck.

Principles of genetics; sex determination and sex linkage; inheritance of characteristics in domestic animals, with special reference to lethal genes, genetic resistance to disease and quantitative characters; progeny testing, genetic relationships, and inbreeding.

427 Fundamentals of Endocrinology. Fall term. Credit four hours. Prerequisite: a course in human or veterinary physiology, or by permission. Lecture: T Th S 10:10. Morrison 167. Laboratory: T Th 2-4:25. Professor Hansel.

A general course in the physiology of the endocrine glands and the roles played by each hormone in the regulation of normal body processes. The laboratory work consists of a series of experiments designed to illustrate the basic principles of endocrinology.

430 Livestock Improvement through Artificial Breeding. Spring term. Credit four hours. Prerequisite: 220, 221 or equivalent, and consent of instructor. Lecture: T 10:10. Recitation to be arranged. Laboratory: T and F 2-4:25. Morrison 174 and 167. Associate Professor R. W. Bratton.

The application of principles of physiology and genetics in the artificial breeding of farm livestock so as to maximize genetic improvement of those traits of economic importance. The laboratories will provide opportunity for students to obtain experience in the techniques relevant to both the male and the female aspects of artificial insemination

of large farm animals, and to study the physiological, genetical, and economic problems relevant to the further improvement of livestock through the application of artificial insemination.

440 Advanced Reproductive Physiology. To be taught one term each year by a visiting professor. Credit three hours. M W F 10:10. Laboratory: W 2:30-4:25. Room to be arranged. Consult Professor Hansel for details.

Subjects may include neuroendocrinology, biochemistry related to reproductive physiology, or biochemistry of the gametes depending on the qualification of the visiting professor.

520 Experimental Methods in Quantitative Genetics and Animal Breeding. Fall term. Credit three hours. Prerequisite: Statistics and Biometry 417, and either Statistics and Biometry 513, or a course in mathematical statistics. Time and place to be arranged. Professor Henderson.

Estimation of genetic and environmental parameters required to design efficient selection programs. Particular emphasis is given to interpretation of experimental and survey data with unequal subclass numbers and to prediction of genetic progress resulting from alternative selection methods.

610 Seminar in Animal Reproduction and Endocrinology. Spring term. Noncredit. Open to graduate students with majors or minors in animal physiology. T 4:30. Morrison 348.

620 Seminar in Animal Breeding. Fall or spring term. Credit one hour. Open to graduate students with major or minor in animal breeding. Time and place to be arranged.

Mammalian Physiology (Biological Sciences 414).

Comparative Physiology of Reproduction of Vertebrates (Poultry Science 425).

Animal Nutrition

112 Livestock Nutrition. Spring term. Credit four hours. S-U grades optional. Prerequisite: Chemistry 103, 107, or Biological Science 131. Lecture: M W F 9:05. Morrison 146. Laboratory: M W Th or F 2-4:25. Morrison 164. Professor S. E. Smith.

An introductory course in animal nutrition, covering fundamentals of nutrition, the composition of feeds, feeding standards, and their application to various forms of production in dairy and beef cattle, sheep, swine, and horses.

311 The Principles and Practice of Animal Feeding. Spring term. Credit three hours. Given primarily for students in the Veterinary

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College. Lectures: M W 8. Morrison 163. Laboratory: T 10:10-12:30. Morrison 164. Associate Professor Hogue.

Consideration is given to the basic principles of animal nutrition, nutritive requirements for various body functions; the identification, composition, and nutritive value of feeds, and the formulation of animal rations. The species covered include dairy cattle, beef cattle, sheep, swine, and horses, and there will be some consideration of dogs, cats, and other small animals.

410 Principles of Animal Nutrition, Lectures. Fall term. Credit three hours. Prerequisite: a course in human or veterinary physiology, and a course in organic chemistry or biochemistry, or permission of the instructor. Lecture: M W F 10:10. Morrison 163. Professor Loosli and Professor Nesheim, and Assistant Professor Hintz.

The chemistry and physiology of nutrition and the comparative nutritive requirements for maintenance, growth, reproduction, egg production, and lactation.

411 Principles of Animal Nutrition, Laboratory. Fall term. Credit one hour. Enrollment limited to 12 students. Must be concurrently registered in 410. Registration by permission only. Time to be arranged. Professor Nesheim and Assistant Professor Hintz.

Laboratory problems with animals will be designed to introduce the student to techniques of experimentation in nutrition.

511 Laboratory Work in Animal Nutrition. Fall term. Credit three hours. S-U grades optional. Prerequisite: quantitative analysis and 410, or its equivalent, or permission of the instructor. Laboratory: M W F 2-4:25. Morrison 342 and 443. Professor Warner.

Each student engages in a series of short research projects with experimental animals, such as rats and sheep. Both classical and modern techniques of animal experimentation are considered. The applications of biochemical methods to the solution of animal nutrition problems are stressed.

619 Field of Nutrition Seminar. Fall and spring terms. No credit. M 4:30. Fall, Morrison 348. Spring, Savage 100.

Current research in nutrition presented by visitors, graduate students, and faculty.

Advanced Nutrition

A series of nutrition courses are offered jointly by the Department of Human Nutrition and Food, College of Human Ecology; Department of Animal Science, College of Agriculture; Department of Poultry Science, College of Agriculture; and the Graduate School of Nutrition.

Prerequisites include courses in nutrition, physiology, and biochemistry to include intermediary metabolism, or permission of instructor.

Among the topics presented are the biochemical and physiological bases of digestion, absorption, transport and metabolism of nutrients, and species differences where applicable. Historical as well as current concepts of nutrition are discussed.

Proteins and Amino Acids (Food and Nutrition 501). Fall term. Credit two hours. M W 10:10. Martha Van Rensselaer 339. Associate Professor M. A. Morrison.

Lipids and Carbohydrates (Poultry Science 502).

503 Nutritional Energetics. Spring term. Credit two hours. M W 10:10. Morrison 342. Professor Reid.

Minerals and Vitamins (Poultry Science 504).

505 Biochemistry of Gastrointestinal Fermentation. Fall term. Credit two hours. S-U grades optional. Prerequisite: quantitative analysis, course 410 and Biochemistry 431, or permission of the instructor. Lectures: to be arranged. Morrison 342 and 301. Associate Professor Van Soest.

Gastrointestinal fermentations in relation to utilization of cellulosic materials as food. Chemical composition of plants and factors affecting their nutritive value.

513 Forage Analysis. Fall or spring term. Credit two hours. Prerequisite: Animal Science 505 and permission of the instructor. Enrollment limited to 5 students per term. Laboratory to be arranged. Associate Professor Van Soest.

Departmental Research and Seminars

395 Undergraduate Research. Fall and spring terms. Credit one to three hours, depending upon the problem undertaken and extent and quality of work done. Undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade. Open only to juniors and seniors of high scholastic ability with grade averages of 2.7 or above.

Designed to afford opportunities for outstanding undergraduates who plan to go to graduate school to carry out independent studies of suitable research problems under appropriate supervision. Each student will be expected to make a review of the literature, prepare a project outline, conduct the research, and write a summary report.

402 Undergraduate Seminar. Spring term. Credit one hour. S-U grades optional. Limited to advanced undergraduates interested in animal husbandry. Hour to be arranged. Morrison 348. Staff.

A study of the pertinent literature of special topics in animal science. Students will be required to review current literature and to present oral and written reports.

500 Research. Fall and spring terms. Credit and hours by arrangement. All members of departmental staff.

601 Seminar. Fall and spring terms. Credit one hour. Required of all graduate students taking either a major or a minor subject in animal science. M 11:15. Morrison 348. Staff.

Biological Sciences

Students will be provisionally accepted in the biological sciences specialization as established by the Division of Biological Sciences during their sophomore year; application should be made to the Division of Biological Sciences office. Final admission to the specialization will require completion of (1) a year of biology (course 101-102 or equivalent; Advanced Placement may be allowed, at the student's choice, on receipt of a score of 5 in the Princeton Advanced Placement Test); (2) a year of general chemistry (preferably Chemistry 107-108); and (3) a year of calculus (Mathematics 111-112 or 111-122 or 107-108). Whenever possible, the student should include the above three subjects in his freshman schedule and complete organic chemistry and genetics in the sophomore year. A student is not encouraged to undertake a specialization in biological sciences unless his performance in the above courses gives evidence of capacity to do satisfactory work at a more advanced level.

In addition to the introductory courses in chemistry, biological sciences and mathematics, each specializing student must complete the following: (1) Chemistry 353-355 (or 355 and 357-358 or 353-301 or 357-358-301); (2) a year of physics (Physics 101-102 or 207-208); (3) course 281 (Genetics); (4) course 431 (Biochemistry); (5) the breadth requirement outlined below; (6) one of the concentration areas outlined below; and (7) a minimum of six hours of college credit in a foreign language. It is recommended that the language requirement be met with French, German, Japanese, or Russian (other languages may be substituted only with special permission). The six hours may be satisfied by Advanced Standing but not by Advanced Placement. Qualification in a foreign language, as defined by the College of Arts and Sciences, meets the Division's language require-

ment. The Division of Biological Sciences does not have a practice requirement, but all students are strongly encouraged to seek appropriate experience of a professional nature; inquiry should be made at the Student Practice Office. *Students anticipating a concentration in biochemistry should contact an adviser in biochemistry as soon as possible after provisional admission to the major.*

The breadth requirement is designed to insure that each major student becomes familiar with a minimum number of different aspects of modern biology. In fulfillment of this requirement, each student must pass one of the listed courses in two of the following eight categories: (1) *Neurobiology and Behavior*: courses 320, 421; *Psychology* 201, 323. (2) *Developmental Biology*: courses 347, 386. (3) *Ecology and Evolution*: courses 361, 475. (4) *Microbiology*: course 290A. (5) *Morphology*: courses 273, 313, 316, 345. (6) *Physical Science and Mathematics*: Chemistry 236, 287, or 389; Geological Sciences 101; Mathematics 213 or 221; Statistics 510. (7) *Physiology*: 242 or 340, 410, 414. (8) *Taxonomic courses*: 316, 371, 344; Entomology 212; Plant Pathology 309.

The concentration requirement is designed to help the student achieve depth in some area of biology of his own choosing. It permits maximum flexibility, while insuring that the selection of advanced courses will form a coherent and meaningful unit. The student should seek the advice of his adviser in selecting the courses he will take in fulfillment of both the breadth and concentration requirements. The possible concentration areas are:

(1) *Animal Physiology and Anatomy*: Twelve hours, usually selected from courses 273, 313, 316, 386, 410, 410A, 412, 414, 419, or 512; Animal Science 427-428; Poultry Science 425, 520; Veterinary Medicine 924.

(2) *Neurobiology and Behavior*: Course 320 at least one semester of 620, and eleven hours, including a second course in neurobiology, to be selected in consultation with the adviser.

(3) *Biochemistry*: The student must fulfill the organic chemistry requirement by taking Chemistry 355, 356, 357, 358. Chemistry 236 must be taken under the breadth requirement unless Chemistry 116 was taken. In addition, the student should take Chemistry 287-288 (or 389-390) and Biological Sciences 433 or 434.

(4) *Botany*: Courses 242 or 340, 345, 347, and 371 (two of these may be selected under the breadth requirement).

(5) *Ecology and Evolution*: At least fourteen hours, selected in consultation with an adviser. A course in introductory ecology, a course in systematics, and a course in physiology must be included.

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(6) *Genetics and Development*: Nine hours, usually selected from the following: courses 280, 347A, 347B, 386, 440, 441, 475, 480, 484, 488, 495A, 495B, 584A, 584B, Statistics 510, Plant Breeding 505, 515.

(7) *Microbiology*: Courses 290A and B, which may be selected under the breadth requirement, plus three courses in microbiology of which at least one must be selected from among the following: 391B, 394, 490B, 495B or Veterinary Medicine 340. This requirement may not itself satisfy the requirements for certification by the American Academy of Microbiology.

Students who, for good reason, wish to undertake a course of studies not covered by these seven concentration areas may petition for permission to do so.

Students interested in teaching biology in secondary schools may specialize in biological sciences for the B.S. degree and then complete the requirements for the M.A.T. (Master of Arts in Teaching) degree during a fifth year in the Graduate Field of Education. The fifth year includes one semester of graduate study in the sciences, a summer of preparation for teaching, and one semester of internship in a secondary school. Stipends and fellowship support are available to selected candidates in the fifth year. Students interested in the five-year program leading to secondary school teaching are urged to consult their adviser and an adviser in the Department of Education during their freshman year.

THE HONORS PROGRAM offers a student an opportunity to do independent work under the supervision of a member of the faculty. This entails independent laboratory work on a project in addition to writing a thesis. Candidates for this program must have at least a 3.0 cumulative average, although the committee will entertain petitions for special cases. He must also obtain a sponsor in a biology-oriented basic or applied science within the University. An Honors candidate will ordinarily enroll for credit in a research course under the direction of the faculty member acting as his Honors supervisor. No more than four credit hours of research courses can be used for completion of the requirements in the area of concentration. Recommendation to the faculty that a candidate graduate with Honors will be the responsibility of the Honors Program Committee. Students interested should consult their adviser for further details, preferably during the first term of the junior year.

Registration for the Honors program can be no later than the first term of the senior year. The final report of the student's work must be in the hands of the Committee not later than the first day of the study period to the week of final examinations.

General Courses

101-102 Biological Sciences. Throughout the year. Credit two hours a term. Must be taken concurrently with 101L and 102L. Biological Sciences 101 is prerequisite to Biological Sciences 102, unless special permission is obtained from the instructor. 101-102 cannot be taken for credit after 107-108. Lectures, M W F 8, or M W F 10:10. Baker 20. Two preliminary examinations will be given each term at 7:30 in the evening. Professor Keeton, Assistant Professor Ambrose, Mr. Zollinoffer, and assistants.

Designed both for students who intend to specialize in biological sciences and for those specializing in other subjects, such as the social sciences or humanities, who want to obtain a thorough knowledge of biology as part of their general education. Plant and animal materials are considered together rather than in separate units. The fall semester covers cellular biology, the biochemistry of metabolism, physiology and anatomy, and behavior. The spring semester includes genetics, developmental biology, evolutionary theory, the biology of populations and communities, the origin of life, and evolutionary patterns in the plant and animal kingdoms. Each topic considered in the light of modern evolutionary theory.

101L-102L Biological Sciences. Throughout the year. Credit two hours a term. Must be taken concurrently with 101 and 102. This course will consist of one three-hour laboratory each week as well as a weekly lecture section for discussions, special lectures, etc. Laboratory, M T W or Th 1:30-4:25, or T Th or F 10:10-1:00, or S 9:05-11:55, or M T or W 7:30-10:20 p.m. Fall term: The general concepts of biology with particular emphasis on socially relevant topics will be covered. Optional areas of approach will be levels of organization, evolution, contemporary perspectives, and natural history. Spring term: A continuation of the laboratory approaches in 101L. In addition, laboratory sections will be offered that approach biology from several diverse viewpoints drawn from the following options: botany, plant physiology, environmental physiology, molecular biology, morphology, zoology, neurobiology and behavior, population biology, and ecology (plant, marine, and animal).

106 Interactive Computing for Students of Biological Sciences. Spring term. Credit one hour. Lectures every other week, T 1:30. Stimson G125. Assistant Professor Howland.

An introduction to computing using the interactive language FOCAL with a discussion of other algebraic computing languages such as BASIC and elementary FORTRAN. Students will be issued tickets for five hours of computing time at the Division of Bio-

logical Sciences Interactive Computing Facility. Applications to problems in the biological sciences will be emphasized.

107-108 Biology for Non-Majors. Throughout the year. Credit three hours a term. Limited to 500 students. This course can be used to fulfill the Distribution Requirement in the Colleges of Arts & Sciences and Agriculture, but may not be used as an introductory course for the major in biological science. *Students who are uncertain of their choice of major should register in course 101-102. Note that course 107-108 may not always satisfy as a prerequisite to second and third level courses in biology.* Attendance in 107 is requisite for registration in 108, unless special consent is sought and obtained from the instructor. May not be taken for credit after 101-102. Lectures, M W F 9:05 or 11:15. Stimson G-25. Conferences, M T W Th or F 2:00-4:15. Rooms to be arranged. Students do not preregister for the conferences; assignments will be made at the end of the first week of the semester. Each student must attend a conference on alternate weeks. Two preliminary examinations will be given each term at 7:30 in the evening; the dates are October 25 and December 6, 1971, and March 8 and April 26, 1972. No lectures will be given on these examination days. Associate Professor Blackler.

This course offers students who plan *not* to major in biological sciences the opportunity of taking a broad introductory course in modern biology, without the necessity of performing the detailed and formal laboratory study normally required. Nevertheless, the presentation is neither a course in social biology nor an attempt to popularize biology, but addresses itself to biological principles and phenomena with academic rigor. The content is designed to appeal to anyone who seeks a comprehensive knowledge of biology as part of his general education. Living things of all kinds are used as examples in a biological inventory which includes cellular life, life chemistry, heredity, evolution, and reproduction, as well as coverage of ecology, behavior, and the special case of man.

The conference sessions enable small groups of students to meet with the instructor and his assistants, and will be used for discussions, demonstrations and laboratory projects.

201-202 Biology and Society. Fall and spring terms. Credit two hours per semester. S-U grades only. May not be repeated. Evening lectures, M 8:15. Room to be arranged. Discussion periods (one hour) to be arranged. Staff and invited speakers.

A series of public lectures dealing with a variety of topics concerning man as an individual, man as a member of society, and man as a member of the community of life

on earth. The lectures are open to students and nonstudent members of the Cornell community as well as to other Ithaca-area residents.

Students enrolling for credit are requested to attend and participate in one of the weekly discussion groups. The purpose of the discussion period is to permit students to explore lecture material or related topics in depth.

Because the number of students who can be accommodated in Biology 201-202 is dependent upon an unpredictable and variable number of volunteer faculty members, from the many colleges and schools on the Cornell campus, preregistration in this course is not permitted. Registration will be accepted on the Tuesday and Wednesday following the first Monday lecture with preference given to upperclassmen.

203 Special Topics in Social Biology. Fall term. Credit three hours. S-U grades optional. Time to be arranged. Permission of the instructor is required. Students enrolled in course 203 are also expected to attend the Biology and Society lectures (course 201) without additional credit.

Normally, credit for course 203 will count for neither breadth nor concentration requirement in the Biological Sciences curriculum even if the section is under the direction of a biologist, although this restriction may be waived in isolated cases. Simultaneous enrollment in course 201 is not permitted. The purpose of this listing is to provide a vehicle by which any regular faculty member, visiting professor, or postdoctoral fellow with the rank of instructor at Cornell can present a one-semester course in which he discusses problems faced by modern society or guides students in the scholarly investigation of one of these problems.

Course 203 may not be given each fall; information can be obtained by calling the Division of Biological Sciences (6-5233), or the Science, Technology, and Society Program (6-3964).

204 Special Topics in Social Biology. Spring term. Credit three hours. S-U grades optional. Time to be arranged. Permission of the instructor is required. Students enrolled in course 204 are also expected to attend the Biology and Society lectures (course 202) without additional credit. In other respects this course is identical to course 203.

301 Laboratory Methods in Biology. Fall or spring term. Credit three hours. Limited to juniors, seniors, and graduate students, 20 students per section. Prerequisite: 101-102 or equivalent. Lecture-laboratory, T or F 10:10-12:35. Additional periods by appointment. Stimson 206. Professor Uhler.

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For students who intend to teach or follow some phase of biology as a profession. Subjects covered: collection, preservation, and storage of materials; the preparation of bird and mammal study skins; injection of circulatory systems with latex; clearing and staining of small vertebrates; and the preparation and staining of squashes, smears, whole mounts, and sections.

401 Teaching Biology. Fall or spring term. Credit four hours. S-U grades only. Enrollment limited. Prerequisite: permission to register. Hours to be arranged. Roberts 306. Mr. Zollinhofer.

Discussions of recent developments in the teaching of biology, and participation in teaching elementary biology at the college level.

405 Optics in Biology. Fall term. Credit two hours. Enrollment limited to 20. Prerequisite: Chemistry 104 or 108, Math 108 or 111, and Physics 102 or 208, or consent of the instructor. M 1:25-3:20. Plant Science 143. Professor Clayton.

Lectures, problems, demonstrations, and laboratory experience in applications of optics to biology. Topics will include geometrical optics as applied to illumination systems, methods for studying biological effects of light, and analytical uses of optical absorption and fluorescence.

409 Research in Biology. Fall or spring term. Credit and hours to be arranged. Undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade. Staff.

Practice in planning, conducting, and reporting independent laboratory and/or library research programs.

600 Seminar: Current Topics in Modern Biology. Fall and spring terms. Credit one hour per topic (two topics per term). S-U grades only. The requirement for admission is a B (or better) grade average, or recommendation. Interested students should attend an organizational meeting. The date of this meeting, and the topics to be covered, will be issued in the preregistration supplement to this bulletin. Do not register for course 600 before attending the meeting.

602 Seminar for M.S.T. Degree Candidates. Spring term. Credit one hour. Hours to be arranged. Professor Uhler.

Discussion and evaluation of new approaches to biological instruction.

Animal Physiology and Anatomy

210 Human Physiology. Spring term. Credit three hours. No credit for majors in biological sciences. Prerequisite: Chemistry 103 or equivalent; students must at least have taken high school courses in biology and chemistry. Lectures, M W F 8. Morrison 146. Associate Professor Kennedy and Assistant Professors Stini and Thomas.

Basic concepts of human anatomy and physiology will be presented to provide the groundwork for the understanding of the functioning of the human body in health and disease. Emphasis will be placed on the relationship of human physiology to problems of public health and contemporary living. The individual systems, such as cardiovascular, gastrointestinal, neurological, endocrine, renal, etc., will be discussed singly and in correlation with each other. Guest lecturers will be invited as appropriate.

313 Histology: The Biology of the Tissues. Fall term. Credit four hours. Prerequisite: a two-semester introductory biology sequence; comparative anatomy and organic chemistry or biochemistry desirable. Lectures, T Th 11:15. Stimson G-1. Laboratory, T Th 8-9:55, or 2:30-4:25. Fernow 14, 16. Professor Wimsatt.

A general course dealing with the biology of the tissues to provide the student with a basis for understanding the microscopic and fine structural organization of vertebrates and the methods of analytic morphology at the cell and tissue levels. The dynamic interrelations of structure, chemical composition, and function in cells and tissues are stressed.

316 Invertebrate Zoology. Spring term. Credit four hours. Prerequisite: at least one year of biological science or permission of instructor. Two lectures and two laboratories per week. Lectures, W F 11:15. Fernow 14. Laboratory, W F 2:00-4:25. Fernow 14. Professor Anderson and assistant.

Lectures on selected topics in the development, structure, function, and interrelations of invertebrate animals, with particular attention to phylogenetic aspects. Intensive laboratory work in representative invertebrates, utilizing living or fresh specimens wherever possible. Each student will be expected to do a significant amount of independent work, and a term paper may be required.

410 General Animal Physiology, Lectures. Spring term. Credit three hours. S-U grades optional. Prerequisite: one year of biology and physics and courses in chemistry, organic chemistry, and biochemistry desirable.

Lectures, M W F 10:10. Stimson G-25. Assistant Professor Howland.

The principles of animal physiology are developed through consideration of the functioning of cells, tissues, and organs. Specific topics discussed include respiration, metabolism, circulation, excretion, chemical integration, muscle contraction, nerve action, and sensory reception. A quantitative, systems-theoretical approach is emphasized.

410A General Animal Physiology Laboratory. Spring term. Credit two hours. Prerequisite: course 410 or equivalent must be taken concurrently. Lecture, W 2. Stimson G-25. Laboratory, T 8-11 or M T Th or F 1:25-4:25. Stimson 306. Assistant Professor Howland.

Students are introduced to basic techniques utilized in the study of the physiology of animal tissues. Experiments cover topics dealing with respiration, properties of muscle, circulation, activity of nerves, and osmotic phenomena.

[412 Special Histology: The Biology of the Organs. Spring term. Credit four hours. Organ in alternate years. Enrollment limited to 18 students. Prerequisite: 313, or consent of instructor. Lectures, W F 9:05. Fernow 14. Laboratory, W F 2-4:25. Fernow 14. Professor Wimsatt. Not offered in 1971-72.

A continuation of course 313. The microscopic and ultrastructural organization of the principal vertebrate organ systems are studied in relation to their development, functional interaction, and special physiological roles. Courses 313 and 412 together present the fundamental aspects of the microscopic and submicroscopic organization of the vertebrate body from a physiological perspective. The organization of the course involves student participation in lecture-seminars, and the prosecution of independent project work supplementary to the regular work of the laboratory. The latter enables students to gain practical experience with histological and histochemical preparative techniques.]

414 Mammalian Physiology. Spring term. Credit six hours. Registration by permission. Prerequisite: a year of biological sciences. Courses in biochemistry, histology, and gross anatomy desirable. Lectures, M W F 8. Morrison 167. Discussion, S 10:10. Morrison 167. Laboratory, M or W 1:25. Morrison 174. Professors Gasteiger, Hansel, and Visek (in charge), and Associate Professor Bensadoun.

A general course in mammalian physiology including circulation, respiration, digestion, metabolism, renal function, endocrinology, and the nervous system.

419 Research in Animal Physiology and Anatomy. Fall or spring term. Credit and hours to be arranged. Undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade. Staff.

Practice in planning, conducting, and reporting independent laboratory and/or library research programs.

[512 Comparative Physiology. Spring term. Credit two hours. Prerequisite: 410 or 414 and biochemistry or the equivalent. Students are encouraged to enroll in 512A concurrently. T Th 9:05. Stimson 318. Associate Professor McFarland and Assistant Professor Pough. Not given in 1971-72.

A comparison of the principal physiological functions of vertebrates and invertebrates, with emphasis on adaption to different environments.]

[512A Comparative Physiology Laboratory. Spring term. Credit two hours. Limited to 10 students. Prerequisite: concurrent enrollment in 512 and consent of instructors. T Th 1:25-4:25. Stimson 318. Professor McFarland and Assistant Professor Pough. Not given in 1971-72.

Introduction to comparative physiological techniques and their application to original research projects.]

Animal Embryology (Course 386).

Comparative Physiology of Reproduction of Vertebrates (Poultry Science 425).

Developmental Anatomy and Histology (Veterinary Anatomy 507).

Elements of Physical Biology (Veterinary Medicine 920).

Fundamentals of Endocrinology (Animal Science 427-428).

General Photobiology (Course 547).

Neuroanatomy (Veterinary Anatomy 505).

Optics in Biology (Course 405).

Insect Morphology and Histology (Entomology 322).

Sensory Function (Courses 427, 428).

Vertebrate Morphology (Veterinary Medicine 900).

Vision (Course 425).

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Neurobiology and Behavior

320 Neurobiology and Behavior. Spring term. Credit three hours. Limited to juniors, seniors, and graduate students. Prerequisite: courses 101-102. Lectures, T Th S 12:20. Ives 120. Professors Eisner (in charge), O'Brien, and van Tienhoven, Associate Professors Emlen and Halpern.

Evolution of behavior, cueing of behavior; social and nonsocial behavior, neuroanatomy, neurophysiology, neurochemistry, neural networks, memory.

323 Physiological Psychology. Fall term. Credit three hours. Prerequisite: Biological Sciences 101-102 or equivalent and introductory chemistry, Psychology 201 or a 300-level course in psychology. Lectures T Th 9:05. Upson 330. Associate Professor Halpern.

Selective examination of neural, endocrine, and biochemical functions related to emotion, memory, learning, perception, hunger, and thirst.

323A Physiological Psychology Laboratory. Fall term. Credit three hours. Prerequisite: Biological Sciences 320, Psychology 201, concurrent registration in 323, and consent of instructor. Discussion, M 7:30-9:00 p.m. Laboratory, T 1:25-5:00. Stimson 216. Associate Professor Halpern.

Experiments will be done on physiological aspects of conditioning in vertebrates and invertebrates, memory, interactions between hormones and behavior, and effects of brain lesions on perceptual and alimentary behavior. A final original experiment will be planned and carried out.

324 Animal Social Behavior. Spring term. Credit four hours. Limited to 20 undergraduates. Prerequisite: Biological Sciences 101-102 or 103-104. Not open to students who have already taken course 523. M F 11:15-1:10. Warren 160. Assistant Professor Bradbury.

An introductory but intensive examination of social evolution in animals. Topics range from social integration in bees to origins of human societies. Students are expected to prepare and present individual topics and participate actively in discussions.

325 Fine Structure of the Nervous System. Fall term. Credit three hours. Prerequisite: Biological Sciences 101-102 and 320; the latter may be waived by permission of the instructor. Lectures, T Th 11:15. Bradfield 108. Associate Professor Salpeter.

A course on the cellular organization of the nervous system. Special emphasis on development, functional relationships, and ultrastructure.

326 Excitable Membranes. Spring term. Credit two hours. Prerequisite: Biological Sciences 325 or permission of the instructor. Lectures, T Th 9:05. Warren 245. Associate Professor Podleski.

Lectures will examine in detail the biophysical and biochemical properties of the excitable membranes of nerve cells and muscle. Emphasis will be placed on the quantitative analysis and the possible molecular mechanisms underlying these properties. When possible the subject will be discussed in terms of the fundamental problem of the structure and function of biological membranes. Among the topics to be studied are the following: the origin of bioelectric potentials, excitability, synaptic transmission, the specificity of neural membranes, and possible mechanisms for plasticity.

328 Behavioral Maturation. Spring term. Credit four hours. Prerequisite: familiarity with psychological theories of learning and development and one year of college biology. W F 12:20. Goldwin Smith D. Professor Lenneberg.

Emergence of behavior will be studied in the light of developmental biology, including behavior genetics, neuroembryology and morphogenesis, physical maturation of the brain, transformation and allometry as well as retarding influences from the environment.

421 Comparative Vertebrate Ethology. Fall term. Credit three hours. S-U grades optional. Prerequisite: 101-102 or 103-104, and 320, and permission of the instructor. Lectures, T Th 9:05. Rice 300. Laboratory, to be arranged. Associate Professor Dilger.

A survey of the methods and principles of vertebrate ethology for students specializing in this field or for those in other branches of zoology wishing to broaden their knowledge of animal behavior. Emphasis is placed on the causation, function, biological significance, and evolution-of-species typical behavior. The laboratories are designed to give first-hand knowledge of the material covered in lectures.

423 Animal Communication. Fall term. Credit four hours. Enrollment limited to 32 students. Prerequisite: Biological Sciences 320 and Physics 207-208. Lectures, T Th 10:10. Plant Science 143. Laboratory, T or Th 1:25-4:25. Associate Professor Capranica and Assistant Professor Bradbury.

The course will emphasize the functional aspects of biological signals their physical properties, and the physiological mechanisms underlying their generation and reception. Lectures will examine in detail selected biological communication problems from each of the known sensory modalities. Discussion will cover signal analysis, transmission prop-

erties, and the limitation of each type of communication. Laboratories will include behavioral observations under both field and captive conditions, and individual experience with the techniques of signal recording and analysis.

424 Brain and Behavior. Spring term. Credit four hours. Prerequisite: familiarity with theories of perception, memory, and physiological psychology, or permission of the instructor. M 1:25-4:00. Morrill 340. Professor Lenneberg.

A theoretical introduction to human neurology for psychologists. This survey of clinical symptoms and their etiology is designed to enable students to make use of disease for research purposes.

425 Vision. Fall term. Credit two hours. Prerequisite: Chemistry 104 or 108, Math 108 or 111, Physics 102 and 208, or consent of the instructor. Lectures T Th 10:10. Plant Science 141. Professor Clayton.

A study of the mechanism of seeing, embracing biochemical, biophysical, and physiological approaches to the subject.

427 Sensory Function (Lectures). Fall term. Credit three hours. Prerequisite: course 320 or the equivalent. Lectures, M W F 11:15. Stimson 105. Discussion period to be arranged. Professor Tapper and Associate Professor Halpern.

Sensory receptors and the central nervous system transformation of afferent activity will be considered in relation to human and animal psychophysical data and to the adaptive significance of behavior. The receptors will be examined in terms of anatomy, biochemistry, biophysics of transduction, and the central nervous system control of peripheral input. Information and signal detection theories will be applied.

427A Sensory Function (Laboratory). Fall term. Credit two hours. Enrollment limited to 15 students, and only by permission of the instructors. Prerequisite: course 427. Hours to be arranged. Stimson 216. Organizational meeting 4:30 on the first Monday of the term. Professor Tapper and Associate Professor Halpern.

428 Neurochemistry. Spring term. Credit three hours. S-U grades optional. Prerequisite: an introductory course in biochemistry or consent of the instructor. Students should contact the instructor prior to or during registration. Lectures, W F 10:10. Bradford 108. Discussion, M 10:10. E. Roberts 223. Assistant Professor Grossfeld.

Special features of the composition and metabolism of neural tissue will be discussed. The identification of synaptic transmitters in

the nervous system, including their specific localization, biosynthesis and metabolism, release, inactivation, and action on post-synaptic receptors will be considered in detail. Chemical aspects of vision and of neuronal development and maturation will also be described.

429 Research in Neurobiology and Behavior. Fall or spring term. Credit and hours to be arranged. S-U grades optional. Undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade. Staff.

Practice in planning, conducting, and reporting independent laboratory and/or library research programs.

522 Brain Mechanisms and Models. Spring term. Credit four hours a term. Prerequisite: calculus, introductory biology or psychology, and consent of the instructor; courses 325 and 326 are strongly suggested, and acquaintance with modern algebra and probability theory is desirable. Lecture, M W 7:30-9 p.m. Goldwin Smith 120. Associate Professor Rosenblatt.

Deals with mechanisms underlying the higher functions of the central nervous system, particularly perception, learning, and memory. Includes topics of coding and representation of information in the brain, analysis of sensory data, and mathematical and computer models for perceptual processes; adaptive mechanisms, memory and learning, including physiological and biochemical basis of memory, perceptions, and other models, and approaches to language and thinking.

523 Ecological Aspects of Animal Behavior. Fall term. Credit four hours. S-U grades optional. Prerequisite: courses 320 and 361, and permission of instructor. Lectures, T Th 11:15. Discussions, T Th 12:20. Warren 245. Associate Professor Emlen and Assistant Professor Ambrose.

A discussion of the interrelationships of animal behavior and ecology, with emphasis on the following topics: behavioral adaptations to the environment; ecological significance of diverse social systems; evolution of coloniality; spatial relationships; habitat selection; foraging strategies; predator-prey interactions; role of social behavior in population regulation; evolution of altruistic behavior.

524 Behavioral Neurophysiology. Spring term. Credit three hours. S-U grades optional. Prerequisite: course 320 or equivalent. Lectures, T Th S 9:05. Warren 145. Assistant Professor Camhi.

A study of the relationship between animal behavior and the activity of individual nerve

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cells considered empirically. Review of electrical properties of excitable tissue. Predictions from the study of animal behavior. Sensory coding of environmental energies. Principles of integration. Integration of sensory inputs. Neural control of muscle contraction. Correlating nerve activity and behavior problems and prospects. Examples will be chosen from throughout the animal kingdom, with slight preference for invertebrate phyla.

524A Behavioral Neurophysiological Laboratory. Spring term. Credit two hours. Enrollment limited to 15 students. Course 524 must be taken concurrently. Time and place to be announced. Assistant Professor Camhi.

Experiments in neurophysiology, often related to specific behavior patterns.

[525 Functional Organization of the Nervous System. Fall term. Credit six hours. Given in alternate years. Prerequisite: two years of biological science, Biological Sciences 320 or equivalent. Courses in biochemistry, physics and neural anatomy are desirable. Lectures M W F 10:10. Stimson 105. Laboratory W 1:25. Stimson 216. Professor Gasteiger. Not given in 1971-72.

Cellular, sensory, central integrative, and motor aspects of the nervous system will be considered with an emphasis on the electrophysiological approach. Laboratory studies will include electrical activity of cells, reflexes, decerebrate rigidity, acoustic microphonic response, subcortical stimulation, and evoked and spontaneous cortical activity.]

526 Bioelectric Systems. Spring term. Credit three hours. Prerequisite: Biological Sciences 423 or 427 or 524, or Physics 360, or Electrical Engineering 4401, and permission of instructor. Lectures, M W 9:05. Discussion and demonstrations, Th 2. Phillips 320. Associate Professors Capranica and Kim.

This course deals with the application of systems techniques to biological problems. Electrical activity of nerve cells; generation and propagation of nerve impulse; voltage clamp technique, Hodgkin-Huxley model; electrical excitability and transfer function of neuromuscular systems; synaptic transmission; models of nerve cells and control system analysis of oscillatory activity. Nerve Nets: I. evoked activity; II. spontaneous activity; III. simulation and computer analysis. Functional neuroanatomy of brain; transfer characteristics of sensory receptors; sensory encoding and processing in the peripheral and central nervous systems; neural mechanisms for vision and hearing.

620 Seminar in Neurobiology and Behavior. Fall or spring term. Credit one hour. S-U grades optional. Time to be arranged. Or-

ganizational meeting, first Monday of semester, 8 p.m. Comstock 245. Staff.

Fall topic, Animal Behavior; spring topic, Neurobiology.

622 Seminar in Ecological Animal Behavior. Spring term. Credit one hour. Open to qualified graduate and undergraduate students who have taken courses in animal behavior and ecology, and who have secured permission of the instructor. Time to be arranged. Assistant Professor Ambrose.

629 Advanced Topics in Neurobiology and Behavior. Fall or spring terms. A seminar course for graduate students and selected undergraduates. Topics, credit, and hours to be arranged. Staff and students.

The course is designed to provide several study groups each semester on specialized topics. A group may meet for whatever period is judged adequate to enable coverage of the selected topics. Ordinarily, topics will be selected and circulated during the preceding semester. Suggestions for topics should be submitted by faculty or students to the chairman of the Section of Neurobiology and Behavior.

Optics in Biology (Course 405).

Biochemistry

131 Introductory General Biochemistry. Fall term. Credit five hours. A terminal course primarily for non-science undergraduates. Lectures, M T W Th 11:15. Riley-Robb 15. Recitation, Th 2-4:25. Riley-Robb 105. Associate Professor Neal.

Lectures, demonstrations, and recitations dealing with selected fundamental principles of general organic and biochemistry with emphasis on biochemistry.

132 Orientation Lectures in Biochemistry. Spring term. Noncredit. For freshman and sophomore students. Eight lectures or discussion sessions given in February and March covering interesting areas of biochemistry. W 7:30 p.m. Wing 403. Professor Racker and staff.

231 Introductory Biochemistry. Fall term. Credit three hours. Prerequisite: Chemistry 104 or 108, or the equivalent. May not be taken for credit by students who have completed a more advanced course in this section. Lectures, T Th F 12:20. Stocking 204. Professor Williams.

A brief survey of organic chemistry as related to biological compounds and a discussion of selected biochemical topics and reactions associated with the metabolism of animals, plants, and microorganisms. Especially designed as a general course for four-year students in agriculture.

431 Principles of Biochemistry (Lectures).

Fall and spring terms. Credit four hours a term. Prerequisite: Organic Chemistry 353-355 or the equivalent. Fall term lectures, M 8. Morrison 146. T Th S 8. Ives 120. Professor Daniel. Spring term lectures, M W F S 10:10. Stoking 204. Assistant Professor Edelstein.

A basic course dealing with the chemistry of biological substances and their transformations in living organisms.

433 Principles of Biochemistry (Laboratory).

Fall term. Credit three hours. Prerequisite: quantitative analysis or permission of the instructor. Course 431 may be taken concurrently. Laboratory, M W 2-4:25. Wing 106. Discussion period, M 1:25. Riley-Robb 105. Associate Professor Neal.

Laboratory practice with biochemical substances and experiments designed to illustrate basic biochemical principles and techniques. This laboratory is designed primarily for students who have not had previous biochemical laboratory training.

434 Principles of Biochemistry (Laboratory).

Spring term. Credit three hours. Primarily for advanced undergraduates intending to enter graduate school and for graduate students. Prerequisite: quantitative analysis, course 431, and permission of instructor. Laboratory, T or Th 10:10-4:25. Wing 106. Discussion, to be arranged. Assistant Professor Fessenden-Raden.

Laboratory practice with biochemical substances and experiments designed to introduce the student to techniques used in biochemical research, such as enzyme purification and characterization, kinetic analyses, use of radioisotopes, and chromatography.

435-436 Undergraduate Biochemistry Seminar.

Fall and spring terms. Credit one hour each term. Juniors and seniors only. Enrollment limited. Prerequisite: 431 or consent of instructor.

A group of selected papers from the literature will be critically evaluated during six or seven two-hours meetings. A term paper will probably be required. Fall term: Photosynthesis. First meeting M 4:00 p.m. September 13. Wing W-105. Assistant Professor McCarty. Spring term: Nucleic Acids. First meeting T 7:30 p.m. Feb. 1. Wing 403. Professor Heppel.

439 Research in Biochemistry.

Fall or spring term. Credit hours to be arranged. For undergraduate students concentrating in biochemistry. Prerequisite: adequate ability and training for the work proposed. Undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade. Professor Gaylor and staff.

Special work in any branch of biochemistry

on problems under investigation by the staff of the section.

530 Biochemistry of the Vitamins.

Spring term. Credit two hours. Given in alternate years. Prerequisite: Chemistry 353-355 and course 431 or their equivalent. Lecture: T Th 10:10. Savage 100. Professor Daniel.

The chemical and biochemical aspects of the vitamins.

531-532 Intermediate Biochemistry (Lectures).

Fall and spring terms. Credit four hours a term. Prerequisite: Chemistry 358, course 431 or consent of the instructor. Physical chemistry desirable. Lectures, M W F S 9:05. Riley-Robb 125. Fall term, Assistant Professor Moffat and staff. Spring term, Assistant Professor Wilson and staff.

The major areas of biochemistry will be covered in some detail. Appropriate for students who have previously had a one-semester introductory biochemistry course. Fall semester: proteins, enzymes, and the nature of enzymatic catalysis; carbohydrate metabolism; nitrogen metabolism. Spring semester: energetics; lipid metabolism; biosynthesis of informational macromolecules.

533 Intermediate Biochemistry (Laboratory).

Fall term. Credit three hours. Prerequisite: Chemistry 287-288 or 389-390. Must be taken with or following course 531. Laboratory, T or Th 9:05-4:25. Wing 106, 107. One discussion period to be arranged. First meeting for both sections will be held on the first Tuesday at 9:05. Professor Nelson, Associate Professor Wharton, and Assistant Professor McCarty.

Selected experiments on carbohydrates, proteins, amino acids, and metabolism (cellular particulates, kinetics, general enzymology) will be given to illustrate basic biochemical principles. The course will emphasize the quantitative aspects rather than qualitative identifications.

536 Advanced Biochemical Methods (Laboratory).

Spring term. Credit two hours. Graduate majors in biochemistry only. Prerequisite: course 533. Hours to be arranged. Assistant Professor Keller and Associate Professor Wu.

After the formal instruction on research techniques in biochemistry and molecular biology, the students will do research work in the laboratory of three different professors chosen by the students.

631-632 Research Seminar in Biochemistry.

Fall and spring terms. Credit one hour per term. S-U grades only. M 8-9:30 p.m. Wing 403. Professor Racker.

Required of all graduate students (except first-year students) majoring in biochemistry. The course may be repeated for credit.

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633-638 Advanced Biochemistry. Throughout the year. Lectures and seminars on specialized topics, three topics per term. Credit one hour per topic. Prerequisite: Biological Sciences 532 or consent of instructor. May be repeated for credit. The following fields will be covered (each field is divided into three related topics): Enzyme Structure and Mechanism of Action (Fall 1972, 1974); Aspects of Protein and Nucleic Acid Synthesis (Spring 1971, 1973); Structure, Function, and Synthesis of Biological Membranes (Fall 1971, 1973); Aspects of Metabolic Pathways and their Control (Spring 1972, 1974).

633 Structure of Biological Membranes. Fall term 1971. First 4½ weeks of term. T Th 9:05. Savage 100. Professor Zilversmit.

635 Structure and Function of Mitochondrial and Chloroplast Membranes. Fall term 1971. Middle 4½ weeks of term. T Th 9:05. Savage 100. Professor Racker.

637 Biogenesis of Membranes. Fall term 1971. Last 4½ weeks of term. T Th 9:05. Savage 100. Associate Professor Schatz.

634 Regulatory Aspects of Photosynthesis. Spring term 1972. First 4½ weeks of term. T Th 9:05. Savage 100. Associate Professor McCarty.

636 Regulatory Aspects of Respiration. Spring term 1972. Middle 4½ weeks of term. T Th 9:05. Savage 100. Associate Professor Wharton.

638 Regulatory Aspects of Muscle Contraction. Spring term 1972. Last 4½ weeks of term. T Th 9:05. Savage 100. Associate Professor Guillory.

639 Biochemistry Seminar. Fall and spring terms. Noncredit. F 4:15. Stocking 204. Staff.

Lectures on current research in biochemistry presented by distinguished visitors and staff.

Botany

146 Plant Biology. Spring term. Credit three hours. Lectures, T Th 9:05. Bradfield 101. Laboratory, M T or W 1:25-4:25. Plant Science 107. Professor Banks.

Introductory botany for those who plant to specialize in some aspect of the plant sciences and designed to introduce several major plant groups not covered in course 102, and intended to acquaint students with the genetic bases of evolutionary change. Evolutionary principles will emerge from the study of certain groups in which both fossil

and living material is available. Emphasis in laboratory is placed on the development of skills in handling plant materials, including plant identification.

242 Plant Physiology. Spring term. Credit five hours. Primarily for undergraduates in the agricultural sciences. Prerequisite: courses 101-102 and introductory chemistry. Lectures, T Th S 10:10. Plant Science 143. Conference, M T W or Th 12:20-1:10. Room to be arranged. Laboratory, M T W or Th 1:25-4:25. Plant Science 227. The laboratory is the same as for course 340. Assistant Professors Davies and Spanswick.

Plant physiology as applied to plants growing in communities. Examples will deal with crop plants or higher plants where possible, though not exclusively. Topics will include cell structure and function; soil-plant-water relations; water uptake, transport and transpiration; irrigation of crops; sugar transport; mineral nutrition of crops; respiration and photosynthesis; light relations in crops; growth and development-hormones, flowering, fruiting, dormancy, and abscission; chemical control of plant growth.

340 Plant Physiology. Spring term. Credit three hours. Primarily for undergraduates or graduate students without background in plant physiology. Prerequisite: Biological Sciences 101-102 and organic chemistry. Must be accompanied by Biological Sciences 342 except by permission of the instructor. Lectures, T Th S 10:10. Plant Science 141. Professor Jagendorf.

The behavior, growth, transport processes, and environmental response of plants. Topics will include membrane properties, solute and water transport, function of osmotic forces; mineral and organic nutrition; stress resistance; growth and hormonal action; metabolism including photosynthesis and respiration; responses to gravity, light, photoperiod, and temperature.

342 Plant Physiology Laboratory. Spring term. Credit two hours. Must be accompanied by course 340. Conference and laboratory must be on the same day. Conference M T W or Th 12:20-1:10. Room to be arranged. Laboratory, M T W or Th 1:25-4:25. Plant Science 227. Assistant Professor Spanswick.

344 Phycology. Spring term. Credit four hours. Lectures, M W F 10:10. Plant Science 37. Laboratory, M or F 2-4:25. Plant Science 202. Professor Kingsbury.

An introduction to freshwater and marine algae including consideration of their ecology as members of the plankton and benthos and their importance to man. The laboratory, utilizing field material and cultures from an extensive living collection, is designed to

illustrate lecture topics, provide familiarity with algae in the field, and introduce the student to techniques used in isolating, culturing, and studying algae in the laboratory.

345 Plant Anatomy. Fall term. Credit four hours. Prerequisite: courses 101-102 and pre-registration with instructor in charge. Lectures, T Th 8. Warren 145. Laboratory, T Th 10:10-12:35 or M W 2-4:25. Plant Science 211. Professor Paolillo.

347 Cytology. Fall term. Credit four hours. Prerequisite: Biological Sciences 101-102 or the equivalent; 281 recommended. Lectures, M W 9:05. Plant Science 143. Laboratory, M W or T Th 10-12:35. Plant Science 219. Associate Professor Uhl.

A study primarily of the structure of cells and their components and the relation of these to function and to heredity. Special attention is given to chromosomes. Both plant and animal materials are used.

347A Cytology, Lectures. Fall term. Credit two hours. Lecture part only of Biological Sciences 347. Associate Professor Uhl.

347B Cytology, Laboratory. Fall term. Credit two hours. Prerequisite: 347A (may be taken concurrently). Laboratory part of Biological Sciences 347.

349 Plants and Man. Fall term. Credit three hours. S-U grades optional. Lectures and discussions, M W F 9:05. Warren 231. Associate Professor Bates.

A consideration of the role of plants in the human environment and in the evolution of civilizations. Intended for students in all colleges. Emphasis is on ethnobotanical considerations and on historical to present day utilization of plants in nutrition, housing, clothing, medicine, religion, and the arts.

[440 Cytogenetics. Spring term. Credit three hours. Prerequisite: courses 347 and 281 or the equivalent. Lectures, M W 9:05. Plant Science 143. Laboratory, M or W 10:10-12:35. Plant Science 219. Associate Professor Uhl. Given in alternate years. Not given in 1971-72.

An advanced course dealing mainly with the cellular mechanisms of heredity and including recent researches in cytology, cytogenetics, and cytotaxonomy.]

441 Plant Growth and Development. Fall term. Credit three hours. Given in alternate years. Prerequisite: course 242 or 340, or 345, or equivalent, or permission of instructor. Lectures, M W F. Time to be arranged. Professor Paolillo and Assistant Professor Davies.

An advanced course dealing with changes during growth and development of plants and their control; morphological and anatomical

changes in apices; tissue differentiation; organ formation; embryo development; nucleic acid and protein synthesis; gene regulation; hormones—their action, mode of action, and interaction; the influence of light in development; flowering, fruiting, dormancy and abscission; reactions to stress.

[444 Comparative and Developmental Morphology of the Embryophyta. Spring term. Credit four hours. Prerequisite: course 345 and consent of the instructor. Lectures, T Th 8. Plant Science 141. Laboratory, T Th 2-4:25. Plant Science 211. Professor Paolillo. Given in alternate years. Not given in 1971-72.

The life histories of bryophytes, vascular cryptogams, and seed plants are explored for their developmental attributes and for their bearing on concepts of evolution and group relationships. The course content is presented so that an awareness of the integration between morphology and other disciplines in biology can be developed.]

448 Paleobotany. Spring term. Description to be announced. Time and room to be arranged. Professor Banks.

449 Research in Botany. Fall or spring term. Credit and hours to be arranged. Undergraduates must attach to their pre-registration material, written permission from the staff member who will supervise the work and assign the grade. Staff.

Students engaged in special problems or making special studies may register in this course. They must satisfy the instructor under whom the work is taken that their preparation warrants their choice of problem.

543 Plant Physiology, Advanced Laboratory Techniques. Fall term. Credit four hours. Primarily for graduate students doing work in plant physiology, but open to others if space permits. Prerequisite, organic chemistry, biochemistry, course 242 or 340, or the equivalent. Preregistration recommended. Laboratory, T or W 8-5. Plant Science 241. Recitation, M 4:30-5:30. Room to be arranged. Staff.

An introduction to some modern methods in experimental plant biology.

[545 Photosynthesis. Fall term. Credit three hours. Prerequisite: Chemistry 104 or 108, Math 108 or 111, and Physics 102 or 208, or consent of the instructor. Lectures, M 1:25, T Th 10:10. Plant Science 141. Professor Clayton. Given in alternate years. Not given in 1971-72.]

A detailed study of the process by which plants use light in order to grow, emphasizing physical and physico-chemical aspects of the problem.

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[547 General Photobiology. Fall term. Credit three hours. Open to undergraduate students. Prerequisite: same as for course 545. Lectures, M 1:25, T Th 10:10. Plant Science 141. Professor Clayton. Given in alternate years. Not given in 1971-72.

An introduction to biological applications of optics, and a study of the major interactions between light and living matter as encountered in photosynthesis, vision, regulation of physiology and development, bioluminescence, and damage by ultraviolet and visible light.]

548 Plant Physiology: Aspects of Metabolism. Spring term. Credit three hours. Given in alternate years. Prerequisite: courses 242, 340, and 431; Chemistry 353, or the equivalent. Lectures, M W F 9:05. Plant Science 141. Professor Jagendorf, Associate Professor Thompson, Assistant Professor McCarty, and staff.

Selected areas of plant biochemistry will be reviewed in the context of the plant life cycle and responses to the environment. Probable topics include: metabolism and storage function of lipids, carbohydrates, organic acids, proteins and pigments; nitrogen and sulfur assimilation; hormone metabolism; respiration, photosynthesis, development and replication of mitochondria and chloroplasts; cell wall composition and properties. Attention will be paid to operation of control mechanisms.

[549 Plant Physiology: Transport of Solutes and Water. Fall term. Credit three hours. Prerequisite: course 340, or equivalent. Lectures, M W F 10:10. Plant Science 141. Assistant Professors Miller and Spanswick. Given in alternate years. Not given in 1971-72.

An advanced course dealing with the transport of ions, water, and organic materials in plants. Mechanisms of ion transport. Relationships between ion transport and metabolism. Ion uptake and transport in higher plants. Phloem transport. Water relations of single cells and whole plants. Water relations of crops and natural communities.]

641 Perspectives in Plant Physiology: Advanced Lecture Series. Fall term. Credit two hours, or may be taken without credit. S-U grades optional. M W F 10:10. Plant Science 143. Professor Steward.

Primarily intended for graduate students, but open to qualified undergraduates. Review of salient topics in plant physiology, their present status, historical development, and the problems they still present. Topics considered will change somewhat from year to year but will normally include some treatment of cell physiology, organic and inorganic nutrition, metabolism, growth, and development.

643 Plant Physiology Seminar. Fall and spring terms. Noncredit. Required of graduate students taking work in plant physiology. F 11:15. Plant Science seminar room. Staff.

Lectures on current research in plant physiology presented by visitors and staff.

645 Current Topics in Plant Physiology. Fall and spring terms. Credit two hours per term. Course may be repeated for credit. Time and place to be arranged. Staff.

Seminar reports by graduate students, on current literature in experimental plant physiology or related areas. Fall term 1971: Water Relations and Plant Movements. Spring term 1972: Photomorphogenesis.

647 Special Topics in Plant Taxonomy. Fall and spring terms. Credit one hour per term. Prerequisite: permission to register. Lecture and discussion. Hours to be arranged. Mann Library 471. Professors Moore and Dress, Associate Professors Bates and Ingram.

A series of four topics, one presented each term, designed to provide professional background in biosystematics, literature of taxonomic botany, nomenclature, and tropical families of phanerogams.

A. Fall term, 1971. Families of Tropical Phanerogams. The families of flowering plants encountered solely or chiefly in tropical regions will be considered in lectures, discussions, and demonstrations with the aim of providing basic points of recognition for and an understanding of diversity and relationships in these families for the student venturing into the tropics. Professor Moore.

B. Spring term, 1972. Literature of Taxonomic Botany. A survey of the basic reference works in taxonomy from the pre-Linnaean literature drawn on by Linnacus to contemporary publications with comments on the peculiarities of the books (when appropriate) on publication dates, typographic devices, and intricacies of bibliographic citation. Lectures, demonstrations, discussions, and problems. Associate Professor Ingram.

C. Fall term, 1972. Nomenclature. An analysis of the International Code of Botanical Nomenclature and its application to various plant groups. Lectures, problems, discussion. Professor Dress.

D. Spring term, 1973. Biosystematics. A consideration of biosystematic approaches to taxonomy including chemical, numerical, cytological, and statistical methodologies as well as a review of classic studies. Associate Professor Bates.

Evolution, Taxonomy, and Ecology of Vascular Plants (Courses 371, 464, 663).

Plant Ecology (Course 463).

Advanced Mycology (Plant Pathology 569, 579, 589).

Current Topics in Mycology (Plant Pathology 649).

Comparative Morphology of Fungi (Plant Pathology 309).

Optics in Biology (Course 405).

Ecology, Evolution, and Systematics

273 The Vertebrates. Fall term. Credit five hours. Laboratory enrollment limited to 20 per section. Prerequisite: Course 101-102 or equivalent. Lectures, T Th 10:10. Stimson G-25. Laboratory, M W 1:25-5; T Th 1:25-5; M 7-10 p.m., F 1:25-5; T Th 7-10 p.m. Stimson 310, 316, 318. Associate Professor McFarland and Assistant Professor Pough.

An introduction to the evolution, classification, comparative anatomy, life history, and behavior of vertebrate animals. Laboratory dissection, experimentation, and demonstration are concerned with structure, classification, systematics, biology of species, and studies of selected aspects of vertebrate life. Midterm examination will be given in the evening. Time to be announced.

361 General Ecology. Fall or spring term. Credit three hours. Not open to freshmen. Prerequisite: course 101-102 or the equivalent. Lectures, T Th 9:05. Plant Science 233. Discussion, W or Th 1:25, 2:30, or 3:35. Associate Professor Root.

Principles concerning the interactions between organisms and their environment. Influence of competition, social behavior, predation, and other factors of population size and dispersion. Role of energy flow and mineral cycling in determining the structure and productivity of ecosystems. Succession and classification of natural communities. Influence of climate and past events on the diversity and stability of communities in different regions of the world. Interspecific competition and the niche concept. Chemical interactions between organisms. Application of ecological principles to human problems. Modern evolutionary theory will be stressed throughout and attention given to conflicting ecological hypotheses.

363 Laboratory and Field Methods in Population Biology. Fall term. Credit two hours. Enrollment limited. Prerequisite: permission of instructor. Laboratory, T Th 2-4:25, plus some Saturday field trips. Stimson 225. Assistant Professor Brussard.

A laboratory and field course to follow course 361, for students who intend to con-

centrate in the area of population biology. It will give the students a first-hand contact with techniques designed to understand the function and structure of aggregates of organisms.

364 Introduction to Marine Science. Credit four hours. S-U grades only. Prerequisite: a full year of college biology. Postrequisite, University of New Hampshire, Marine Science 774. A special course offered on Star Island, off Portsmouth, New Hampshire, June 1972. Professors Anderson, Gilbert, Hewitt, and Kingsbury (in charge), Associate Professors Barlow, Bloom, Eipper, and Likens, and guest lecturers.

Living material and habitats are emphasized in introducing students to the major disciplines of marine biology and in rounding out the student's knowledge of these topics as presented at inland locations. Shipboard demonstrations are conducted of oceanographic tools and techniques, and the North Atlantic fisheries are examined with the participation of commercial trawlers and fishermen from the Gloucester fleet and the Bureau of Commercial Fisheries. This course constitutes half of a four-week summer program in introductory marine science offered cooperatively by Cornell University and the University of New Hampshire. For more details, see the *Announcement of the Summer Session*, or consult Professor Kingsbury.

371 Taxonomy of Vascular Plants. Fall term. Credit four hours. Prerequisite: course 281 or permission to register. Lectures and discussions, T Th 9:05. Plant Science 143. Laboratory, T Th 2-4:25. Mann 464. Professor Clausen.

An introduction to the evolution and classification of vascular plants, with attention to principles, methods of identification, and literature. In the first part of the term, trips are held in laboratory periods.

460 Marine Ecology. Spring term. Credit three hours. Given in alternate years. Enrollment limited. Prerequisite: courses 361, 461, organic chemistry, and permission of the instructor. Lectures, M W F 10:10. Riley-Robb 15. Associate Professor Barlow.

A consideration of the oceanographic aspects of the marine environment. For graduate students and advanced undergraduates. Lectures and seminars, with demonstrations and field trips to be arranged.

461 Oceanography. Fall term. Credit three hours. Prerequisite: Course 361 or consent of the instructor. Lectures, T Th 10:10. Stimson G-1. Additional lectures, Th 12:20 alternating with laboratory, M T or Th 2-4:30. Stimson 309. Associate Professor Barlow.

An introduction to general oceanography, designed to present a general description of

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the physical aspects of the oceans as a background for further studies in marine science. Laboratory, which will meet for about half the term, will be devoted to field demonstrations of equipment, analysis of some typical oceanographic observations, and work with simple models.

462 Limnology. Spring term. Credit four hours. Prerequisite: course 361 or permission of instructor. Lecture, M W F 9. Caldwell 100. Laboratory, F 1:25-4:25 or S 9-12. Stimson 309. Associate Professor Likens.

A study of the interaction of biological communities and their aquatic environment. Lectures deal with the physical, chemical, and biological dynamics of freshwater ecosystems. Laboratories devoted to both field studies and experiments on model ecosystems.

462A Limnology, Lectures. Spring term. Credit three hours. Prerequisite: course 361, or permission of instructor. Lecture, M W F 9. Caldwell 100. Associate Professor Likens. The lecture portion of Biological Sciences 462.

463 Plant Ecology. Fall term. Credit four hours. Prerequisite: two advanced-level courses in biology or consent of instructor. Lectures, M W F 10:10. Caldwell 100. Laboratory and field trips, T or F 2-5. Assistant Professor Miller.

Principles of plant-environment interactions in relation to the distribution, structure, and functioning of plant communities. These principles will be illustrated by analysis in the field of representative plant communities and their environments, and by conducting experiments in the laboratory with plants grown under controlled environmental conditions.

464 Evolution and Ecology of Vascular Plants. Spring term. Credit four hours. Prerequisite: course 371 or permission to register. Lectures and discussions, T Th 9:05. Plant Science 143. Laboratory, T Th 2-4:25. Mann 464. Professor Clausen.

A study of the variation, evolution, and ecological distribution of vascular plants. Laboratory periods in the later part of the term are devoted to study of natural populations in the field.

466 Chemical Ecology. Spring term. Credit two hours. Primarily for seniors and graduate students. S-U grades optional. Given in alternate years. Prerequisite: Chemistry 353 or 357-358, course 101-102 or permission of instructor. Lectures, M F 12:20. Comstock 245. Professors Alexander, Eisner, Meinwald, and Whittaker, Assistant Professor Feeny (in charge).

Ecological and evolutionary significance of chemical interactions of organisms. Summary

of key processes in regulation of natural populations. Survey of major classes of natural products with emphasis on appropriate analytical techniques. Chemical adaptations for reproduction, defense, habitat selection, dispersal, feeding efficiency and competition in animals, plants, and microorganisms. Choice of adaptive strategy in relation to energy flow. Practical applications of chemical ecology.

468 Biology of Fishes. Spring term. Credit two hours. Prerequisite: introductory biology, or 273, or the equivalent. Lectures, M W 9:05. Rice 300. Professor Raney.

An introduction to the study of fishes; their structure, classification, evolution, distribution, ecology, physiology, and behavior. Laboratory studies on structure, identification, classification, and nomenclature. Field studies of local species.

[470 Ichthyology. Spring term. Credit two hours. Prerequisite: Biological Sciences 468 or consent of the instructor. Lectures, M W 9:05. Professor Raney. Given in alternate years. Not offered in 1971-72.

Lectures on advanced aspects of the biology of fishes including systematics, ecology, life history, and literature. Laboratory studies of the orders, major families, and principal genera, and of systematic procedures. Field studies of the ecology and life history of local species.]

471 Mammalogy, Lectures. Spring term. Credit three hours. Prerequisite: 101-102; 273. Lectures, T Th S 10:10. Stimson 105. Associate Professor Hudson and Assistant Professor Richmond.

Lectures on the evolution, classification, distribution and adaptations, both physiological and morphological, of mammals.

471A Mammalogy, Laboratory. Spring term. Credit one hour. Prerequisite: concurrent enrollment in course 471. Laboratory, F 1:25-4:25. Stimson 316. Associate Professor Hudson and Assistant Professor Richmond.

Laboratory and field work on ecology, behavior, physiology, and the taxonomy of recent mammals, with emphasis on the North American fauna.

472 Ornithology. Spring term. Credit four hours. Prerequisite: course 373 or equivalent work in vertebrate biology and permission of instructor. Lectures, T Th 11:15. Bradfield 108. Laboratory, W 2-4:30 and S 8-11. Professor Cade or Assistant Professor Lancaster.

Lectures cover various aspects of the biology of birds, including anatomy, physiology, classification, evolution, migration and orientation, behavior, ecology, and distribution. Laboratory will include studies of external and internal morphology, pterylosis, molts and

plumages, skin identification of birds of New York, and families of birds of the world. Several demonstration periods will emphasize hybridization, evolution, adaptive radiation, mimicry, and geographic variation. Field work includes identification of birds and familiarization of some techniques used in field research.

474 Herpetology. Spring term. Credit two hours. Prerequisite: course 273 or equivalent work in vertebrate biology, and permission of the instructor. Students are encouraged to enroll in 474A concurrently. Lectures, T Th 10:10. Bradfield 108. Given in alternate years. Assistant Professor Pough.

Lectures on the evolution, classification, distribution, and adaptations of reptiles and amphibians. Emphasis on ecology, behavior, and environmental physiology.

474A Herpetology Laboratory. Spring term. Credit two hours. Limited to 12 students. Prerequisite: concurrent enrollment in 474. T Th 1:25-4:25, S 8-11. Stimson 316. Professor Pough.

Laboratory and field work on systematics, ecology, behavior, and physiology of amphibians and reptiles. In the second half of the semester the class may be divided into several groups which will concentrate on different projects.

475 Evolutionary Theory. Fall term. Credit four hours. Prerequisite: course 281; a course with some taxonomic content in botany or zoology is desirable, or else some experience with making and maintaining a personal collection of some plant or animal group. Lectures, T Th 11:15. Discussion, Th 12:20. Comstock 245. Professor W. L. Brown.

Lectures and class discussions on organic evolution, with primary emphasis on the mechanisms of speciation and adaptation. The course begins with a few lectures on taxonomic methodology.

479 Research in Ecology, Evolution, and Systematics. Fall or spring term. Credit and hours to be arranged. Undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade. Staff.

Practice in planning, conducting, and reporting independent laboratory and/or library research programs.

561 Quantitative Ecology. Fall term. Credit four hours. Prerequisite: one year of biology and permission of instructor. Organic chemistry and some college mathematics are desirable. Lectures, T Th S 11:15. Laboratory, W 1:25-4:25. Stimson 225. Professor Cole.

A quantitative course on selected eco-

logical topics for advanced undergraduates and students. Topics include the origin and interpretation of habitat differences, toleration and response physiology, population dynamics, construction and uses of life tables, spatial distribution patterns, and approaches to the quantitative analysis of biotic communities.

562 Ecology of Pest Management. Spring term. Credit three hours. Prerequisite: Biological Sciences 101 and 102 or the equivalent. Lectures T Th 11:15. Special problem required. Comstock 145. Professor Pimentel and staff.

The focus will be on the ecology of pest management for the development of safe, effective population control measures. The "systems approach" to the management of pests (insects, algae, weeds, animal and plant pathogens, birds, and mammals) will be emphasized. Combinations of biological, physical, and chemical means for pest management will be discussed.

564 Advanced Plant Ecology. Spring term. Credit two or four hours. Prerequisite: course 463. One course each in plant physiology and soils is strongly recommended. Meetings, M W F 11:15. Plant Science 143. Professor Whitaker and Assistant Professor Miller.

Seminars dealing with either (a) physiological mechanisms and the physical, chemical, and biological processes which underlie the distributions of plants and communities, or (b) structure, function, and theoretic interpretation of plant communities. The seminars may be offered concurrently; both may be taken for four credits.

565 Special Topics in Limnology. Fall term. Credit one hour. Primarily for graduate students. Prerequisite: consent of instructor. Hours to be arranged. Associate Professor Likens.

Primarily a seminar course. Advanced discussion in specific topics in limnology. Content variable from year to year.

571 Special Topics in Higher Vertebrates. Fall term. Credit two hours. Enrollment limited. Prerequisite: advanced courses in vertebrate biology and permission of instructors. Hours to be arranged. Professor Cade and Associate Professor Hudson.

Seminars in selected topics of vertebrate ecology, behavior, physiology, and systematics with an emphasis on review of current literature.

[573 Special Topics in Lower Vertebrates. Fall term, even-numbered years only. Credit two hours. Enrollment limited. Prerequisite: consent of instructor. For advanced students in biological sciences. Hours and topics to

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be arranged. Associate Professor McFarland and Assistant Professor Pough. Given in alternate years. Not given in 1971-72.

Seminars in selected topics in the biology of fishes, amphibians, and reptiles. Topics vary from year to year.]

661 Seminar in Population and Community Ecology. Fall term. Credit one hour. Course restricted to graduate students. Prerequisite: permission of instructor. Lecture, M 7:30 p.m. Langmuir Penthouse. This course may be repeated for credit. Associate Professor Root, Assistant Professors Brussard and Levin.

663 Seminar in Evolution and Ecology of Vascular Plants. Fall term. Credit one hour. Prerequisite: course 464 and Statistics 510 and 511 or equivalent, or permission of instructor. Lecture and discussion, M 11:15. Mann 464. Professor Clausen.

A consideration of primary problems concerned with the classification, evolution, and environmental relationships of vascular plants.

665 Environmental Physiology. Fall term. Credit three hours. Lectures, M W 9:05-10:35. Warren 261. Associate Professor McFarland and Assistant Professor Miller.

Comparison of the responses and adaptations of organisms to environment in selected ecosystems. Emphasis on similarities and differences in molecular and organismal mechanisms by which plants and animals cope with their environments.

666 Population Ecology. Spring term. Credit three hours. Prerequisite: graduate standing with some background in calculus, statistics, ecology, and evolutionary theory plus consent of instructor. Lectures and discussions, M W 9:05-10:35. Warren 160. Professor Cole and Assistant Professor Brussard.

Critical examination of the properties and dynamics of populations. Emphasis on theories of population structure, dynamics, and regulation. Discussion of experimental approaches to analyses of natural populations.

[667 Community Ecology. Fall term. Credit three hours. Prerequisite: course 666 or permission of instructor. Lectures, M W 9:05-10:35. Rice 300. Professor Whittaker, Associate Professor Barlow, and Assistant Professor Marks. Not given in 1971-72.

The structure and dynamics of natural communities; patterning and sampling problems, species-diversity, gradient relations, succession, and classification. Comparative aspects of terrestrial, marine, and freshwater communities will be stressed.]

[668 Ecosystems. Spring term. Credit three hours. Prerequisite: course 667 or permission of instructor. Lectures, M W 9:05-10:35. Rice

300. Professor Whittaker and Associate Professor Likens. Not given in 1971-72.

Analysis of ecosystems in terms of energy flow, materials circulation, and model systems; biogeochemistry, pollution, and human ecology. Emphasis on the functional properties of ecosystems considered from simple systems to the biosphere as a whole.]

669 Current Topics in Plant Ecology. Either term. Credit two hours. May be repeated for credit. Hours to be arranged. Assistant Professor Miller.

Insect Biology (Entomology 212).

Invertebrate Zoology (Course 316).

Advanced Soil Microbiology (Agronomy 506).

Soil Microbiology Lectures (Agronomy 306).

Soil Microbiology Laboratory (Agronomy 307).

Microbial Ecology (Course 492).

Aquatic Plants (Agronomy 431).

Phycology (Course 344).

Aquatic Entomology and Limnology (Entomology 471).

Introductory Insect Taxonomy (Entomology 331).

Advanced Insect Taxonomy (Entomology 531, 532, 533, 534).

Introductory Parasitology (Entomology 351).

Advanced Parasitology (Entomology 551).

Ecological Aspects of Animal Behavior (Course 523).

Genetics and Development

280 Human Genetics. Spring term. Credit three hours. Prerequisite: course 101-102 or equivalent. Students who have had course 281 may register only with the permission of the instructor. Lectures, M W 10:10. Warren 45. Discussion, F 10:10. Room to be arranged. Professor Srb.

An introduction to biological heredity through consideration of the genetics of man. Advances in the science of genetics are having a profound effect on man's understanding of himself and on his potential for influencing his present and future well-being. The course is intended primarily to contribute to the student's general education in these matters and, although certain aspects of genetics will be considered with some rigor,

the course is not designed to serve as a prerequisite to advanced courses in genetics.

281 Genetics. Fall or spring term. Credit four hours. Prerequisite: course 101-102 or equivalent. Students who have had course 280 may register only with the permission of the instructor. Lectures, M W F 8. Plant Science 233. Laboratory, M T W Th or F 2:30-4:25, or T Th or S 8-9:55. Plant Science 41. Students do not preregister for laboratory sections; laboratory assignments will be made at the end of the first lecture period. Assistant Professors Bruns, Fink, and MacIntyre, and assistants.

A general study of the fundamental principles of genetics in eucaryotes, procaryotes, and viruses. Discussions of gene transmission, gene action and interaction, gene linkage and recombination, gene structure, gene and chromosome mutations, genetic aspects of differentiation, genes in populations, breeding systems, extrachromosomal inheritance. Animals, plants, and micro-organisms are used in the laboratory, which also includes an independent study of inheritance in *Drosophila*.

386 Animal Embryology. Spring term. Credit four hours. Prerequisite: course 281. Lectures, M W F 9:05. Stimson G-25. Laboratory, M W or F 2-4:25. Fernow 14, 16. Professor Wimsatt.

An introductory course in general animal embryology with major emphasis directed to vertebrates. The lectures cover the physiological, genetical, and morphological bases of early development. The laboratories have a strong anatomical theme.

[480 Population Genetics. Spring term. Credit three hours. S-U grades optional. Prerequisite: course 281 or the equivalent. Lectures, T Th 11:15. Plant Science 143. Professor B. Wallace. Given in alternate years. Not given in 1971-72.

A study of factors which influence the genetic structure of Mendelian populations and which are involved in race formation and speciation. In contrast with course 484, course 480 deals largely with the algebraic aspects of population genetics.]

484 Molecular Evolution. Spring term. Credit three hours. Given in alternate years. Prerequisites: course 281 and organic chemistry. Lectures, T Th 11:15. Plant Science 143. Assistant Professor MacIntyre.

An analysis of evolutionary changes in proteins and nucleic acids and gene-enzyme variability in natural populations. The role of natural selection in effecting these changes and maintaining genetic variation at the molecular level will be critically examined. Theories on the evolution of the genetic code

and the construction of phylogenetic trees from biochemical data will be discussed.

488 Genetics of Lower Eucaryotes. Spring term. Credit three hours. S-U grades optional. Prerequisites: course 281 and a course in organic chemistry. Lectures, M W 9:05. Stocking 204. Professor Srb and Assistant Professors Bruns and Fink.

Genetic aspects of the biology of a few eucaryotic microorganisms, primarily yeast, *Neurospora*, and ciliated protozoa, with emphasis on the use of these organisms as experimental tools. Major topics to be covered include gene action, control mechanisms, cytoplasmic genetic systems, recombination and conversion, morphogenetic systems and evolutionary aspects of physiological systems. Extensive appropriate reading in the original literature of genetics is a primary component of the course.

489 Research in Genetics and Development. Fall or spring term. Credit and hours to be arranged. Undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade. Staff.

Practice in planning, conducting, and reporting independent laboratory and/or library research programs.

680 Current Topics in Genetics. Throughout the year. Credit two hours a term. Open to graduate students, with preference given to majors in the field of genetics; undergraduates by permission only. No auditors. Enrollment limited to 20 students. Time and place to be arranged. Staff.

A seminar course with critical presentation and discussion by students of original research papers in a particular area of current interest. Content of the course and staff direction will vary from term to term, and will be announced a semester in advance.

Cytology (Courses 347A and 347B).

Cytogenetics (Course 440).

Cytochemistry and Cytophotometry (Poultry Science 430).

Microbial Genetics (Courses 495A and 495B).

Physiological Genetics of Crop Plants (Plant Breeding 505).

Plant Growth and Development (Course 441).

Microbiology

290A General Microbiology (Lectures). Fall or spring term. Credit three hours. Prerequisite: course 101-102 or equivalent and Chemistry 104 or 108 or the equivalent. It is

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recommended that 290B be taken concurrently. Lectures, M W F 11:15. Stocking 204. Fall term, Professor H. W. Seeley; spring term, Professor VanDemark.

A study of the basic principles and relationships in the field of microbiology, with fundamentals necessary to further work in the subject. The course offering in the spring term will provide special emphasis on the application of microbiology in home economics and agriculture.

290B General Microbiology (Laboratory). Fall or spring term. Credit two hours. M W 2-4:25; T Th 8-11 or 2-4:25. Stocking 301. Fall term, Professor H. W. Seeley; spring term, Professor VanDemark.

A study of the basic principles and techniques of laboratory practice of microbiology with fundamentals necessary to further work in the subject.

391A Natural Selection in the Bacteria. Fall term. Credit three hours. Prerequisite: Biological Sciences 290 and 431 or consent of instructor; Biological Sciences 431 may be taken concurrently. Lectures, M W F 9:05. Stocking 119. Associate Professor MacDonald.

A study of the comparative physiological and ecological relationships among bacteria and some related organisms. A number of groups of bacteria will be discussed in detail as well as factors which influence their ability to survive in nature. Parasitism, autotrophy, and evolution will be among the major topics discussed.

391B Bacterial Ecology Laboratory. Fall term. Credit three hours. Enrollment limited to 15. Prerequisite: concurrent registration in 391A and consent of instructor. Lecture, M 1:25. Discussion, F 1:25. Laboratories to be arranged. Associate Professor MacDonald.

Techniques for the isolation, cultivation, and detailed study of selected groups of organisms. Some of the more standard techniques of physiological study will be introduced. Emphasis will be placed on independent work.

393 Applied and Industrial Microbiology. Fall term. Credit three hours. Given in alternate years. Prerequisite: course 290 or equivalent. Lectures, T Th S 11:15. Stocking 119. Professors Delwiche, Dondero, and VanDemark.

A survey of the microbiology of industrial fermentations, water, and waste decomposition.

394 Food Microbiology. Spring term. Credit four hours. Prerequisite: course 290A, 290B. Graduate students must have permission of the instructor. Lectures, M W 12:20. Stocking 120. Laboratory, M W 2-4:25. Stocking 301. Professor Naylor.

The major families of microorganisms of

importance in foods are studied systematically with emphasis on the role played by these organisms in food preservation, food fermentations, and public health. The laboratory work includes practice in the use of general and special methods for microbiological testing and control of food products as well as practice in the isolation and characterization of organisms found in foods.

490A Microbial Physiology Lectures. Spring term. Credit three hours. Prerequisite: 391A or permission of instructor. Primarily for microbiology majors intending to enter graduate school and for graduate students. Lectures, T Th S 10:10. Stocking 119. Associate Professor Gibson.

A study of the organization of physiological processes in microorganisms, including a study of structure, energy-yielding mechanisms, macromolecular biosyntheses, and growth and regulation.

490B Microbial Physiology Laboratory. Spring term. Credit three hours. Enrollment is limited and preference will be given to students obtaining a grade of B- or better in Biological Sciences 391B. Prerequisite: co-registration in 490A and permission of instructor. Laboratory, F 9:05-4:25. Stocking 321. One discussion period to be arranged. Assistant Professor Gibson.

Experiments on material covered in Course 490A will be used to introduce modern research techniques for the study of growth and physiological activities.

[492 Microbial Ecology. Spring term. Credit two hours. Given in alternate years. Prerequisite: an elementary course in some facet of microbiology. M W 8. Bradfield 108. Professor Alexander. Not given in 1971-72.

An introduction to the basic principles of microbial ecology. Attention is given to behavior, activity, and interrelationships of bacteria, fungi, algae, and protozoa in natural ecosystems.]

495A Microbial Genetics, Lectures. Fall term. Credit two hours. S-U grades optional. Prerequisite: courses 281 and 290A, or permission of the instructor. For upperclassmen and graduate students. Lecture, W 7:30-9:25 p.m. Stocking 204. Associate Professor Zahler.

Genetics of bacteria and their viruses, with emphasis on the mechanisms of genetic phenomena.

495B Microbial Genetics, Laboratory. Fall term. Credit three hours. S-U grades optional. Prerequisite or parallel: course 495A. Permission of the instructor is required. Primarily for upperclassmen. Laboratory, T 1:25-4:25, and other hours to be arranged. Stocking 321. Associate Professor Zahler.

Problem solving in bacterial genetics.

496 Selected Topics in Microbial Metabolism. Spring term. Credit two hours. S-U grades optional. Prerequisite: beginning courses in general microbiology, biochemistry, and organic chemistry, Course intended for upperclassmen and graduate students. Lectures, M W 11:15. Riley-Robb 15. Professor Delwiche.

Selected topics pertaining to the energy metabolism, oxidative and fermentative abilities, and biosynthetic capacities of microorganisms. Where possible and appropriate the subject matter deals with the various microbial forms in a comparative sense.

498 Virology. Spring term. Credit three hours. Given in alternate years. Prerequisite: courses 290A and 281 or permission of the instructor. Lectures, T Th S 11:15. Stocking 204. Professor Naylor, assisted by Professor Ross and Associate Professor Carmichael.

A study of the basic physical, chemical, and biological properties of plant, animal, and bacterial viruses.

499 Research in Microbiology. Fall or spring term. Credit and hours to be arranged. Undergraduates must attach to their pre-registration material, written permission from the staff member who will supervise the work and assign the grade. This course cannot be used to fulfill the concentration requirement. Staff.

590 Methods in Advanced Bacteriology. Fall and spring term. Credit to be arranged. Limited enrollment. Prerequisite: permission of instructor. Primarily for graduate students in microbiology. Hours to be arranged. Staff.

Intended to acquaint advanced students with some of the more important techniques used in microbiology.

596 Molecular Immunology. Spring term. Credit two hours. For advanced undergraduates and graduate students. Prerequisite: Biochemistry 531 or permission of the instructor. W 7:30-9:25 p.m. 204 Stocking. Assistant Professor Slobin.

A study of the immune response with particular emphasis on the structure and evolution of immunoglobulins, the nature of antigen-antibody interactions, and the molecular biology of antibody biosynthesis.

691 Graduate Seminar in Microbiology. Fall and spring terms. Credit one hour per term. Required of all graduate students majoring in microbiology. Time and place to be arranged. Staff.

699 Microbiology Seminar. Fall and spring terms. Non-credit. Required of graduate students majoring in microbiology and open to all who are interested. Th 4:15. Riley-Robb 105. Staff.

Soil Microbiology (Agronomy 306).

Advanced Soil Microbiology (Agronomy 506).

Serology (Veterinary Medicine 941).

Immunochemistry (Veterinary Medicine 944).

Animal Virology (Veterinary Medicine 945).

Microbial Ecology (Agronomy 410).

Communication Arts

This curriculum is based on a strong foundation in the sciences and humanities, which provides content and breadth needed for a specialty area such as communication arts. Beginning with the sophomore year communication courses are carefully integrated with those in other disciplines to offer majors intellectual strengths for individual accomplishment. Prospective majors may get additional information directly from the Department. Each major must complete twenty-six semester hours of communication arts courses prior to graduation. Those specifically required are: 200, 301, 311, 401, 420 or 421, and 430. Majors must also select one of the following: 214 or 215; and two from the following: 313, 315, 316, 318, and 319.

Each major must be involved in campus communication activity each semester. The student should consult his adviser for details.

The Graduate Teaching and Research Center of the Department of Communication Arts is located at 640 Stewart Avenue.

Communication Theory

200 Theory of Human Communication. Fall term. Credit three hours. Lecture, T Th 10:10. Discussion, T or Th 12:20. Warren 131. Assistant Professor Barwind.

Introduction to behavioral theories of communication from a multidisciplinary perspective. Contributions from the mass media, anthropology sociology, psychology, social psychology, rhetoric, and cybernetics are considered.

403 Topics in Communication Theory. Fall term. Credit three hours. Prerequisite: 200 or consent of instructor. M W F 9:05. Warren 260. Assistant Professor Miller.

Specific topics to be covered will vary from semester to semester but generally will be drawn from such areas as nonverbal communication, effects of status on communication patterns and networks, interpersonal influence and person perception, mass persuasion, general semantics, rumor transmission, propaganda, etc. These areas will be

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discussed with particular reference to their effects on the process of communication.

404 Psychology of Communication. Spring term. Credit three hours. Prerequisite: 200 or consent of instructor. M W F 9:05. Roberts 131. Assistant Professor Barwind.

An advanced study of communication theory from a multidisciplinary orientation. Topics to be covered include: interpersonal interaction, channels of communication, and effectiveness of message. Study will include intensive analysis of primary sources of major communication theorists.

Interpersonal Communication

100 Oral and Written Expression. Fall term. Credit three hours. Not open to four-year students. Conferences by appointment, daily 8-5, S 8-12. M W F 8, 9:05. Warren 345. Mr. Lueder and assistants.

A program of speaking and writing designed to develop proficiency in clear effective communication. Individual appointments are scheduled to counsel the students in principles of effective expression.

205 Parliamentary Procedure. Fall or spring term. Credit two hours. Not open to freshmen. Limited to 20 students. Th 2-4:25. Warren 361. Professors Freeman and Martin and Mr. Lueder.

Principles and practice of parliamentary procedure including formation of by-laws, and meeting evaluation. Programmed instructional materials used. Emphasis on experience in applying principles of parliamentary procedure in meeting situations.

301 Oral Communication. Fall or spring term. Credit three hours. Fall term limited to juniors and seniors; spring term open to sophomores, juniors, and seniors. Each section is limited to 20 students. Fall term: M W F 8 or 9:05, Warren 131; 10:10, Warren 231; or 11:15, Warren 245; or T Th 9:05 and W 12:20, Warren 131; or T Th 10:10 and W 12:20, Warren 345. Spring term: M W F 8, 9:05, 10:10, 11:15, Warren 131; or T Th 9:05 and W 12:20, Warren 131; or T Th 10:10 and W 12:20, Warren 345. Conferences daily 8-5, S 8-12. Professors Freeman and Martin, and Assistant Professors Barwind and Miller.

Training and experience in the theory, preparation, presentation, and evaluation of oral topics. Designed to encourage interest in public affairs and to develop self-confidence. Individual appointments are scheduled to counsel the students in principles of effective self-expression.

302 Advanced Oral Communication. Fall or spring term. Credit two hours. Prerequisite: 301. Fall term: T Th 11:15. Spring term: T

Th 10:10, Warren. Conferences by appointment, daily 8-5, S 8-12. Professors Freeman and Martin.

Students present a variety of talks of varying lengths with emphasis on persuasive, manuscript, and visual aid speeches. The theory of persuasion and audience analysis is stressed. Individual appointments are scheduled to counsel the students in principles of effective self-expression.

303 Small Group Communication. Spring term. Credit three hours. M W 12:20-1:45. E. Roberts 222 and 223. Assistant Professor Miller.

Theory and practice in leadership and participation in small-group communication. The course stresses learning and problem solving in the discussion setting.

Mass Media

214 History of Mass Communication. Spring term. Credit three hours. Limited to 100 students. M W F 10:10. Warren 145. Assistant Professor Crawford.

A survey of the history of the print, film, and broadcast media with particular emphasis on the United States. Includes an analysis of the sociological and technological factors influencing media development.

215 Introduction to Mass Media. Fall term. Credit three hours. Limited to 190 students above the freshman level. M W F 11:15. Bradfield 101. Professor Russell.

An introductory course which explores policies, philosophies, and practices of communication media. Freedom of the press, ethics, libel, and slander are considered in the day-to-day function of the media.

311 Radio and Television Communication. Fall term. Credit three hours. Limited to 40 students. Prerequisite: 215. T 1:25-4:25. Educational Television Center, Van Rensselaer. Associate Professor Colle.

Analysis of information program formats, including those used in commercial and educational broadcasting, in instructional television, and in various specialized applications of radio and television. Students will be responsible for designing sample programs.

312 Advertising and Promotion. Spring term. Credit three hours. Limited to 190 students at the junior, senior, and graduate level. M 1:25-4:25. Ives 120. Professor Russell.

Examines advertising principles and techniques in both a historical and an economic perspective. Advertising and promotion campaigns and their overall effectiveness as a multiplier in the economy are analyzed. Current advertising trends and the strategy of media planning are examined.

401 Communication Law. Spring term. Credit three hours. Enrollment limited to majors at the junior, senior, and graduate levels, and others by permission. T Th 2-3:30. Roberts 131. Associate Professor Bugliari.

Writing for the Media

313 Writing for Magazines. Spring term. Credit three hours. Open to juniors, seniors, and graduate students. M 1:25-4:25. Communication Arts Graduate Center, Professor Ward.

An intensive fact-writing course to help students communicate more effectively through the medium of the printed word in magazines. Art and techniques of good writing studied; continuous analysis of magazines in many fields of interest. All articles analyzed and returned to each student for rewriting and submission to a magazine.

315 News Writing and Analysis. Fall term. Credit three hours. Limited to 30 students. Lecture: T Th 11:15. Roberts 131. Laboratory: W 1:25-3:20. Communication Arts Graduate Center. Assistant Professor Kim.

The writing and analysis of news stories. A study of press problems, press-society relations, the elements that make news, sources of news, interviewing, writing style and structure, and the reporting of public affairs. Reasonable typing ability is essential for the laboratory work.

316 Science Writing. Spring term. Credit three hours. M W F 8. Roberts 131. Assistant Professor Kim.

In-depth interpretation of scientific subjects for general publications. The translating of scientific language to the degree necessary for reaching various publics. Analysis of issues that arise in general reporting of the news of science. Previous writing courses and/or experience are strongly recommended.

318 Radio Writing and Production. Spring term. Credit three hours. Prerequisite: 311. Lectures: T Th 9:05. Roberts 131. Laboratory: T 3-5. Communication Arts Graduate Center. Associate Professor Colle.

Writing for various radio formats, with an emphasis on public affairs programs, including documentaries and interviews. Students will tape record their programs for possible use on radio stations in the state.

319 Television Writing and Production. Fall term. Credit three hours. Limited to 25 students. Prerequisite: 215. W 1:25-4:25. Educational Television Center, Van Rensselaer. Associate Professor Colle.

Emphasis will be on creating several kinds of programs whose objective is to inform,

educate, or persuade. Students will write and produce their own television programs which will be video-taped for playback and analysis. Previous television courses or experience strongly recommended.

420 Media Laboratory. Fall term. Credit two hours. Open to majors at junior and senior levels. Th 1:25-4:25. Communication Arts Graduate Center. Assistant Professor Kim.

Communication Arts majors participate in on-going media activities under the supervision of the Department faculty. Emphasis will be placed on publishing the *Cornell Countryman*, and other periodicals, and on production work in radio, television, and film.

421 Media Laboratory. Spring term. Continuation of 420.

430 Visual Communication. Fall term. Credit three hours. Open to juniors, seniors, and graduate students. M W F 10:10. Roberts 131. Associate Professor Stephen.

Explores the importance of graphic arts for communicating ideas in today's visually oriented society. Examines the principles of visual communication as related to message content and psychological impact. Still photography, slide sets, motion pictures, TV, posters, exhibits, and other media are analyzed.

431 Art of Publication. Spring term. Credit three hours. Open to juniors, seniors, and graduate students. W. 1:25-4:25. Communication Arts Graduate Center. Assistant Professor Kim.

Designed to explore creative visual concepts to increase communication effectiveness through the printed word. Importance of selecting and coordinating format, layout, typography, and illustrations is stressed. Lectures, field trips, and assignments examine merits and problems in using publications as a communication medium.

International Communication

501 International Communication. Spring term. Credit three hours. F 1:25-4:25. Communications Arts Graduate Center. Assistant Professor Crawford.

Analysis of the purposes, techniques, and effects of organizations involved in cross-national communication, with particular emphasis on the mass media—the flow of information between nations. Also considered are international conventions and other agreements that pertain to international communication.

524 Communication in the Developing Nations. Fall term. Credit three hours. Open to seniors and graduate students. F 1:25-

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4:25. Communication Arts Graduate Center. Assistant Professor Crawford.

An examination of existing communication patterns and systems and their contributions to the development process. Special attention is given to the interaction between communication development and national development in primarily agrarian societies.

526 Comparative Mass Media. Spring term. Credit three hours. Th 1:25-4:25. Communication Arts Graduate Center. Associate Professor Colle.

A study of the mass media in several national settings with particular attention to the structure, controls, audience, and content of press and telecommunications.

Communication Seminars

512 Seminar: Interpersonal Communication. Spring term. Credit three hours. W 1:25-4:25. Communication Arts Graduate Center. Assistant Professor Barwind.

A study of recent advances and research in listening, conference, small-group interaction. New developments will be examined as they relate to business, administration, and education.

[521 Seminar: United States Communication. Fall term. Credit three hours. Prerequisite: 214 or 215 or permission of the instructor. W 1:25-4:25. Communication Arts Graduate Center. Associate Professor Colle. Not given 1971-72.

An examination of the structure of communication in the United States focusing particularly on the organization, content, controls and audience of the print, broadcast, and film media. Selected media of other nations are included in the analysis to provide a perspective on the United States system.]

531 Studies in Communication. Fall term. Credit three hours. Limited to 15 students. Open to graduate students in communication arts; others by permission. M 1:25-4:25. Communication Arts Graduate Center. Assistant Professor Crawford.

A review of classical and contemporary research in communications, key concepts, and areas of investigation. Exploration of the scope of the field and the interrelationships of its various branches.

532 Methods of Communication Research. Fall term. Credit three hours. Limited to graduate students. Assistant Professors Barwind and Miller.

An analysis of the methods employed in communication research. Particular concern is given to the philosophical rationale behind

experimental, descriptive, and historical-critical research methods.

543 Frontiers in Communication. Fall term. Credit three hours. Th 1:25-4:25. Communication Arts Graduate Center. Associate Professor Colle.

A study of recent developments in communication. Emphasis is on the creative application of the newest methods, materials, and technology in visual, print, film, oral, and telecommunication media to contemporary and future problems involving communication. Examples include the applications and implications of satellite communication, multi-media "self"-teaching systems, mobile printing technology, facsimile, computer retrieval systems, heat-power radia, electronic video recorder, laser beams, etc.

550 Advanced Communication Seminar. Spring term. Credit three hours. T 1:25-4:25. Communication Arts Graduate Center. Professor Russell and staff.

Designed to give graduate students the opportunity to study and work on special problems in communication.

Research

495 Undergraduate Research. Fall and spring terms. Credit one to three hours. Open only to seniors majoring in the Department, who must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade.

Designed to permit outstanding undergraduates to carry out independent studies in communications research under appropriate supervision. Departmental staff.

595 Directed Graduate Study. Fall and spring terms. Credit three to six hours. Staff.

Education

Undergraduates may specialize in agricultural education or in science education. It is possible to combine the requirements for a Bachelor of Science degree with those for provisional certification as a teacher. Students intending to teach should consult an appropriate member of the faculty in education to ascertain requirements and to plan a program of studies.

Graduate programs are offered in educational research, foundations of education, and in specialized areas of agricultural education, science and environmental education, administration, guidance, curriculum, and continuing education.

Agricultural Education

331 Introduction to Teaching Agriculture. Spring term. Credit one hour. Required of juniors and others entering the directed teaching program in the senior or following year. M 2-4:25. Warren 261. Professor Drake.

An introduction to the origin, development, objectives, course of study, and method of teaching agriculture in secondary schools, and to individual experience programs.

332 Methods, Materials, and Directed Practice in Teaching Agriculture in the Secondary School. Fall term. Credit nine hours. Staff in agricultural education.

Directed participation in off-campus centers in specific and related problems of teaching agriculture at the junior and senior high school levels, which includes adjustment in the school and community; evaluation of area resources, materials of instruction, and school facilities; organization and development of local courses of study; launching and directing work experience programs; planning for and teaching all-day classes; advising youth organizations; and other problems relating to development of a balanced program for vocational education in agriculture in a local area.

433 Special Problems in Agricultural Education. Spring term. Credit one or two hours. S-U grades optional. Graduate and undergraduate students. Th 1:25. Warren 231. Professor Bail and staff.

The purpose is to provide students an opportunity to study individually or as a group, selected problems in agricultural education to meet the particular needs of the students.

434 Organization and Direction of Out-of-School Programs. Fall term. Credit three hours. Professor Cushman.

Emphasis will be placed on solving the problems encountered by teachers of agriculture in such phases of the out-of-school program as making arrangements to have a program, determining instructional needs and planning programs of instruction, teaching in groups, giving individual instruction, organizing and advising the local out-of-school association, and evaluating the out-of-school program.

531 Supervision in Agricultural Education. Fall term. Credit two hours. Offered in alternate years. Open to students with experience in teaching agriculture, or by permission. W 2:30-4:25. Plant Science 141. Professor Bail.

The function of supervision, program planning, and supervisory techniques as applied to state programs in agricultural education.

532 Advanced Methods and Materials of Teaching Agriculture. Spring term. Credit two or three hours. M 2:30-4:25. Warren 101. Assistant Professor Berkey.

Consideration is given to an analysis of selected teaching techniques and to the selection, preparation, and use of instructional materials in agriculture.

533 Planning Courses of Study and Agricultural Experience Programs. Fall term. Credit three hours. M F 1:25-2:55. Warren 260. Professor Drake.

Guiding principles, objectives, and sources of information will be developed for planning the courses of study and teaching calendar. Consideration will be given to principles, meaning, and function of agricultural experience programs, and how they are planned, developed, and used as a means of instruction.

534 Education for Leadership of Youth and Adult Groups. Fall term. Credit two hours. F 1:25-3:20. Warren 101. Professor Cushman.

Designed for leaders in the field of agricultural education who are responsible for organizing programs. A consideration of the principles involved in organizing and conducting out-of-school programs for young and adult groups.

535 Planning and Conducting Programs of Teacher Preparation in Agriculture. Fall term. Credit two hours. Given in alternate years. T 1:25-3:20. Warren 131. Professor Tom.

Open to persons with teaching experience in agriculture who are preparing for or are engaged in the preparation of teachers, or in related educational service.

[536 Organization and Administration of Agricultural Education. Spring term. Credit two hours. W 2:30-4:25. E. Roberts 223. Professor Cushman. Given in alternate years. Not given in 1971-72.

Designed for teachers, high school principals, teacher trainers, supervisors, and others who are responsible for the administration of agricultural programs or who wish to qualify for this responsibility. Emphasis will be placed on interpreting the vocational acts and on problems of administration at the local and state levels.]

538 Teaching General Agriculture in the Secondary School. Spring term. Credit two hours. F 4:15-6. Warren 261. Professor Tom.

The organization, purpose, and content of courses in agriculture in junior and senior high schools to serve those who elect to study agriculture for its general educational values in preparation for everyday living.

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539 Evaluating Programs of Agricultural Education. Spring term. Credit two hours. Given in alternate years. Open to students with experience in teaching agriculture, or by permission. T 1:25-3:20. Comstock 145. Professor Drake.

Students will study objectives and evaluative criteria, and will develop criteria and procedures for evaluation of programs of agricultural education in the secondary schools.

630 Seminar In Agricultural Education. Spring term. Credit one hour. S-U grades only. Th 2:30-4:25. Warren 260. Staff.

Recommended for Master's degree candidates who have had teaching experience and doctoral candidates with majors and minors in agricultural education. The seminar will be primarily centered around current problems and research in the field not included in other course work.

Curriculum and Instruction

332 Methods, Materials, and Directed Practice in Teaching Agriculture in the Secondary Schools. Fall term. Credit nine hours. Staff in agricultural education.

See page 85 for description.

407 The Teaching of Elementary School Science. Fall term. Credit three hours. Registration by permission. Professor Rockcastle.

See page 92 for description.

408 Methods of Teaching Science in Secondary Schools. Fall or spring term. Credit three hours. Registration by permission. Assistant Professor Brautigan.

See page 92 for description.

409 Practice in Teaching Science in Secondary Schools. Fall or spring term. Credit six or twelve hours. Prerequisite: 408 and permission of the instructor. For seniors and graduate students. Hours to be arranged. Assistant Professor Brautigan.

See page 92 for description.

444 Teaching of Secondary Mathematics. Spring term. Credit three hours. T Th 4-5:15. Warren 232. Professor Geiselmann.

Useful materials and practical methods for effective teaching of mathematics in the junior and senior high schools. Attention will be given to research in mathematics education, and to recent proposals for curriculum revision. Special interests of the students serve as a guide for the further selection of topics.

445 Teaching Reading and Study Skills. Spring term. Credit three hours. Limited to seniors and graduate students. Professor Pauk.

For teachers, administrators, guidance counselors, and supervisors. Pertinent research as well as the psychology and philosophy of developmental reading and study skills will be examined. Teaching methods and sample materials for class-room use will be demonstrated and discussed.

473 Contemporary Philosophy of Education. Spring term. Credit three hours. M W 12:20-2:20. Warren 145. Professor Gowin.

Topic for 1971-72: Structure of Knowledge.

509 Development of Curriculum in Science. Spring term. Credit three hours. For graduate students interested in elementary, secondary, or college science teaching. Limited to 20 students. M 1:25-4:25. Professor Novak.

See page 93 for description.

533 Planning Courses of Study and Agricultural Experience Programs. Fall term. Credit three hours. M F 1:25-2:55. Professor Drake.

See page 85 for description.

540 The Art of Teaching. Fall and spring term. Credit and hours as arranged. S-U grades optional. Students may register only with the consent of the instructor. Professor Wardeberg.

For students enrolled in teacher education programs.

545 The Curriculum of American Schools. Fall term. Credit three hours. Limited to graduate students.

A survey of the basic elements involved in making curriculum decisions, and an examination of contemporary curriculum developments in elementary and secondary schools.

[546 Teaching Reading and Language Skills. Fall term. Credit three hours. T Th 2:30-3:45. Warren 231. Professor Wardeberg. Not given in 1971-72.

Materials and techniques in teaching the language arts in the elementary school; special emphasis on the teaching of reading.]

547 Seminar in Elementary Education. Fall term. Credit and hours to be arranged. S-U grades optional. Professor Wardeberg.

A problems seminar to study current problems and research in this field.

549 Modern Mathematics for the Elementary Teacher. Fall term. Credit three hours. T 1:25-3:35. Warren 231. Professor to be appointed.

565 Supervision of Instruction. Spring term. Credit three hours. Professor Wardeberg.

See page 87 for description.

645 Seminar in Curriculum Theory and Research. Spring term. Credit three hours. S-U grades optional. Registration by permission of instructor. T 1:25-3:30. Plant Science 37. Staff.

Educational Administration

561 Theory and Practice of Administration. Fall term. Credit three hours. W 4-6. Warren 131. Assistant Professor Haller.

Keyed to concepts and research findings in the social and behavioral sciences that are basic to the administration of educational organizations. Institutional and individual problems are analyzed from the viewpoint of organizational dilemmas and role conflict.

562 The Principalship. Spring term. Credit three hours. Th 2:30-4. Bradfield 105. Professor Hixon.

Organized to enable recognition and cognition of the administrative functions essential to effective elementary and secondary schools. Analysis will include the elementary and secondary school as institutions, innovation in organization and curriculum, administration of instructional and noninstructional personnel, and community relationships. Each student will elect to specialize at the elementary or secondary school level for an individually planned program of intensified study.

563 Social Context of Educational Administration. Spring term. Credit three hours. W 4-6. Warren 145. Assistant Professor Haller.

The purpose of this course is to familiarize students with environmental and organizational factors influencing contemporary education. Topics include stratification and mobility, socialization processes, social control, professionalization, bureaucratization, and the teaching career. Students concerned with educational administration will consider the administrative implications of topics covered. The course will be organized as a seminar. Students will be expected to conduct and report a small-scale empirical research project.

564 Economic Issues in Education. Fall term. Credit three hours. M 2:30-4. Staff.

Introduction to problems of resource procurement and allocation in education. Attention will be focused on existing and alternative strategies of fiscal support for schools and new management techniques for allocating such resources.

565 Supervision of Instruction. Spring term. Credit three hours. T 4-6. Warren 145. Professor Wardeberg.

A basic course in the nature and scope of supervision. Open to those already in supervisory positions, either in public schools or

elsewhere, and experienced persons aspiring to become supervisors.

567 Education Law. Fall term. Credit three hours. T 2:30-4. Bradfield 108. Professor Hixon.

Review and analysis of federal and state legislation, court decisions, opinions, and regulations which affect educational institutions. Attention to New York State legislation is optional.

569 Personnel Administration. Fall term. Credit three hours. Th 2:30-4. Bradfield 108. Associate Professor Egner.

Designed to provide an introduction to modern psychological and sociological perspectives of personnel administration. Three purposes are paramount: (1) to acquaint the student with a variety of ways of conceiving the problems of personnel administration; (2) to acquaint the student with relevant research; and (3) to develop some facility in the analysis of conceptual schemes and research projects.

668 Seminar in Educational Administration. Spring term. Credit three hours. Prerequisite: 569 or 561, or consent of instructor. Time to be arranged. Professor Hixon.

Consideration of problems and policy issues in public schools and higher education.

Educational Psychology and Measurement

110 General Psychology. Fall or spring term. Credit three hours. May not be taken for credit by students who have had Psychology 101 or equivalent. Two lectures, a testing and demonstration period, and one discussion section each week. Lecture and testing period: M W F 10:10. Plant Science 233. Discussion sections: Th or F 8, 9:05, 10:10, 11:15, 12:20, 1:25, 2:30, or 3:35. E. Roberts 223. Associate Professor McConkie.

A survey of research and theories in the field of psychology. Areas of emphasis include research methods, perception, learning and memory, language and thought, motivation and emotion, individual differences and psychological testing, personality development, and abnormal psychology.

411 Educational Psychology. Fall or spring term. Credit three hours. Freshmen and sophomores not admitted. Registration limited to 100 students. Prerequisite: an introductory course in psychology. Designed for students in teaching programs and/or those interested in the educational process. Special section for students in agricultural education, fall term, time to be arranged. Professor Glock.

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Fall term: M W F 11:15. Professor Ripple.
Spring term: M W F 9:05. Comstock 245.
Professor Glock.

Consideration of the outstanding facts and principles of psychology bearing upon classroom problems. A project in tutoring may be required in the spring term.

417 Psychology of Adolescence. Spring term. Credit three hours. Freshmen and sophomores not admitted. Registration limited to 100 students. Prerequisite: a course in general psychology. T Th 1:25-3:20. Warren 345. Professor Ripple.

A survey of the nature of adolescent growth and development, with emphasis on some of the causal factors pertaining to adolescent behavior.

452 Interpretation of Statistics Used in Education. Fall term. Credit one hour. T 12:20. Warren 101. Will be offered in the spring term only to those students concurrently enrolled in course 453. Time to be arranged. Professor Millman.

See page 88 for description.

453 Introduction to Educational Statistics. Spring term. Credit three hours. Prerequisite: 452 (may be taken concurrently), or permission of the instructor. T Th 8-9:55. Warren 101. Professor Millman.

See page 88 for description.

511 Educational Psychology. Fall term. Credit three hours. Permission of instructor required. M W F 11:15. Warren 260. Professor Ripple.

A basic course in educational psychology for graduate students.

551 Educational Measurement. Spring term. Credit three hours. Not offered every year. Permission of the instructor required. M 1:25-3:20. Comstock 145. Professor Glock.

A study of the construction of achievement tests and the use of aptitude tests, achievement tests, and other measuring instruments in the classification and guidance of pupils and improvement of instruction.

555 Use and Interpretation of Tests in Guidance and Personnel Administration. Fall term. Credit three hours. Th 4-6. Warren 232. Professor Andrus.

Open to students in guidance or personnel administration and to classroom teachers who expect to work with standardized group tests. Deals with the historical development and the use and interpretation of aptitude tests as a basis for guidance and selection in public schools, colleges, and/or industry. Designed to meet the New York State certification for guidance counselors.

599 Methods of Educational Inquiry. Fall and spring terms. Credit three hours. Prerequisite: one course in statistics or 452 taken concurrently. T Th 2:30-4. Caldwell 100. Professor Millman and staff.

See page 89 for description.

613 Seminar in Educational Psychology. Fall term. Credit three hours. Permission of Instructor required. Hours to be arranged. Professor Glock.

Topic to be announced.

617 Seminar in Learning and Memory. Fall term. Credit three hours. Prerequisite: Psychology 306 or equivalent. Hours to be arranged. Associate Professor McConkie.

A study of current issues in the learning, retention, and transfer of verbal information.

618 Seminar in Educational Psychology. Spring term. Credit three hours. Permission of the instructor required. Hours to be arranged. Professor Ripple and staff.

Emphasis on theoretical considerations of various areas in educational psychology. Primarily for doctoral students. Not designed for project students earning a Master's degree.

Educational Research Methodology

452 Interpretation of Statistics used in Education. Fall and spring terms. Credit one hour. Registration in spring term limited to those concurrently enrolled in 453. Fall term. T 12:20. Warren 101. Spring term. Time to be arranged. Professor Millman.

A brief introduction to the vocabulary and symbolism used in reporting empirical research in education. Both univariate and multivariate statistical procedures will be covered from an intuitive point of view.

453 Introduction to Educational Statistics. Spring term. Credit three hours. Prerequisite: 452 (may be taken concurrently), or permission of the instructor. T Th 8-9:55. Warren 101. Professor Millman.

A study of common statistical procedures encountered in educational literature and research. The course includes the mathematical bases, computation, and interpretation of univariate and multivariate descriptive and inferential statistics.

527 Evaluation for Program Management. Fall term. Credit three hours. S-U grades optional. M 1:25-3:20, and one hour to be arranged. Caldwell 250A. Associate Professor Bruce.

See page 90 for description.

599 Methods of Educational Inquiry. Fall term. Credit three hours. Prerequisite: one course in statistics or 452 taken concurrently. T Th 2:30-4. Caldwell 100. Professor Millman and staff.

An introduction to the methods that underlie the conduct of significant research in education. Emphasis will be placed upon describing and analyzing such procedures as forming concepts, developing educational products, making observations and measurements, performing experiments, building models and theories, providing explanations, and making predictions.

616 Seminar In Educational Research. Fall term. Credit three hours. Prerequisite: courses 453 and 599 or permission of the instructor. Time to be arranged. Professor Millman.

Topic to be arranged.

698 Practicum in Educational Research. Fall and spring terms. Three to six credit hours per term. Hours to be arranged. Members of the staff.

Participation in a research project under the direction of the principal investigator of said project. Level of responsibility will increase with the experience and capability of the candidate, the eventual goal being his assumption of responsibility for a portion of the research.

699 Conceptual Problems in Educational Inquiry. Fall term. Credit three hours. Primarily for doctoral candidates in their second year of residence. Prerequisite: 599 or equivalent, or permission of instructor. W 2:30-4:30. Warren 231.

An examination of such concepts as causation, operationism, validity, reliability, hypothetical construct, generalization, explanation, probability, and hypothetico-deductive method.

Extension and Continuing Education

Other departments that offer additional courses helpful in the field of extension education are Community Service Education, Rural Sociology, Sociology, Agricultural Economics, and Anthropology.

Extensive flexibility is permitted each student in the selection of a course program to meet his special interests and professional needs.

522 Educating for Community Action. Spring term. Credit three hours. Open to juniors and seniors by consent. W 11:15-1:10; F 11:15. Caldwell 250A. Associate Professor Bruce.

Emphasis is on the design and execution of the educational aspects of community action programs. The course deals with the

identification and statement of educational goals, selection of teaching strategies, and evaluation of outcomes.

523 Administration of Continuing Education Programs. Spring term. Credit three hours. An application of the principles of administration and supervision to the problems of organizing and operating continuing education programs. W 1:25-4:00. Bradfield 105. Professor Durfee.

Emphasis is on identifying, describing, and analyzing alternative models for planning, organizing, staffing, directing, controlling, and financing an adult education enterprise.

524 Designing Continuing Education Programs. Fall term. Credit three hours. An analysis of current theories, concepts, principles, and procedures central in the development of programs for the continuing education of adults. T 1:25-4:00. Caldwell 250A. Professor Leagans.

Programming is conceptualized as a process of systematic decision making about objectives to be achieved and the design of educative activity to achieve them. In this context, emphasis is placed on such major problems as situation analysis, leadership involvement, need identification, selection of objectives from alternatives, creating support at macro level, organizing program resources at micro level, and planning for program execution.

525 Educational Communication. Spring term. Credit three hours. T 1:25-4:00. Caldwell 250A. Professor Leagans.

Emphasizes the centrality of useful technology and effective communication in continuing education programs. Emerging models of the communication process are reviewed as a framework for analyzing major elements, including communicator credibility, program content, messages, organization and use of transmission channels, message treatment, audience identification, feedback, and the design of operation communication programs.

526 Practicum In Continuing Education. Continuous fall and spring terms. Credit one to three hours. Open only to graduate majors and minors in extension and continuing education. Hours to be arranged. Staff.

Provides opportunity for students to supplement the formal aspects of their curriculum through systematic participation in an ongoing continuing education program. Each student designs and carries out a planned program with guidance from a supervising faculty member and a cooperating practitioner. A final written report is required. Admission and credit to be assigned are determined by the student's special committee. Grades are assigned by the supervising faculty member.

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527 Evaluation for Program Management. Fall term. Credit three hours. S-U grades optional. Time to be arranged. Associate Professor Bruce.

Program evaluation is treated as a part of the overall task of making program management decisions. Primary attention is given to educational and other community change programs, but inferences to other program management tasks are possible. The course has three aspects: (1) a series of lecture-discussions; (2) a continuing workshop; and (3) individual student evaluation projects.

626 Divisional Seminar. Continuous fall and spring terms. Credit one hour each term. Required of all majors in extension and adult education and open to minors. Time to be arranged. Division staff.

Provides opportunity for divisional students and staff to jointly analyze and reflect on current professional issues. A committee of three students directs the seminar in consultation with other students and the staff.

CSE 411 Introduction to Adult Education.

See the *Announcement of the College of Human Ecology*.

Guidance and Personnel Administration

580 Student Culture in the American College. Spring term. Credit three hours. Prerequisite: consent of the instructor. M W 1:45-2:45. Plant Science 141. Assistant Professor Hedlund.

Study of the student culture in the American college with emphasis on current research.

581 Student Personnel Administration. Fall term. Credit three hours. Prerequisite: permission of the instructor. T Th 1:25-2:45. Plant Science 141. Assistant Professor Hedlund.

Analysis of the objectives, functions, and organization of student personnel services in higher education. Emphasis on behavioral science theories supporting student personnel administration.

582 Educational and Vocational Guidance. Fall term. Credit two hours. For graduate students only. T 4:15-6. Warren 232. Professor A. G. Nelson.

Principles and practices of educational and vocational guidance. Historical and theoretical background of the guidance movement; educational, vocational, and community information needed; study of the individual; group methods; counseling; placement and follow-up; organization, administration, and appraisal of guidance programs.

583 Counseling. Spring term. Credit two hours. For graduate students only. Prerequisite: permission of instructor. M 4:15-6. Warren 232. Professor A. G. Nelson.

Principles and techniques of counseling with individuals concerning various types of educational, social, and vocational and social adjustment problems at the high school and college levels.

584 Group Techniques in Guidance. Spring term. Credit two hours. Prerequisite: permission of the instructor. T 4:15-6. Warren 260. Professor A. G. Nelson.

Methods and materials for presenting educational and orientation information to students. Theory and practice of group guidance and counseling in a group setting.

585 Occupational and Educational Information. Fall term. Credit four hours. Permission of the instructor required. M 4:15-6. Field trips and laboratory to be arranged. Warren 232. Professor A. G. Nelson.

Survey and appraisal of occupations and training opportunities; study of sources of educational and vocational information; job analysis; vocational trends. Field trips to places of employment. Practicum exercises.

602 Field Laboratory in Student Personnel Administration. Fall or spring term. Credit and hours to be arranged. Prerequisite: consent of instructor. Staff.

Directed field project in student personnel administration.

681 Seminar in Student Personnel Administration. Fall or spring term. Credit as arranged. S-U grades optional. Prerequisite: permission of instructor. F 9:05-11. Caldwell 250A. Assistant Professor Hedlund.

Topic varies.

The following courses are not ordinarily offered on campus during the academic year, but they *are* offered in alternate summer sessions, along with many of the courses listed above.

586 Organization and Administration of Guidance Programs. Credit two hours.

587 Practicum in Measurement and Appraisal for Counselors. Credit two hours.

588 Case Studies in Counseling. Credit two hours.

History, Philosophy, and Sociology of Education

470 Educational Issues in a Democracy. Fall or spring term. Credit three hours. Open to juniors by consent, seniors, and graduate students. Registration in morning sections

limited to 50 students; afternoon sections, 25 students. M W F 10:10, or T Th 2:30-4. E. Roberts 222. Professors Gowin and Stutz. Special honors tutorial is offered by Professor Gowin.

A critical examination of theories, policies, and practices.

[471 Logic in Teaching. Spring term. Credit three hours. Consent of instructor required. T Th 2:30-4. Bradfield 101. Not given in 1971-72.

A consideration of definition, explanation, proof, and structure of subject matter as they bear upon the work on the classroom teacher.]

472 Philosophers on Education. Fall term. Credit three hours. For graduates and advanced undergraduates. Consent of instructor required. M W 2:30-4. Plant Science 37. Professor Peard.

Selected writings by such philosophers as Plato, Descartes, Rousseau, and Dewey will be examined in their own right and for the light they throw on the persistent problems in education.

473 Contemporary Philosophy of Education. Spring term. Credit three hours. M W 12:20-2:20. Warren 145. Professor Gowin.

Topic for 1971-72: Structure of knowledge.

563 Social Context of Education. Spring term. Credit three hours. M W 2:30-4. Warren 145. Assistant Professor Haller.

See page 87 for description.

574 History of American Education. Fall term. Credit three hours. For graduate students; seniors admitted with permission of the instructor. M 4-6. Warren 260. Professor Stutz.

An examination of the role of education in the development of American society.

[578 Comparative Education. Fall term. Credit three hours. For graduate students. M 4-6. Warren 260. Professor Stutz. Not given in 1971-72.

A comparative treatment of several national systems of education from a historical perspective.]

598 Education as a Field for Inquiry. Fall term. Credit three hours. Graduate students only. W 2:30-4. Bradfield 105. Professor to be appointed.

Designed primarily for students without previous training or experience in the field of education, this course is intended to provide insight into the nature and content of the field to which their research efforts will be directed. Deals with the structure of the educational enterprise, its history, its objec-

tives and the ways it seeks to achieve them, its main concerns, emphases, and sources of strain.

670 Seminar in the College and University. Spring term. Credit three hours. S-U grades optional. Professor Gowin and staff.

Conditions of disciplined inquiry in higher education.

671 Seminar: Analysis of Educational Concepts. Spring term. Credit three hours. Admission by consent. W 2:30-4:40. Bradfield 108.

Topic for 1971-72: to be announced.

672 Seminar in Educational Classics. Spring term. Credit three hours. Admission by consent. Professor Peard.

Topic for 1971-72: to be announced.

673 Seminar on Dewey. Fall term. Credit three hours. Consent of instructor required. W 12:20-2:20. Warren 201. Professor Gowin.

Primary aim is a critical understanding and appraisal of Dewey's philosophy, especially as it centers upon education.

674 Seminar in History of Education. Spring term. Credit three hours. Admission by consent. M 3:35-5:35. Plant Science 141. Professor Stutz.

Topic for 1971-72: Urban education.

699 Conceptual Problems in Educational Inquiry. Fall term. Credit three hours. Primarily for doctoral candidates in their second year of residence. Prerequisite: 599 or equivalent, or permission of instructor. W 2:30-4:30. Warren 231.

An examination of such concepts as causation, operationism, validity, reliability, hypothetical construct, generalization, explanation, probability, and hypothetico-deductive method.

Science and Environmental Education

401 Our Physical Environment. Fall or spring term. Credit three hours. Open only by written permission of the instructor. Limited to 18 students. Lecture, T 1:25. Practical exercises, T 2:30-4:25 and one other period to be arranged. Stone 7. Professor Rockcastle.

A study of the commonplace phenomena and substances in our physical environment, and their use in demonstrating basic scientific principles. Frequent field trips and first-hand examination will be used in studying air, water, soil, light, and sound, as well as some elementary mechanical and electrical devices. Emphasis will be placed on the

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physical environment as an aid to teaching the physical sciences in the public secondary schools.

402 Literature in Conservation and Environmental Education. Spring term. Credit two hours. Open only to students above sophomore rank. T Th 11:15. Stone 7. Professor R. B. Fischer.

An examination of books, periodicals, and reports dealing with historical and present aspects of environmental quality and education. Students are involved in planning and offering the lectures, discussions, and literature reports.

403 Environmental and Natural History Writing. Fall term. Credit two hours. Open to students above sophomore rank. T Th 11:15. Stone 7. Professor Fischer.

For persons who wish to improve their ability to reach and influence others by publishing in magazines and newspapers. The class produces a weekly column for a local newspaper, in addition to other types of articles. Subject matter, outlets for articles, news releases, posters, newsletters, and brochures are dealt with. A working knowledge of biology and ecology is assumed.

404-405 Field Natural History. Fall or spring terms. Credit three hours. May be taken either term or both terms. Limited to 40 students. Lecture, M 10:10. Stone 7. Weekly field trips and lecture, T or Th 1:30-4:30. Professor Fischer.

Devoted to studies of Northeastern plants and animals, their biology, ecology, and their use in the environmental education programs of Interpretive centers, schools, and field biology courses. Man's impact on plant and animal communities is stressed. A methods and materials course.

407 Teaching of Elementary School Science. Fall and spring terms. Credit three hours. Registration by permission. Limited to 18 students. Lecture, W 1:25. Practical exercises, W 2:30-4:25 and one other period to be arranged. Stone 7. Professor Rockcastle.

The content and methods of elementary school science and nature study, with field work and laboratory experience useful in classroom and camp. Designed particularly for those who are preparing to teach or supervise elementary school science.

408 Methods of Teaching Science in Secondary Schools. Fall or spring term. Credit three hours. For juniors, seniors, and graduate students without teaching experience. Prerequisite: 411 or the equivalent or concurrent registration. Open to students in science education intending to register for 409; permission of instructor required for all others. Limited to 20 students per section. Fall term:

Th 1:25-4:25. Stone 7. Hours for observation to be arranged. Spring term: M or Th 1:25-4:25. Stone 7. Assistant Professor Brautigam.

Consideration of current methodology, newly developed curricula, and materials for teaching science in secondary schools. Attention is given to the aims and goals of science instruction in relation to classroom techniques. Systematic observations in local schools. Use of video tapes.

409 Practice in Teaching Science in Secondary Schools. Fall or spring term. Credit six or twelve hours. Prerequisite: 408 and permission of the instructor. Hours to be arranged. Assistant Professor Brautigam and staff.

Supervised practice in teaching science in secondary schools, with frequent conferences. Special seminars scheduled in conjunction with practice teaching. Multimedia forms of feedback information concerning the classroom performance will be provided to the practice teacher.

505 Nature Center Operation and Programming. Fall term. Credit three hours. Open only to students above sophomore rank. M W F 10:10. Stone 7. Assistant Professor LaBastille.

Designed for interpretive naturalists and others who will be responsible for showing persons their place in the environment they share with other organisms, explaining how man's actions affect the living things around him, and teaching what can and must be done to preserve the quality of the environment. Course content emphasizes methods of interpreting nature through the nature center program, and includes constructing teaching aids, designing and building nature trails, design and organization of a live museum, cataloging and storing teaching materials, making bulletin board displays, developing interest corners, guiding nature walks, making and presenting slide talks, giving lectures with visual aids, setting up photographic exhibits, and using schoolyard and neighboring teaching resources.

507 The Teaching of Science. Fall term. Credit three hours. For graduate students interested in elementary, secondary, or college science teaching. Limited to 20 students. M 1:25-4:25. Stone 7. Professor Novak.

A consideration of learning theory as applied to problems of selection and organization of subject matter, methods of teaching and instructional innovation. Study of published research relevant to the improvement of science teaching. Course is conducted in a seminar style.

508 Nature Center Development and Direction. Spring term. Credit three hours. S-U grades optional. Open only to juniors, seniors,

and graduate students. M W F 10:10. Stone. Assistant Professor LaBastille.

Providing directors with the managerial skills needed for successful operation of a nature center, the course is organized around techniques such as recruiting, fund raising, publicity, personnel management, brochure production, public relations, allocating funds and budgeting, enlisting local support, liaison with schools, program development, natural area surveys, planning new buildings, adding to existing facilities, and determining staff needs; also, the role of nature center directors as local conservation catalysts is examined.

509 Development of Curriculum in Science. Spring term. Credit three hours. For graduate students interested in elementary, secondary, or college science teaching. Limit 20 students. M 1:25-4:25. Stone 100. Professor Novak.

Study of new science curriculum programs, including philosophy and rationale of the programs. Observation of classes using new materials. Concentrated study of science curriculum development in the area of individual student's interest. Course is conducted in a seminar style.

606 Science Education Seminar. Fall or spring term. Credit one hour. S-U grades only. Required of graduate students who major or minor in this division. M 4:30-6. Stone 7. Professors Fischer, Novak, and Rockcastle, and Assistant Professors Brautigan and LaBastille.

General Education

380H Independent Honors Research in Social Science. Throughout the year. Credit one to six hours. Open only to candidates who have met the requirements for the Honors program listed on page 30. A maximum of six credits may be earned in the Honors program.

499 Informal Study in Education. Maximum credit three hours each term. S-U grades optional. Staff.

This privilege is granted to a qualified junior, senior, or graduate student, when approved by an adviser from the Education staff who is personally responsible for the study. Undergraduates must attach to their pre-registration material, written permission from the staff members who will supervise the work and assign the grade. Two purposes are sanctioned: (1) to engage in a study of a problem or topic not covered in a regular course; or (2) to undertake tutorial or honors study of an independent nature in the area of the student's research interests. The privilege is not designed to engage in a study supplementary to a regular course for the purpose of increasing the content and credit allocation of the course.

500 Special Studies. Credit as arranged. S-U grades optional. Limited to graduate students working on theses or other research projects. Each registration must be approved by a staff member who will assume responsibility for the work. Members of the staff.

594 College Teaching. Spring term. Non-credit. Members of the University staff.

Designed for those who plan to teach in college and universities. Concepts and methods of teaching, organization of subject matter, motivation, learning, testing, grading, and similar problems are treated.

600 Internship in Education. Fall and spring terms. Credit two to six hours, as arranged. Members of the faculty.

Opportunity for apprentice or similar practical experience on the graduate level in educational administration, agricultural education, guidance, personnel administration, supervision, and other types of professional service in education.

698 Practicum in Educational Research. Fall and spring terms. Three to six credit hours per term. Hours to be arranged. Professor Millman and other members of the staff.

Participation in a research project under the direction of the principal investigator of said project. Level of responsibility will increase with the experience and capability of the candidate, the eventual goal being his assumption of responsibility for a portion of the research.

Entomology

Students are accepted as majors in entomology only upon the consent of the head of the Department or a member of the staff designated to act for him.

General Entomology

210 Introductory Entomology. Spring term. Credit three hours. Prerequisite: Biological Sciences 101-102, or their equivalent. Lectures: T Th 10:10. Comstock 245. Laboratories: M T W Th 2-4:25. Comstock 100. Associate Professor Raffensperger and assistants.

A survey of the structure, biology, and classification of insects; an introduction to the study of insects as a major segment of the biological community, with attention to representative species of economic importance, the techniques and consequences of their control. Laboratory exercises in the anatomy and biology of insects and practice in the techniques of insect identification.

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212 Insect Biology. Fall term. Credit three hours. Prerequisite: Biological Sciences 101-102 or concurrent registration or their equivalent. Lectures: W F 11:15. Savage 100. Laboratory: Th or F 2-4:25. Comstock 100. Assistant Professor Eickwort and assistants.

Designed to introduce the science of entomology by focusing on the basic principles of the systematics, morphology, physiology, behavior, and ecology of insects. The laboratory in early fall includes field trips to study and collect insects in their natural environment.

[518 Techniques of Biological Literature. Fall term. Credit two hours. Given in Alternate years. Lectures: T Th 9:05. Comstock 300. Not given in 1971-72.

History of the development of entomological literature and critical study of the biologists' works of reference. Practice in the use of indices and bibliographies and practice in the preparation of the latter.]

[521 Acarology. Fall term. Credit four hours. Prerequisite: 210 or 212 and permission of instructor. Lectures: M F 10:10. Laboratories: M F 1:25-4:25. Comstock 270. Assistant Professor Eickwort. Not given 1971-72.

An introduction to the taxonomy, morphology, and bionomics of mites and ticks, with emphasis on taxa of economic importance. A collection will be required.]

Insect Morphology

322 Insect Morphology. Fall term. Credit four hours. Prerequisite: 210 or 212 or permission of instructor. Lectures: M F 10:10. Laboratories: M F 1:25-4:25. Comstock 270. Assistant Professor Eickwort.

An introduction to the external and internal anatomy of insects, with emphasis on the comparative and functioning aspects. The laboratory is devoted largely to dissection.

Insect Taxonomy

331 Introductory Insect Taxonomy. Spring term. Credit three hours. Prerequisite: 210 or 212. Lecture: Th 10:10. Laboratories: T Th 2-4:25. Comstock 300. Professor Brown.

An introduction to the systematics and distribution of insects. Laboratory practice in the identification of orders, families, and representative genera of insects; methods of collection and preparation of insect specimens. Field trips are taken in the late spring.

531 Taxonomy of the Smaller Orders of Insects. Fall term. Credit three hours. Given in alternate years. Prerequisite: 311. Discussion: F 10:10. Laboratories: F 2-4:25 and one other by arrangement. Comstock 300. Professor Brown.

Discussions of the classification, evolution, and bionomics of the orders and families of insects, exclusive of the larger orders of Holometabola. Laboratory studies on the literature and on the characters and classification of representative genera and species. Continuation of taxonomy of Holometabola is in courses 532, 533, and 534.

[532 Taxonomy of the Immature Stages of Holometabola. Fall term. Credit three hours. Given in alternate years. Prerequisite: 531 or permission of the instructor. Lecture: W 10:10. Laboratories: W F 2-4:25. Comstock 300. Professor Franclemont. Not given 1971-72.

Lectures on structure and habits of insect larvae. Laboratory studies of the literature, comparative morphology, and identification of the immature stages of the Holometabola.]

[533 Taxonomy of the Coleoptera and Lepidoptera. Spring term. Credit three hours. Given in alternate years. Prerequisite: 331. Lecture: W 10:10. Laboratories: W F 2-4:45. Comstock 300. Professor Franclemont. Not given 1971-72.

Laboratory studies on the literature and on the character and classification of representative genera and species of these orders.]

534 Taxonomy of the Diptera and Hymenoptera. Spring term. Credit three hours. Given in alternate years. Prerequisite: 331. Lecture: W 10:10. Laboratories W F 2-4:25, and one other by arrangement. Comstock 300. Professor Brown.

Laboratory studies on the literature and on the characters and classification of representative genera and species of these orders.

Evolutionary Theory (Biological Sciences 475)

Economic Entomology

441 Principles of Economic Entomology. Fall term. Credit three hours. Prerequisite: 210 or 212 or the equivalent. Enrollment limited. Lectures: T Th 11:15. Comstock 145. Laboratory: T 2-4:25. Comstock 100. Several all-afternoon field trips by arrangement. Professor to be appointed.

Principles in the management and control of insect populations.

442 Pesticide Technology. Fall term. Credit three hours. Prerequisite: 411 or equivalent. Lectures M W F 1:25. Comstock 145. Professor to be appointed.

Selected topics concerned with the practical use of pesticide chemistry including formulation, application, and safety procedures as well as the problems of residues and the legal aspects of insecticide development and regulation.

[541 Experimental Methods in Economic Entomology. Fall term. Credit three hours. Given in alternate years. Designed primarily for graduate students but open to qualified undergraduates. Prerequisites: 210 or 212 or equivalent, and Plant Breeding 510. Enrollment limited. Permission to register is required. Lectures: M W F 11:15. Comstock 245. Laboratory and field trips to be arranged. Professor Gyrisco. Not given in 1971-72.

An advanced course dealing with the principles and methods of insect control and experimentation. Emphasis will be placed on instrumentation and its use in modern methods of insect control, biology, and applied ecology. Field plot designs, field techniques, analysis of data, practical sampling methods, regulations concerning pesticide residues on field crops and in milk and meat, and effects of pesticides on pollinators will be stressed. Soil insects, small grain insects, and forage insects will be used largely as examples.]

Parasitology

351 Introductory Parasitology. Spring term. Credit four hours. Prerequisite: Biological Sciences 101-102 or their equivalent. Course 210 or 212 and Biological Sciences 371 are also recommended. Limited to 12 students per section. Lectures: M W 10:10. Comstock 145. Laboratories: M W or T Th 2-4:25. Comstock 200. Professor Travis.

An introduction to the symbiotic ways of life among animals, primarily the protozoan, helminth, and arthropod species of temperate and tropical areas. Special emphasis is given to the recognition of selected symbiotic species and how they live with their hosts.

[551 Advanced Parasitology (Protozoa and Helminths). Fall term. Credit three hours. Given in alternate years. Undergraduates only by permission. Prerequisite: 351 or its equivalent. Lecture and one laboratory: T 1:25-4:25 and Th 2-4:25. Comstock 200. Professor Travis. Not given in 1971-72.

A continuation of 351 for graduate students interested in the parasitic protozoa and helminths. Practical experience with methods of collection, preparation; detailed studies on recognition and life cycles. Special emphasis is given to the parasites that are transmitted by arthropods in the tropics.]

552 Advanced Parasitology (Medical Entomology). Fall term. Credit three hours. Given in alternate years. Undergraduates only by permission. Prerequisite: 351 and 212 or their equivalent. Lecture and one laboratory: T 1:25-4:25 and Th 2-4:25. Comstock 200. Professor Travis.

A continuation of 351 for graduate students interested in medical or veterinary entomology. Practical experience with methods of

collection, preparation; detailed studies on recognition, life cycles, and control. Special emphasis is given to causative agents, vectors, and intermediate hosts of disease-producing organisms. The study examples include species of worldwide distribution, especially those of tropical areas.

553 Advanced Parasitology (Insect Pathology). Spring term. Credit three hours. Prerequisite: a course in entomology, a course in microbiological science, and permission of instructor. Lectures and discussion: M W F 10:10. Caldwell 250. Associate Professor Kramer.

A survey of the microbial and zooparasitic diseases of insects with emphasis on the natural history of the pathogens. Pathogens considered include viruses, rickettsiae, bacteria, spirochetes, fungi, protozoa, nematodes, and selected arthropods.

Apiculture

260 Introductory Beekeeping. Spring term. Credit two hours. T Th 11:15. Comstock 245. Professor Morse.

Intended to afford a general knowledge of the fundamentals of bee-keeping including the life history, instincts, and general behavior of honey bees. Special attention is given to the role of bees in the cross-pollination of agricultural crops as well as production of honey and beeswax.

262 Biology of the Honey Bee. Fall term. Credit one hour. Limited to 10 students. Registration by permission only. Fifteen laboratories by arrangement in September and October only. Professor Morse.

A laboratory and field course in which the classical experiments on the vision, chemical senses, and language of the honey bee, as described by von Frisch, are repeated. Laboratories include demonstration of the sex attractant, swarm orientation, the natural nest, and a study of wasp, bumble bee, and other social insect nests.

Environmental Biology

General Ecology (Biological Sciences 361).

471 Bionomics of Fresh-Water Invertebrates. Spring term. Credit three hours. Prerequisite: Entomology 210 or 212. Biological Sciences 361 is recommended. Lecture: F 10:10. Comstock 145. Laboratories: F 2-4:25, S 8-10:25. Comstock 200. Professor Berg.

A field and laboratory study of the bionomics of fresh-water invertebrates. The course includes characteristics of fresh-water habitats, identification of insects and other invertebrates found in them, understanding of

96 Entomology

life cycles, and consideration of the ecological relationships among organisms in various aquatic biotopes.

672 Seminar in Aquatic Ecology. Fall term. Credit one hour. Given in alternate years. Prerequisite: Entomology 471 or Biological Sciences 462, and permission of instructor. Time and place to be arranged. Professor Berg.

Discussions and analysis of current concepts and problems in limnology and aquatic entomology, including the critical study of selected reference works and research papers.

577 Biological Control. Fall term. Credit three hours. Consent of instructor is required. Time and place to be arranged. Assistant Professor Tauber.

Participants will critically review theory and method of biological control of pest species with emphasis on the role of behavior.

595 Environmental Biology and Population Management. Fall and spring terms. Credit one hour. Prerequisite: permission to register. Time and place to be arranged. Professor Pimentel.

The ecological principles concerned with the management and control of populations. Emphasis will be placed on current problems of environmental pollution.

660 Insect Ecology. Spring term. Credit two hours. Prerequisite: courses in ecology, entomology, and taxonomy. Consent of instructor is required. T 8 p.m. Caldwell 382. The class will be away from campus from March 18-27. Associate Professor Root.

A field course stressing the methods for study of insect populations and communities. The class will engage in a coordinated set of projects during a camping trip in Florida.

[662 Insect Behavior Seminar. Spring term. Credit one hour. Prerequisites: Entomology 210 or 212 and Biological Sciences 320 or equivalent. T 4:00 p.m. Caldwell 192. Assistant Professors Eickwort and Tauber. Not given 1971-72.]

Ecology of Pest Management (Biological Sciences 562).

Insect Physiology

483 Insect Physiology (Lectures). Fall term. Credit three hours. Open to seniors in entomology and graduate students. No prerequisite but courses in biochemistry, physics, and animal physiology are recommended. M W F 9:05. Comstock 145. Professor Patton.

An introductory course in the physiology of insects. Primarily for graduate students in entomology, or physiology majors.

484 Insect Physiology (Laboratory). Fall term. Credit two hours. Laboratories: M W 2-4:25. Caldwell 294. Professor Patton.

A laboratory course to accompany Insect Physiology Lectures. Should be taken in conjunction with Insect Physiology Lectures.

Insect Toxicology and Insecticidal Chemistry

590 Insect Toxicology and Insecticidal Chemistry. Spring term. Credit four hours. Given in alternate years. Prerequisite: general chemistry and organic chemistry. Undergraduate students by permission. Lectures: M W F 8. Comstock 145. Laboratory: day to be arranged, 1:25-4:25. Caldwell 294. Assistant Professor Wilkinson.

The chemistry of insecticides and their metabolism and mode of action in insects and mammals.

591 Analysis of Pesticide Residues. Spring term. Credit one hour. Given in alternate years. Prerequisite: general chemistry and organic chemistry. Undergraduate students by permission. Time and place to be arranged. Professor Lisk.

Analytical techniques in extraction, isolation, and determination of pesticide residues.

592 Introductory Insecticide Chemistry. Fall term. Credit two hours. Prerequisite: permission to register. Time and place to be arranged. Associate Professor Young and Assistant Professor Wilkinson.

A brief consideration of selected physical and chemical concepts of importance in insecticidal chemistry and biochemistry.

Research

Research. Fall and spring terms. Credit to be arranged. Prerequisite: permission to register. Undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade.

510 Ecology. Professors Berg, Gyrisco, and Pimentel, Associate Professor Root, and Assistant Professors Feeny, Helgesen, and Tauber.

511 Biological Control. Professors Berg, Gyrisco, and Pimentel, Associate Professors Kramer and Root, and Assistant Professor Tauber.

512 Behavior. Assistant Professors Eickwort and Tauber.

515 Insect Pathology. Associate Professor Kramer.

520 Morphology. Assistant Professor Eickwort.

530 Taxonomy. Professors Brown, Franclemont, and Keeton, Associate Professor Pecuman, and Assistant Professor Eickwort.

540 Economic Entomology. Professors Brann, Dewey, Gyrisco, Matthyse, Muka, Pimentel, and Associate Professors Johnson, Raffensperger, and Semel, and Assistant Professors Helgesen and Tauber.

550 Medical Entomology and Parasitology. Professor Travis and Associate Professors Kramer and Reffensperger.

564 Apiculture. Professor Morse.

570 Aquatic Entomology. Professors Berg, Pimentel, and Travis.

585 Insect Biochemistry. Associate Professors Patton and Young, and Assistant Professor Wilkinson.

586 Insect Biochemistry. Associate Professor Young, and Assistant Professor Wilkinson.

596 Toxicology and Chemistry of Insecticides. Professors Dewey, Lisk, and O'Brien, Associate Professor Young, and Assistant Professor Wilkinson.

Seminar

Jugatae. Fall and spring terms. M 4:30-5:30. Comstock 245.

The work of an entomological seminar is conducted by the Jugatae, an entomological club, that meets for a discussion of the results of investigations by its members.

Floriculture and Ornamental Horticulture

Instruction in the Department of Floriculture and Ornamental Horticulture is planned for students with the following interests: (1) commercial plant production, distribution, or utilization, including the management of greenhouses, nurseries, and wholesale and retail establishments; (2) developing a landscape service, including the planning, construction, planting, and maintenance of small properties; (3) superintendence of parks, golf courses, cemeteries, arboretums, or garden centers; (4) the culture and use of ornamental plants in the home garden and in the

home; (5) turfgrass production and management; (6) scientific research and teaching; (7) landscape architecture.

Special curricula are set up to meet the needs of those students desiring training in the fields listed above.

Undergraduate students may plan their courses as preparation for graduate training leading to university teaching or research positions with universities, experiment stations, or industry.

Courses 100, 210, 213, 312, 315, 401-402, Landscape Architecture 103, Biological Sciences 242 or 340, Agronomy 200, and Plant Pathology 301 provide a core of courses basic and fundamental to the general knowledge of floriculture and ornamental horticulture, regardless of area of specialization, and should be taken by all departmental students, except those in the landscape specialization, which has other requirements.

General Courses

General Horticulture (Vegetable Crops 103).

Introduction to Landscape Design (Landscape Architecture 102).

100 Introductory Floriculture and Ornamental Horticulture. Fall term. Credit three hours. S-U grades optional for students not specializing in floriculture. Lecture: M W 8. Plant Science 37. Laboratory: T 2-4:25. Plant Science 37 or Kenneth Post Laboratory. Professor Boodley.

An introduction to the opportunities and scope of the field and the Department of Floriculture and Ornamental Horticulture at Cornell. A rationale for information that will be obtained in subsequent courses taken in the Department and the College to develop student awareness of the vital impact ornamental horticulture in its broadest sense has on everyday life. A required field trip to visit various commercial enterprises is made and costs approximately \$15 plus room and meals.

105 Principles of Flower Arrangement. Fall or spring term. Credit two hours. Enrollment limited to 18 students for each laboratory section. Lecture, Th 9:05; Plant Science 37; laboratory, W or Th 2-4:25 or Th 10:10-12:35, Plant Science 22. Associate Professor Fox.

A study of the care and handling of flowers, the factors affecting keeping quality, and the design principles involved in the use of flowers and related decorative materials.

401-402 Physiology of Horticultural Plants. Fall and spring terms. Prerequisite: Biological Sciences 242 or 340 or permission of the instructor. Fall term: credit three hours; lec-

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ture, T Th 8, Plant Science 37; laboratory, Th 2-4:25, greenhouses. Professor Tukey. Spring term: Credit four hours; lecture, M W F 8; Plant Science 37; laboratory M 2-4:25; Plant Science 37 and greenhouses. Assistant Professor Steponkus.

Fall term. Application of physiology to germination of seeds, rooting of cuttings, manipulation of bulbs, and propagation of plants by budding and grafting, stressing basic mechanisms concerning initiation and development of roots and shoots.

Spring term. A study of the physiology of growth and development of horticultural plants in response to their environment.

Plant Materials

210 Taxonomy of Cultivated Plants. Fall term. Credit four hours. Intended primarily for departmental majors. Prerequisite: Biological Sciences 103-104 or its equivalent. Lecture: M W 10:10. Plant Science 37. Laboratory: M W 2-4:25. Plant Science 29. Associate Professor Ingram.

A study of the kinds of cultivated ferns and seed plants and their classification into families and genera. Emphasis is placed on methods of identification, the preparation and use of the analytical keys, the distinguishing characteristics of the families concerned, and their importance in ornamental horticulture.

213 Woody-Plant Materials. Spring term. Credit four hours. Prerequisite: 210 or permission to register. Lectures: T Th 9:05. Plant Science 29. Associate Professor Mower.

A study of the trees, shrubs, and vines used in landscape planting. Emphasis is placed on their identification and values for use as landscape material. The class visits Rochester parks and gardens. Cost: \$5 plus one meal.

312 Herbaceous Plant Materials. Fall term. Credit three hours. Prerequisite: course 210 or permission to register. Lecture: T Th 10:10. Plant Science 29. Laboratory: T 2-4:25. Plant Science 29. Associate Professor Mower.

A study of the ornamental herbaceous plants used in landscape and garden plantings. Emphasis is placed on the identification, use, and culture of bulbs, annuals, and perennials.

313 Woody-Plant Materials. Advanced Course. Fall term. Credit two hours. Prerequisite: 213. F 1:25-4:25. Plant Science 29. Associate Professor Mower.

The important groups of landscape materials and the literature of the subject. A knowledge of the ordinary woody plants for landscape use in the Northeast is presumed. Emphasis is on lesser-known northern plants and upon plant groups basic in landscape design in other regions of the United States.

Opportunities for practice in the determination of unknowns and in the use of the literature are provided. A trip is taken to Washington, D.C., and vicinity. Cost: \$15 plus room and meals.

Nursery Management

314 Turfgrass Management. Spring term. Credit two hours. Prerequisite: Agronomy 200 or permission to register. Lecture: Th 11:15. Plant Science 141. Laboratory: Th 2-4:25. Plant Science 15. Professor Cornman.

The principles, practices, and materials for the construction and maintenance of lawn, sports, and utility turfgrass areas.

317 Nursery Crop Production and Maintenance. Fall term. Credit four hours. Prerequisite: 401. Lectures: M W F 9. Plant Science 37. Laboratory, M 2-4:25. Greenhouses and nursery. Assistant Professor Good.

The problems of commercial propagation and growing of nursery plants to marketable stage. Digging, storage, and packaging of nursery stock are included. Consideration is given to the planting and culture of landscape plants. Some aspects of garden center management are stressed. Field problems and observational trips are included in laboratory work. Field trips cost \$10 plus room and meals.

318 Advanced Turfgrass Management. Fall term. Credit two hours. Prerequisite: 314 or the equivalent. Lecture: M 10:10. Plant Science 141. Laboratory: M 2-4:25. Plant Science 22. Professor Cornman.

A continuation of course 314, with emphasis on the application of basic principles to problems of such large-scale operations as landscape maintenance and the execution and maintenance of golf courses, athletic fields, industrial grounds, and nursery sod production. A weekend inspection trip is taken to experimental test plots and special turf areas. Cost \$10 plus room and meals.

Commercial Floriculture

325 Flower-Store Management. Spring term. Credit three hours. Prerequisite: 105 and permission to register. Lectures: Place and two hours to be arranged. Laboratory: T 2-4:25. Plant Science 22. Associate Professor Fox.

Lectures devoted to flower-shop management, business methods, merchandising, and marketing of floricultural commodities. Laboratories to include the application of subject matter and the principles of commercial floral arrangement and design. A required four-day weekend field trip is made to flower shows and to wholesale and retail florist establishments. Cost: \$10 plus room and meals.

424 Florist Crop Production. Spring term. Credit four hours. Given in alternate years. Lectures: M W F 9:05. Plant Science 37. Laboratory: W 2-4:25. Greenhouses. Professor Seeley.

The commercial production of florist crops. Emphasis is on culture of plants as influenced by greenhouse environment. Field trips are made to commercial greenhouses. Cost \$5.

[425 Greenhouse Production Management. Spring term. Credit three hours. Given in alternate years. Prerequisite: an elementary course in horticulture or equivalent. Lectures: M W 9:05. Plant Science 37. Laboratory: W 2-4:25. Kenneth Post Laboratory. Professor Langhans. Not given 1971-72.

Intended to provide the latest information relative to efficient operation and administration of a commercial greenhouse range outside the sphere of actual production methods for specific crops. Consideration is given to the industry and centers of production and competition, location of the greenhouse range, types of structures, heating and ventilation, plant containers, soils and fertilizers, photoperiod control, and harvesting and postharvest handling of floriculture crops. Field trips will be taken. Cost \$15 plus room and meals.]

Department Seminars

450 Special Topics in Floriculture and Ornamental Horticulture. Fall and spring terms. Hours and credit to be arranged. Written permission of staff member is required to register. Primarily for upperclass and graduate students. Professor Mower.

Topical subjects in plant materials. Independent and group study of important groups of plant materials and of situations that affect their successful use in planting programs. The topics will be announced each year in the supplementary announcement.

550 Special Problems in Floriculture and Ornamental Horticulture. Fall or spring term. Credit one or more hours. S-U grades optional. Prerequisite: adequate training for the work. Undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade. Professor J. W. Boodley and staff.

Special work on problems under investigation by the department or of special interest to the student, provided adequate facilities are available. Students must satisfy the staff member under whom the work is to be taken that their preparation warrants their choice of problems.

600 Seminar. Fall and spring terms. S-U grades only. For departmental staff and graduate students. Th 4:30. Plant Science 37.

Introduction to Landscape Architecture (Landscape Architecture 102).

Elementary Landscape Architectural Design (Landscape Architecture 103).

Intermediate Landscape Architectural Design (Landscape Architecture 232).

Planting Design (Landscape Architecture 332).

Junior Landscape Architectural Design (Landscape Architecture 333).

Landscape Construction (Landscape Architecture 341-342).

Senior Landscape Architectural Design (Landscape Architecture 434-435).

Recreational Planning (Landscape Architecture 436).

Professional Practice and Ethics (Landscape Architecture 451).

Special Problems in Landscape Architecture (Landscape Architecture 555).

Food Science

The department of Food Science offers a curriculum leading to a Bachelor of Science degree with a specialization in food science. The curriculum includes a core of basic courses plus electives chosen to meet the specialized interest of the student. Elective courses can be chosen in chemical, physical, or engineering sciences for those planning careers in research or teaching; or in business and accounting for those interested in managerial work.

Students interested in managerial work can combine a regular four-year program with a graduate program by qualifying for the combination program in the Cornell Graduate School of Business and Public Administration. This is a five-year program which permits the student to obtain a Bachelor of Science degree at the end of the senior year and a Master of Business Administration at the end of the fifth year. The curriculum also provides opportunity for the science-minded student to prepare for graduate work in food science.

100 Introductory Food Science. Fall term. Credit three hours. M W F 10:10. Stocking 204. Associate Professor Potter.

A survey course intended to expose the student to the broad field of food science and technology, its scope, principles, and practices. Lectures will deal with the constituent properties of foods, methods of food

100 Food Science

preservation, the major food groups, including their handling and processing, and current problems such as chemical additives and world feeding needs. Throughout the course the interrelationships between sanitation, processing, nutrition, and food quality will be stressed.

210 Food Analysis. Spring term. Credit two hours. Prerequisite: Chemistry 104 or 108. Lecture: F 12:20. Stocking 120. Laboratory: F 1:25-4:25. Stocking 209. Associate Professor Leford and assistants.

Designed to acquaint the student with a variety of chemical and bacteriological tests used by food analysts.

[302 Dairy and Food Engineering. Fall term. Credit four hours. Given in alternate years. Prerequisites: 100 and a course in physics. Lectures: M W F 10:10. Laboratory: M 2-4:25. Stocking 119. Professor Jordan. Not offered in 1971-72.

Engineering aspects of dairy and food plant operations.]

303 Lipid Technology. Fall term. Credit three hours. Given in alternate years. Open to upperclassmen and graduate students. Lecture demonstrations: W F 9:05. Stocking 120. Laboratory practice: F 1:25-4:25. Stocking 119. Assistant Professor Kinsella.

The sources, composition, and properties of edible fats and oils are discussed. All classes of lipids are considered, and their effects on food quality and storage stability are described. Factors affecting the chemical and physical stability of food fats are enumerated. The chemical technology of shortenings, edible oils, margarine, and butter is described.

311 Food Preservation Processes I. Spring term. Credit three hours. Given in alternate years. Lectures: M W 11:15. Laboratory: M 1:40-4:30. Stocking 119. Associate Professor Potter.

Deals with the principles and practices of drying, freezing, canning, and other heat treatments applied to foods. Current processing methods will be considered as related to the chemistry, microbiology, and technology of the ingredients and final products.

[312 Food Preservation Processes II. Spring term. Credit three hours. Given in alternate years. Lectures: M W 11:15. Laboratory: M 1:40-4:30. Stocking 119. Professor Jordan. Not offered in 1971-72.

Deals with the principles and practices of concentrating and other means of preserving foods. Application of many of the principles covered in 311 and 312 will be illustrated in a detailed study of the technology of ice cream manufacturing.]

[314 Milk and Food Sanitation and Plant Operations. Fall term. Credit four hours. Given in alternate years. Prerequisite: 100 and Biological Sciences 394. Lectures: T Th 12:20. Stocking 120. Recitation to be arranged. Laboratory: T 1:25-4:25. Professor White and assistants. Not offered 1971-72.

The biological and chemical control of milk and food processing. Federal, state, and local requirements for the production, collection, and production in the food plant are outlined with special attention given to the fluid milk industry.]

400 Research. Fall or spring term. Credit one or more hours by arrangement. Undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade. Staff.

Special problems in any phase of food science may be elected.

401 Food from Fermentations and Enology. Fall term. Credit four hours. Given in alternate years. Prerequisite: a beginning course in biology, microbiology, or biochemistry is recommended. Lectures (discussions and demonstrations): T Th 11:15-4:25. Stocking 120. Professor Kosikowski and Associate Professor Leford.

Principles and processes leading to important foods such as fermented milks, yogurt, cheese, wines, and beers. Consideration is also given to other fermentations resulting in foods from plant and animal sources. Practices designed to acquaint students with fermentation and enology principles and with the physical and sensory qualities of the above foods are carried out by demonstration and through field trips.

403 International Food Development. Fall term. Credit three hours. Given in alternate years. M W 2-4:25. Stocking 119. Professor Kosikowski.

A study of programs, technical problems and progress associated with developing, processing and marketing acceptable foods throughout the world. Attention will be given to expanding protein resources for man in critical areas. International aspects of pollution and public health related to food are considered. Special attention is given to the organization, operations, relationships, and contributions of U. N. technical agencies, FAO, UNICEF, WHO, and governmental and nongovernmental organizations in the field.

412 Aquatic Microbiology. Spring term. Credit three hours. Given in alternate years. Prerequisite: introductory bacteriology (Biological Sciences 290 or equivalent, or Soil Science 306). M W F 10:10. Stocking 120. Professor Dondero.

A consideration of the relation of microorganisms, especially the bacteria, to aquatic environments, both natural and artificial. The microbiology of waste waters will be included. Attention will be given to fundamental biological concepts and to applied aspects of the occurrence and activities of microorganisms in waters.

420 Sensory Qualities and Evaluations of Foods. Spring term. Credit three hours. Open to upperclassmen and graduate students. Prerequisite: a course in statistics and in biochemistry or organic chemistry. Lecture: M W 9:05. Laboratory: F 8:30-9:55. Stocking 120. Professor Shipe and assistants.

Deals with the chemistry and factors affecting the color, odor, flavor, and texture of foods and the evaluation of these qualities. The techniques and interpretations of both objective and subjective evaluations are discussed. The laboratory exercises involve the evaluation of a variety of foods.

421 Food Mycology and Related Topics. Fall term. Credit three hours. Prerequisite: Microbiology 290A, 290B or equivalent. Microbiology 394 is recommended. M W F 10:10. Stocking 120. Assistant Professor Graham.

A discussion of molds, yeasts, and other organisms; their effects in food production, preservation, and spoilage.

422 Product Development. Spring term. Credit three hours. One extra hour may be arranged in special cases. Lecture: M W 10:10. Stocking 119. Laboratory: W 2-4:25. Riley-Robb 44. Associate Professor Buck.

Fundamentals of food product development from raw materials to marketing the finished, packaged product.

499 Food Industry Management Topics. Fall term. Credit two hours. Open to seniors and graduate students. F 2-4. Stocking 124. Mr. Bandler.

A summary of concepts and techniques useful to Food Science majors in the areas of communication and interpersonal relationships in business. Deals primarily with oral, written, and visual presentation of scientific data, basic office procedures, business practices, and resume preparation. Stress will be on practical use of the material presented.

501 Proteins. Fall term. Credit three hours. Given in alternate years. Open to graduate students. W F 8. Stocking 119. Associate Professor Sherbon and assistants.

The first part of the course will deal with the general properties of proteins: structure, preparation, and reactions. The second part will deal with proteins as part of food systems, occurrence and composition, associations and structures, and reactions to

processing. Assigned readings, writing, and exercises will be used to insure that the students obtain a working knowledge of current research in the area.

[502 Food Lipids. Fall term. Credit two hours. Given in alternate years. Open to graduate students. W F 12:20. Stocking 119. Assistant Professor Kinsella. Not offered 1971-72.

Covers the disposition of lipid materials in foods and the manner in which lipids influence the chemical and physical attributes of various foods. The effects of production techniques, storage, heating, refrigeration, and enzymes on food lipids are described and the chemical mechanisms involved are elucidated. The importance of lipids in the formation of food flavors is discussed.]

503 Food Carbohydrates. Spring term. Credit two hours. Given in alternate years. Open to qualified seniors and graduate students. Prerequisite: Biological Science 431 or equivalent. T Th 10:10. Stocking 120. Assistant Professor Hood.

A consideration of the chemistry of carbohydrates in foods including sugars, starches, pectins, gums, and cellulose. Emphasis will be placed on their origin in raw materials and the subsequent changes occurring during processing and storage.

[504 Chemistry of Milk. Fall term. Credit two hours. Given in alternate years. Prerequisites: qualitative and quantitative analysis and organic chemistry. Hours by arrangement. Stocking 120. Associate Professor Ledford. Not offered in 1971-72.

A study of milk constituents and physical properties. Deals with milk enzymes, lactose, milk fat, milk proteins, and minor constituents.]

507 High Protein Food Technology. Fall term. Credit two hours. Given in alternate years. Designed for graduate student majors in International Food Development but open to other qualified students. Recommended: Food Science 403 or equivalent. F 10:10-12:05. Stocking 124. Other hours by arrangement. Professor Kosikowski.

The needs, types, processing techniques, nutritional qualities, and economics of high protein foods for an expanding world population are examined in discussions and through individual study. Basic protein foods from cereals, pulses, oil seeds, milk, and marine life will be considered along with single cell protein foods from whey, cellulose, leaves, and petroleum.

512 Instrumental Methods. Spring term. Credit five hours. Given in alternate years. Prerequisite: permission of the instructor.

102 International Agriculture

Lecture: M W F 11:15. Stocking 120. Laboratory: M or T 1:25-4:55. Stocking 209. Associate Professor Sherbon.

Deals with instrumental methods widely used in research and industry. The major emphasis is on chromatography, spectroscopy, electrophoresis, ultracentrifugation thermal analysis, and the use of computers. The stress will be on the practical use of the material presented.

600 Seminar. Fall and spring terms. Attendance required of all food science graduate students on the Cornell campus.

Applied and Industrial Microbiology (Biological Sciences 393).

Dairy and Food Microbiology (Biological Sciences 394).

Meat and Meat Products (Animal Science 290).

Meat Cutting (Animal Science 293).

Selection, Grading, and Purveying of Meat (Animal Science 394).

Meat Technology (Animal Science 490).

Postharvest Physiology, Handling, and Storage of Fruits (Pomology 201).

Poultry Meat and Egg Technology (Poultry Science 450).

Handling and Marketing of Vegetables (Vegetable Crops 212).

Handling and Marketing of Vegetables, Advanced Course (Vegetable Crops 412).

Marketing (Agricultural Economics 240).

Marketing Milk and Dairy Products (Agricultural Economics 346).

International Agriculture

600 Seminar: International Agricultural Development. Fall and spring terms. No credit. Third and fourth Wednesdays of each month, 4-5. Emerson 135. Professor Turk and staff.

Primarily for graduate students interested in an integrated view of problems related to international agricultural development. Undergraduates with a specialization in international agriculture are encouraged to attend without registering. The seminar will focus on developing an understanding of the nature and interrelatedness to agricultural development of the social sciences, plant and animal sciences, foods and nutrition, and natural resources.

601 Philippine Agricultural Development: Policy and Administration. Spring term. Credit two hours. Th 3:35. Ives 214. Professors Golay and Levine.

Major aspects of Philippine agricultural development will be considered from economic, social, and technological points of view.

Economics of Agricultural Development (Agricultural Economics 464).

World Food Economics (Agricultural Economics 560).

Seminar on Agricultural Policy (Agricultural Economics 651).

Seminar on Latin American Agricultural Policy (Agricultural Economics 665).

Seminar in the Economics of Agricultural Development (Agricultural Economics 668).

Seminar in Agriculture and Economic Planning Models (Agricultural Economics 669).

Identification, Appraisal, and Geography of Soils (Agronomy 301).

Tropical Meteorology (Agronomy 331).

Geography and Appraisal of Soils of the Tropics (Agronomy 401).

Tropical Agriculture (Agronomy 422).

Special Studies in Soils of the Tropics (Agronomy 481).

Grasslands and Grassland Research (Agronomy 514).

Special Studies in Tropical Agriculture (Agronomy 522).

Livestock Production in Warm Climates (Animal Science 400).

Special Studies on Problems of Livestock Production in the Tropics (Animal Science 401).

Forages of the Tropics for Livestock Production (Animal Science 403).

International Communication (Communication Arts 501).

Communication in the Developing Nations (Communication Arts 524).

Comparative Mass Media (Communication Arts 526).

International Natural Resources (Conservation 511).

Introductory Parasitology (Entomology 351).

Advanced Parasitology (Medical Entomology) (Entomology 552).

International Food Development (Food Science 403).

International Nutrition Problems, Policies, and Programs.

See the *Announcement of the Graduate School of Nutrition*.

International Crop Breeding and Improvement (Plant Breeding 506).

Plant Diseases in Tropical Agricultural Development (Plant Pathology 655).

Economic Fruits of the World (Pomology 301).

Rural Society (Rural Sociology 412).

Comparative Rural Societies (Rural Sociology 420).

Occupational Structure in Industrial and Developing Countries (Rural Sociology 424).

Cross-Cultural Research Methods (Rural Sociology 516).

Applications of Sociology to Development Programs (Rural Sociology 528).

Seminar, Contemporary Social Theory II (Rural Sociology 631).

Seminar in Social Change and Development (Rural Sociology 636).

Special Topics in Plant Science Extension (Vegetable Crops 429).

Research Methods in Applied Plant Science (Vegetable Crops 501).

Landscape Architecture

The Department of Floriculture and Ornamental Horticulture through its Division of Landscape Architecture offers a four-year curriculum in landscape architecture. The student is trained in the use of land, water, and plant and structural forms for efficient, safe, and pleasant use. He learns how to collaborate with the other planning professions. In addition to general and technical courses taught in the classroom, the student makes supervised inspection trips to view examples of professional landscape architecture and, also, is required to obtain a specified amount of approved practical experience during the summer months. The landscape

architecture curriculum leads to the Bachelor of Science degree with a specialization in landscape architecture.

102 Introduction to Landscape Architecture. Fall or spring term. Credit three hours. Lectures: fall term, M W F 9:05, Associate Professor Scannell and Mr. Dwelle; spring term, M W F 9:05, Assistant Professor Carpenter and Mr. Dwelle. East Roberts 222.

A consideration of the principles of landscape architecture as applied to present day planning. Intended primarily for nondepartmental majors.

103 Elementary Landscape Architectural Design. Fall term. Credit four hours. Lecture: T 11:15. Laboratories: M W F 10:10-12:35. Five hours must be scheduled in the laboratory time specified above with an additional 2½ hours as arranged. Intended primarily for department majors. Plant Science 433. Associate Professor Scannell.

Principles of design, with practice in the use of drawing instruments and graphic interpretation of ideas.

232 Intermediate Landscape Architectural Design. Spring term. Credit three hours. Prerequisite: 103, 213, 312, and one course in freehand drawing. Lecture: M 11:15. Laboratories: T Th 10:10-12:35. Plant Science 433. Associate Professor Scannell.

The application of the principles of design to the specific problems of the small residential property as well as other small-scale landscape architectural problems. A terminal course for those not intending to major in this field.

332 Planting Design. Fall term. Credit three hours. Prerequisite: 232. Lecture: W 12:20. Laboratories: W F 2-4:25. Plant Science 433. Assistant Professor Carpenter.

An advanced course in design with emphasis on plant combinations and uses in association with structure and gardens. Practice in drawing and estimating planting plans.

333 Junior Landscape Architectural Design. Spring term. Credit four hours. Prerequisite: 232. Lecture: M 12:20. Laboratories: M W F 2-4:25. Plant Science 433. Associate Professor Scannell.

Practice in making landscape architectural plans for actual situations is an essential part of this course. Industrial and commercial landscape architectural treatments are included.

341-342 Landscape Construction. Throughout the year. Credit four hours a term. Prerequisite: Civil Engineering 2452. Fall term is prerequisite to spring term. Fall term: Lectures, M W 10:10; laboratories, T Th 9:05-

104 Landscape Architecture

11:30. Spring term: lectures, W F 11:15; laboratories, T Th 10:10-12:35. Plant Science 428. Assistant Professor Carpenter.

Theory and drafting room practice in interpretation and preparation of grading, detailed construction drawings, and small structural design; study of highway and road alignment, and landscape hydraulics. Emphasis on surveying applications, earthwork, drainage and structural systems, materials, engineering mathematics, material take-offs, and cost analysis.

434-435 Senior Landscape Architectural Design. Throughout the year. Credit four hours a term. Prerequisite: 333. Fall term is prerequisite to spring term. Lecture: W 1:00. Laboratories: M W Th 2-4:25. Plant Science 433. Associate Professor Scannell and Assistant Professor Carpenter.

A succession of landscape architectural problems of an increased degree of complexity. Included will be problems involved in the design of institutions, resort areas, industrial complexes, and other similar areas.

436 Recreational Planning. Spring term. Credit three hours. Prerequisite: 333. One lecture and two laboratories. Lecture: T 12:20. Laboratories, T F 2-4:25. Plant Science 433. Associate Professor Scannell.

Theory of recreational planning and design with a study of the design, construction details, and other working drawings for recreational areas of all sizes.

451 Professional Practice and Ethics. Fall term. Credit two hours. Prerequisite: 342. Lecture: T 1:00. Laboratory: T 2-4:25. Plant Science 433. Assistant Professor Carpenter.

An extensive coverage of methods used in the professional practice of landscape architecture together with approved office procedure. Problems inherent with office practice and solutions to these problems will be covered.

555 Special Problems in Landscape Architecture. Fall or spring term. Credit one or more hours. Prerequisite: adequate training for the work, and permission of the staff member who will supervise the work. Associate Professor Scannell and staff.

Special work on problems of interest to the student.

Freehand Drawing and Illustration

109-110 Drawing for Landscape Students. Throughout the year. Credit three hours a term. Credit may not be received for both course 109 and 111. S-U grades optional for graduate students only. Fall term is prerequisite to spring term. Intended primarily for

departmental majors. Others may register in the fall, if space permits, with permission of instructor. Fall term, M W F 11:15-1:25. Spring term, M W F 11:15-1:10. Mann 500. Associate Professor Lambert and Mrs. Elliot.

Planned to develop practical ability in the sketching of outdoor planting and landscape features, facility in lettering, and knowledge of isometric and perspective construction from plans and elevations. Sketchbook assignments, to be done outside class, are given throughout the year.

111 Freehand Drawing. Fall or spring term. Credit three hours. Credit may not be received for both 109 and 111. Prerequisite: permission of instructor to register. S-U grades optional for graduate students only. Lecture: Fall term, W 10:10; Spring term, T or W 10:10. Six hours of time, including the lecture period, are to be spent in the drawing room preferably in two-hour units. These hours must be scheduled between 9:05 and 11:15 M W F in the fall term, and between 9:05 and 12:05 M T W Th F or T 2-4:25 in the spring term. Mann 500. Associate Professor Lambert and Mrs. Elliot.

The objective is to develop accuracy of observation and skill in delineation. Practice is given in outdoor sketching and in the drawing of still-life set-ups, interior scenes, and human figures. The principles of freehand perspective are taught and applied. The course is designed to aid those who plan to work in nature study, biological sciences, and home economics. Sketchbook assignments to be done outside class are given throughout the year.

211 Freehand Drawing and Illustration. Fall term. Credit two hours. S-U grades optional for graduate students only. Prerequisite: Drawing 111 or the equivalent. Six hours of time, including one lecture period arranged during the first week, are to be spent in the drawing room, preferably in two hour units. These hours should be scheduled between 9:05 and 12:05 M T W Th F. Mann 500. Associate Professor Lambert.

This course carries on from the object drawing of the beginning course to the organization of a complete illustration. The subject matter is derived largely from quick, on-the-spot sketches. Composition, perspective relationships, and ways of rendering are all considered. The work is planned primarily to help students who expect to use their sketching ability in landscape work, interior decorating, or the illustrating of their own papers, bulletins, and books.

214 Water Color Illustration. Spring term. Credit two hours. Prerequisite: 111 or the equivalent. S-U grades optional for graduate students only. Six hours of practice must be

scheduled, preferably in two hour units, between 9:05 and 12:05 M T W Th F or T 2-4. Mann 500. Associate Professor Lambert.

The student learns to mix colors, lay washes, and plan the values of his composition before he tries illustration in color.

316 Advanced Drawing. Fall or spring term. Credit two hours. S-U grades optional. Three hours of practice required for each hour of credit. Prerequisite: 110, 312, or the equivalent. Time to be arranged. Mann 500. Associate Professor Lambert and Mrs. Elliot.

For students who wish to attain proficiency in some particular type of illustration or technique.

417 Scientific Illustration. Fall term. Credit two hours. S-U grades optional. Prerequisite: 211 or permission of the instructor. Six hours of practice to be scheduled, preferably in two-hour units. These hours may be scheduled between 9:05 and 12:05 M T W Th F. Warren 500. Mrs. Elliot.

A survey of illustration methods suitable for various scientific fields; training in the techniques of pen and ink, scratch board, stipple board, wash, and color overlays. Instruction in the use of the camera lucida, pantograph, projectoscope, and other time-saving methods of getting accurate results as quickly as possible. Methods of reproducing illustrations are studied in relation to problems of publication.

Meteorology

201 Basic Principles of Meteorology. Fall term. Credit three hours. Lectures: T Th 11:15. Bradfield 101. Laboratory: T W or Th 2-4:25. Bradfield 1102. Professor Dethier.

Simplified treatment of structure of the atmosphere; heat balance of the earth; general and secondary circulations; air masses, fronts, and cyclones; hurricanes; thunderstorms, tornadoes, and atmospheric condensation. In the laboratory, emphasis is on techniques of analysis of weather systems.

201A Basic Principles of Meteorology (Laboratory). Fall term. Credit one hour. T W Th 2-4:25. Bradfield 1102. Professor Dethier.

Techniques of analysis of weather systems and the application of dynamical and empirical methods of prediction of the daily atmospheric circulation.

202 Climatology. Spring term. Credit three hours. Prerequisite: 201. M W F 11:15. Bradfield 108. Professor Dethier.

The first ten weeks are devoted to the description of world climates in terms of the global distribution of radiation, temperature, pressure, and wind; precipitation and air

masses; and the factors which produce this distribution. During the last five weeks of study, emphasis is on the factors influencing the microclimate and the variation of climate due to vegetation and small-scale topographic features.

[331 Tropical Meteorology. Spring term. Credit three hours. Given in alternate years. Prerequisite: course 201 or 411. M W F 9:05. Bradfield 105. Professor Dethier. Not given in 1971-72.

A study of the general circulation of the tropics, easterly waves, hurricanes, monsoons, and local diurnal tropical weather phenomena.]

411-412 Basic Theoretical Meteorology. Fall and spring terms. Credit three hours. Prerequisite: one year each of calculus and physics. Course 411 is prerequisite to course 412, unless special permission is obtained from the instructor. M W F 10:10. Bradfield 1102. Assistant Professor Knapp.

The fall semester includes a survey of the fundamental laws governing the atmosphere; basic units and coordinate systems; thermodynamics of dry and moist air; hydrostatic equilibrium and stability. The spring semester covers a review of vector operation; continuity equation; equation of motion; kinematics of fluid flow; variation of wind and pressure in the vertical; surfaces of discontinuity; mechanisms of pressure change; vorticity and circulation; wind structure in the planetary layer; energy concepts.

417 Physical Meteorology. Fall term. Credit three hours. Given in alternate years. Prerequisite: one year each of calculus and physics. M W F 12:20. Bradfield 1102. Assistant Professor Knapp.

The composition and chemistry of air; atmospheric optics and optical phenomena; solar and terrestrial radiation; meteorological acoustics; condensation processes; atmospheric electricity.

438 Atmospheric Pollution. Spring term. Credit three hours. Given in alternate years. Prerequisite: one year each of calculus and physics. M W F 9:05. Bradfield 105. Professor Dethier.

Nature of air pollution; its dispersals by atmospheric processes and its effects upon the atmosphere and biosphere.

[449 Physics of Clouds, Rain, and Rain-making. Fall term. Credit three hours. Given in Alternate years. Prerequisites: one year each of calculus and physics. M W F 12:20. Bradfield 1102. Assistant Professor Knapp. Not given in 1971-72.

Large scale physics of clouds; condensation processes; growth of cloud particles,

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natural precipitation processes; artificial stimulation of precipitation; radar studies of clouds and precipitation.]

462 Undergraduate Research in Meteorology. Fall and spring terms. Credit one to three hours. Required of honor students in the physical sciences majoring in meteorology. Staff.

550 Special Topics in Meteorology and Climatology. Fall or spring term. Credit one or more hours. Undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade. Staff.

Study of meteorological topics more advanced than or different from those in other courses. Subject matter depends on the background and desires of those enrolling.

562 Research in Meteorology. Fall and spring terms. Credit one or more hours. Thesis research. Staff.

691 Seminar in Meteorology. Prerequisite: permission of the professor in charge. Professor Dethier.

Subjects for future times may be such things as weather modification, paleoclimatology, atmospheric pollution. These will be planned and announced in advance.

Natural Resources (Conservation)

The Department of Natural Resources offers a wide variety of educational opportunities to study natural resources. For undergraduates, there are course sequences in fishery science, wildlife science, forest science, outdoor recreation, and environmental conservation. For graduate students there are available as major subjects: fishery biology, wildlife science, natural resources conservation; and, as a minor subject, forest conservation. There may be emphasis in international studies in these subjects. The graduate minor in water resources may be taken in this Department under Professor Hamilton, Associate Professors Eipper and Oglesby, or Assistant Professor Wilkins.

Other areas of study in the natural resources field include programs in soil and water conservation in the Department of Agronomy, conservation education in the Department of Education, and resource economics in the Department of Agricultural Economics.

Natural Resources Conservation

101 Orientation in Natural Resources. Fall term. Credit one hour. Recommended for all freshmen and transfer students in the Department of Natural Resources. M 4-5:30. Bradford 101. Staff.

An introduction to the natural resources and their management. The student is exposed to basic principles of conservation of the natural resources by relating them to specific problems.

110 Ecological Basis for Conservation. Spring term. Credit two hours. Lecture: T Th 10:10 or 12:20. Ives 120. Associate Professor McNeil.

Ecological principles as applied to man's use of his environment, especially its living components. Survival strategies of animals and the application of these concepts to man. Ecological succession, carrying capacity, limiting factors, population dynamics, animal behavior, disease, effects of pesticides on living organisms and systems, other contaminants, noise, heat, nuclear radiation, extinct and endangered species, management of plants and animals and the land, pressures on natural systems caused by technology and increasing human populations, and what to do about it.

201 Environmental Conservation. Fall term. Credit two hours. T Th 10:10. Ives 120. Staff.

Man, natural resources, and environment. Man's use and misuse of the natural components of his environment. Current resource use problems such as air and water pollution, radiation, garbage and waste, and the population explosion. A brief survey of natural resources emphasizes land, water, soil, plants and animals, minerals and energy. Resource-use policies are related to social problems, and an attempt is made to introduce the concept of a conservation ethic.

202 Environmental Conservation Discussions. Fall term. Credit one hour. Corequisite: 201. Times and places to be arranged. Staff.

Treatment of lecture material from 201 in greater depth and with various emphases depending on the background and interests of the instructors and students.

415 Public Relations in Natural Resources Management. Spring term. Credit three hours. Prerequisite: at least junior standing and one Natural Resources course. Lecture, M W 9:05. Morrison 163. Laboratory, F 9-11. Morrison 164. Associate Professor Dickson.

Methods of attaining and maintaining good public relations in the natural resource management professions through the use of effective communications, the media, biopolitics, and understanding the publics involved.

420 Outdoor Recreation. Fall term. Credit two hours. Prerequisite: 201. Open to seniors and graduate students and to juniors with permission of the instructor. T Th 11:15. Fernow 210. Assistant Professor Wilkins.

Factors involved in allocating natural resources for outdoor recreation are considered. Characteristics of public and private administration of recreation area are studied and trends in outdoor recreation explored.

420A Field Studies in Outdoor Recreation. Fall term. Credit one hour. Open to seniors and graduate students. Prerequisite: 420 or concurrent registration. W 2-4:25. Fernow 210. Assistant Professor Wilkins.

A laboratory to be taken by students desiring experience with applied aspects of outdoor recreation data collection and analysis.

421 Seminar in Remote Sensing of Natural Resources. Fall term. Credit two hours. T 7-9. Fernow 304. Mr. E. E. Hardy.

Characteristics of various remote sensors will be described and their sensor capability identified. Current and potential applications for sensing natural resources will be considered and simulated, and actual problems of benefit analysis undertaken. Guest lecturers.

430 Population Dynamics of Fish and Wildlife. Spring term. Credit two hours. Prerequisite: senior or graduate standing in the Department of Natural Resources, or consent of instructor. T Th 10:10. Fernow 210. Staff.

Characteristics of fish and game populations and the analysis of data for purposes of projection.

An examination of the processes that control the abundance of organisms. This course includes a consideration of mortality, reproductive potential, density-dependent and density-independent regulation, predator-prey and parasite-host relationships. Examples are taken mainly from areas of fishery and wildlife science. Emphasis will be placed on the practical application of course material.

510 Perspectives on Conservation. Fall term. Credit two hours. Primarily for graduate students but open to seniors. Th 2:30-4:30. Fernow 210. Assistant Professor Wilkins.

A seminar based upon extensive readings of articles highlighting varying philosophical approaches to the conservation of natural resources. Views espoused by developmentalists, preservationists, naturalists, economists, welfare economists, and urban planners will be considered.

511 International Natural Resources. Fall term. Credit two hours. Upperclassmen and graduate students only. T 3:35. Fernow 304.

Professor Hamilton and Associate Professor McNeil.

A seminar devoted to exploring international programs of nature conservancy; extinct and endangered species; floral and faunal protection in various countries; national park systems; protection vs. management; the relevance of United States experience; role of nature conservancy in resource development of emerging nations. Foreign students especially are invited.

602 Seminar in Natural Resource Analysis for Ecologically Based Planning. Spring term. Credit two hours. W 2:30. Fernow 304. Professor Hamilton.

Multidisciplinary graduate student-faculty-invited specialists seminar. Theme varies from year to year but usually involves a case study of a specific area of land and water. The ecological basis for planning land and water use. Engineers, economists, sociologists, soil scientists, fish or wildlife biologists, foresters, ecologists, and planners especially invited. Field work involved.

604 Seminar on Selected Topics in Natural Resources Conservation. Spring term. Credit one hour. Time to be arranged. Associate Professor Brumsted and staff.

Primarily for graduate students majoring or minoring in natural resources conservation.

Forestry

302 Forest Ecology. Fall term. Credit three hours. Limited to 40 students. Lectures, M W 11:15. Laboratory, M 2-5:00. Fernow 210. Professor Hamilton.

Understanding the wildland environment. Development of ability to identify and analyze what is present, what was present, what is likely to happen in various forest ecosystems. All laboratory sessions in the field. One required weekend trip to the Adirondacks or other major forest region.

303 Woodlot Management. Fall term. Credit three hours. Lecture, M W 11:15. Laboratory, W 1:45-4:25. Bradfield 108. (Three field laboratories will end at 5:15 because of travel time.) Associate Professor Morrow.

Designed to give the student the basic information necessary to permit sound woodlot management decisions. Field trips to woodlots emphasize variations in value and potential as well as biological growth. Introduction to tree identification, log scaling, timber estimating, tree marking, and stand improvement work. Planting, management, harvesting, marketing, Christmas trees, maple syrup, and multiple use are discussed, as well as relationships of forestry to people and to the environment.

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Fishery Biology

439 Fish Ecology. Fall term. Credit three hours. Prerequisite: Biological Sciences 270 or permission of instructor. M W F 10:10. Bradfield 108. Assistant Professor Carlson.

Interactions between fishes and their living and non-living environment, and applications of ecological principles to fish population research and management. Population ecology; interspecific relationships of fishes including competition, predation, parasitism, and commensalism, and relationships of fishes to other organisms. Adaptations, diversity of life history and behavior patterns, and usual inhabitants of major habitat types are considered. The ecology of young fishes is stressed, and the student is introduced to the literature of fishery biology.

439A Fish Ecology Laboratory. Fall term. Credit one hour. T 1:25-4:30. Fishery Laboratory. Assistant Professor Carlson.

A laboratory to be taken concurrently with 439 lectures but not required for all students. Laboratory exercises will include methods of collection and analysis of aquatic organisms, measurement of ecological factors, exercises in fish population dynamics, fish embryology and life history studies, and survey of the literature of fishery biology.

440 Fishery Science. Fall term. Credit three hours. Students other than majors in the Department must have permission of instructor to register. M W F 12:20. Bradfield 108. Dr. W. D. Youngs.

Principles and theories involved in dynamics of fish populations. Methods of obtaining and evaluating statistics of growth, population size, mortality, yield and production, as well as investigational aspects of fishery biology are included.

441 Fishery Resource Management. Spring term. Credit three hours. Prerequisite: 439 and 440 or permission of instructor. Lecture: T Th 11:15. Fernow 210. Discussion to be arranged. Associate Professor Eipper.

Principles and problems in the management of freshwater and marine fishery resources, considered in relation to problems of human population and management of other natural resources. Multiple use concepts, allocation problems, and the economic, legal, and political ingredients in solving those problems. Characteristics of fishery resources and their exploitation. Policies and techniques in managing fish stocks through maintenance and improvement of habitat, fish population manipulation, and regulation of fishing.

443 Ecological Aspects of Water Resources Management. Fall term. Credit three hours. Limited to 30 students; seniors or graduate

students only. T Th 9:05. F 1:25-4:25. Caldwell 250A. Associate Professor Oglesby.

Basic structural and dynamic aspects of freshwater and estuarine ecosystems are reviewed. The nature and modes of action of stresses imposed by man on the systems and their significance to management decisions are then studied. Students will become acquainted with some of the more important laboratory and field study tools.

600 Seminar: Major Fishery Investigations. Spring term. Credit one hour. Given in alternate years. Prerequisite: permission of instructor. W 12:20. Staff.

A comparative review of major fishery investigations of the world constitutes the primary content of seminar. A study of pertinent literature and special topics will be assigned.

601 Seminar on Selected Topics in Fishery Biology. Fall or spring term. Credit one hour. Time to be arranged. Staff.

Wildlife Science

304 Wildlife Ecology. Fall term. Credit two hours. T Th 10:10. Warren 145. Assistant Professor Moen.

Consideration of the basic physical, physiological, interspecific, and intraspecific relationships of the organism and its environment.

410 Principles of Wildlife Management. Fall term. Credit three hours. Prerequisite: junior standing and one Natural Resources course. M W F 9:05. Warren 145. Professor Hewitt.

Fundamental characteristics and mechanisms of wildlife population and habitats. Includes ecological, social, and economic aspects of wildlife management.

411 Wildlife Management Methods. Spring term. Credit two hours. Prerequisite: 410. F 11:15, 1:25-4:30. Several all-day field trips. Fernow 210. Professor Hewitt.

Introduction to methods of management of wildlife and practical application of these techniques in the field. Intended for wildlife science majors.

412 Wildlife Management Laboratory. Fall term. Credit one hour. Prerequisite: 410 or concurrent registration. F 1:25-4:30. Several all day field trips. Fernow 212. Professor Hewitt.

Laboratory problems in wildlife management. Involves data collecting and analysis. Intended for wildlife science majors.

414 Advanced Wildlife Science. Spring term. Credit three hours. Prerequisite: 410 and 411. T Th 11:15. Bradfield 105. Assistant Professor Moen.

Nutrition, behavior and management of free ranging wildlife.

603 Wildlife Science Seminar. Fall and spring terms. Credit one hour. Prerequisite: senior or graduate standing in the Department, or consent of instructor. W 3:35. Fernow 304. Staff.

Discussion of individual research or current problems in wildlife science.

Research. Either term. Credit and hours to be arranged. Problems are undertaken in any of the fields of study in the Department. Prerequisite: adequate preparation in the specialized field, and undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade Fernow Hall.

494 Fishery Biology. Professor Webster, Associate Professors Eipper and Oglesby, and Assistant Professors Carlson and Forney.

495 Wildlife. Professor Hewitt, Associate Professor Thompson, and Assistant Professors Kelley, Moen, and Richmond.

496 Forestry. Professors Hamilton and Winch and Associate Professors Morrow and Dickson.

498 Natural Resources. Professor Hamilton, Associate Professor Brumsted, and Assistant Professors McNeil and Wilkins.

499 Remote Sensing of Resources. Mr. Hardy.

500 Thesis Research. Fall and Spring terms. Credit and hours arranged. S-U grades only. Staff.

Limited to graduate students working on thesis research.

610 Conservation Seminar. Spring term. Non-credit. Th 4:30-6:30. Fernow seminar room. Staff.

All graduate students in the Field of Conservation are expected to participate.

The Vertebrates (Biological Sciences 273).

General Ecology (Biological Sciences 361).

Mammalogy (Biological Sciences 471).

Biology of Fishes (Biological Sciences 469).

Ornithology (Biological Sciences 472).

Introductory Entomology (Entomology 210).

Analysis and Interpretation of Aerial Photographs (Engineering 2423).

Resource Economics (Agricultural Economics 450).

Forest Soils (Agronomy 404).

Plant Breeding and Biometry

Four-year students interested in specializing in genetics, plant breeding, or statistics may obtain suggested sequences of courses by consulting the head of the Department or other members of the faculty. Professional careers in these fields ordinarily involve advanced study. Therefore, undergraduate course work in most instances will be directed toward preparation for graduate study. Appropriate fundamental courses in biology, mathematics, chemistry, and English will make up the bulk of the curriculum.

During summers of alternate years, a series of field trips is scheduled to give students an opportunity to visit commercial seed farms, wholesale seed companies, the New York State Department of Agriculture and Markets, USDA at Beltsville, a plant introduction station, a foundation and certified seed agency, and the Farmers Museum at Cooperstown.

Plant Breeding

503 Methods of Plant Breeding I. Fall term. Credit three hours. Primarily for graduate students, but open to qualified seniors who expect to engage in plant breeding. Prerequisite: Biological Sciences 101-102 or 103-104 and 281, and a course in at least one of the following: field crops, vegetable crops, floriculture, or pomology. T Th 8. Bradfield 108. Laboratory: T 2-4:25. Guterman 120. Professor Murphy.

A study of the principles and practices of plant breeding. Each of the possible variety forms is described, and the methods of producing them are discussed.

505 Physiological Genetics of Crop Plants. Spring term. Credit three hours. Lecture: T Th 9:05. Bradfield 108. Laboratory: T 1:25-4:25. Bradfield 105. Associate Professor Wallace.

Genetic, biochemical, and molecular mechanisms controlling plant variation in physiological phenomena such as photosynthesis, respiration, translocation, self-incompatibility, male sterility, seed dormancy, yield, and heterosis will be discussed. Biochemical and molecular mechanisms through which environmental factors like temperature, light, mineral elements, and water interact with genetics to alter phenotypic expressions of plant growth and development will also be covered. These genetic, physiological, biochemical, and environmental phenomena will be presented from data obtained through studies with higher plants. Emphasis will be upon physiological variation that can be exploited in plant breeding.

110 Plant Pathology

506 International Crop Breeding and Improvement. Fall term. Credit two hours. Given in alternate years. Prerequisite: 503 or consent of the instructor. Lecture: Th 9:05. Bradfield 108. Discussion: Th 2:30-4:25. Bradfield 105. Professor Crowder.

Discussion of plant breeding principles and procedures as related to situations found in different parts of the world. Particular attention will be given to alternate approaches in breeding and crop improvement programs in developing countries and to cropping systems and agronomic practices which influence crop productivity. Specific reference materials and examples will be drawn from current activities in tropical agricultural regions. Student participation is expected.

507 Research Orientation. Spring term. Credit two hours. Prerequisite: 503. Lectures: M W F 9:05 for the first ten weeks of the semester. Bradfield 108. Professor Grogan and staff.

Designed to acquaint the student with the various facets of research in plant breeding. Particular attention will be given to concepts, philosophies relating to plant research, and oral and written communication procedures in research.

[512 Experimental Methods. Spring term. Credit two hours. Given in alternate years. Prerequisite: 511 or consent of the instructor. M W F 12:20. Bradfield 108. Professor Lowe. Not given in 1971-72.

Use of statistical methods and application of experimental designs and plot techniques to problems in plant breeding and related agricultural research.]

516 Advanced Topics in Plant Genetics and Breeding. Fall term. Credit one hour. S-U grades only. Graduate students only. Given in alternate years. Two-hour lecture and workshop discussion time to be arranged. Professor Jensen and invited participants.

Designed for study in depth of advanced research and other topics of special relevance to plant genetics and breeding. Examples of research topics are: somatic hybridization, host pathogen relationships, parameters of yield, mutation or radiation breeding, uses of male sterility, world germ-plasm resources, mass selection, plant competition, and population dynamics.

450 Special Problems in Research. Fall, spring, or summer. Credit one or more hours by arrangement with instructor. Undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade. Members of the departmental staff.

622 Seminar. Fall and spring terms. Without credit. T 12:30. Emerson seminar room. Members of the departmental staff and graduate students.

Plant Pathology

The Department offers programs of instruction in plant pathology, mycology, plant nematology, plant virology, phytobacteriology, dendropathology, and disease physiology. In consultation with an adviser, a student may develop a program to prepare himself for (1) graduate work leading to a career in teaching or research, (2) training as a laboratory or research technician, (3) a career in state and federal regulatory work or as a county agent, or (4) a career in agricultural chemical sales or technical service. An undergraduate major in the field is not required for graduate work in mycology or plant pathology.

[301 Elementary Plant Pathology. Every fall and alternate spring terms. Credit three hours. Prerequisite: Biological Sciences 101-102 or 103-104, or the equivalent. Lecture: T Th 11:15. Plant Science 37. Laboratory: T W Th or F 2-4:25. Plant Science 341. Conferences to be arranged. Professor Boothroyd. Not given in Spring 1972.

An introductory course dealing with the nature, cause, and control of disease in plants. Representative diseases of cultivated crops are studied in the laboratory.]

302 Plant Disease Control Practices. Spring term. Credit three hours. Given in alternate years. Prerequisite: 301 or equivalent. Lecture: T 11:15. Plant Science 336. Laboratories and recitation: T Th 2-4:25. Plant Science 342. Professor to be appointed.

For undergraduates who expect to engage in general farming; in fruit, vegetable, cereal, or ornamental growing; in agriculture agent work; or in teaching of agriculture in secondary schools. Consideration is given to modern methods for controlling diseases of plants through production and use of disease-free propagative materials, seed treatments, regulatory laws, crop rotation, plant surgery, sanitation, soil treatment, spraying and dusting, and development and use of disease resistant varieties. Field trips arranged to observe disease control practices.

309 Comparative Morphology of Fungi. Fall term. Credit four hours. Prerequisite: a year sequence of botany of its equivalent, and permission to register. Lecture: T Th 9:05. Plant Science 336. Laboratory: T Th 1:25-4:25. Plant Science 326. Professor Korf.

An introductory course in mycology. Emphasis is placed on morphology rather than on taxonomy.

403 Pathology of Trees and Shrubs. Spring term. Credit three hours. Prerequisite: 301 or the equivalent. Lectures: W F 10:10. Plant Science 336. Laboratory: F 1:25-4:25. Plant Science 342. Associate Professor Sinclair.

For students desiring some specialized knowledge of diseases of trees and shrubs in preparation for nursery or landscape work, for careers as park superintendents, arborists, or city foresters, or for other horticultural professions; deals with the nature, recognition, diagnosis, and treatment of diseases of woody plants.

431 Undergraduate Research in Mycology or Plant Pathology. Fall or spring term or both. Credit three to five hours. S-U grades optional. Undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade. Not less than three laboratories of three clock hours per week. Staff members.

Designed to afford opportunity for selected undergraduates to test their inclinations and ability to do research work. The student is expected to prosecute with interest and enthusiasm, under informal direction of the professor, some problem or problems mutually agreed upon.

501 Advanced Plant Pathology. Fall term. Credit five hours. Prerequisite: a course in introductory plant pathology and permission to register. Lecture: T Th 11:15. Plant Science 336. Laboratory: T Th or W F 2-4:25. Plant Science 342. Professor Millar.

Designed to acquaint the student with the basic principles and techniques of the science of phytopathology and to provide an adequate foundation for successful prosecution of research in this field.

[502 Principles of Plant Disease Control. Spring term. Credit three hours. Given in alternate years. Graduate students only. Enrollment limited to 24. Prerequisite: 501 or its equivalent and permission to register. Lecture: T Th 11:15. Plant Science 336. Laboratory and discussion: T Th 2-4:25. Plant Science 342. Professor to be appointed. Not given in 1971-72.

Emphasis is placed upon the philosophies underlying the principles of plant disease control. Attention is given to the existing body of knowledge upon which present disease control practices are based. Objectives are to help the student interested in plant protection equip himself not only to apply existing methods and materials but to enable him to improve upon them by developing new ideas, etc., especially in situations where control of plant diseases requires new approaches.]

505 Plant Virology. Fall term. Credit three hours; in special cases permission may be obtained to enroll for lectures only (two hours credit). For graduates students with majors or minors in plant pathology; also open to graduate students interested in general virology. Prerequisite: 501 or permission to register. Lecture: T Th 10:10. Plants Science 336. Laboratory: F 1:25-4:25. Virology-Nematology Laboratory. Professor Ross.

Designed to provide advanced graduate students with basic information on the plant viruses and on the diseases they cause.

506 Plant Nematology. Spring term. Credit three hours. Given in alternate years. For graduate students with majors or minors in plant pathology and, in special cases, other students interested in nematology. Prerequisite: 501 or permission to register. Two lectures and one or two three-hour laboratory periods per week. Hours to be arranged. Lectures: Plant Science 336. Laboratory: Virology-Nematology Laboratory. Professor Mai.

Anatomy, morphology, and taxonomy of plant parasitic forms and nonparasitic soil-inhibiting forms of nematodes are studied. Plant pathogenic forms also are considered from the standpoint of host-pathogen relationships, host ranges, life cycles, and the symptoms they cause. Principles and methods of control are discussed.

[507 Bacterial Plant Pathogens. Spring term. Credit two hours. Given in alternate years. For graduate students with majors or minors in plant pathology; others by permission only. Prerequisite: 501 or permission to register. Lecture: F 9:05. Plant Science 336. Laboratory: F 2-4:25. Plant Science 304B. Professor Dickey. Not given in 1971-72.

Designed to provide students with basic information on bacterial plant diseases and phytopathogenic bacteria. The laboratory will include some of the more important techniques used in the study of bacterial plant pathogens.]

508 Disease and Pathogen Physiology. Fall term. Credit three hours. Given in alternate years. For graduate students with majors or minors in plant pathology; others by permission only. Prerequisite: 501, Biological Sciences 240 and 431, and permission to register. Lecture: W 10:10. Plant Science 336. Laboratory: W 1:25-4:25 and one to be arranged. Plant Science 344. Professor Bateman and Assistant Professor Van Etten.

Designed to provide students with insight into the mechanisms of pathogenesis and altered metabolism of diseased plants.

521 Experimental Methods in Plant Pathology. Fall term. Credit two hours. Given in alternate years. For graduate students with a

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major or minor in plant pathology; others by permission only. W F 10:10. Plant Science 422. Assistant Professor Horst.

Designed to provide students with basic information on the application of statistical procedures and experimental designs in plant pathological research.

531 Special Problems in Mycology or Plant Pathology. Fall or spring term, or both. Credit three or five hours each term. For graduate students only. Registration by permission. Three to five weekly laboratory periods of three hours each. Staff members.

For work in mycology, modern techniques and experimental approach are stressed, in areas such as physiology, developmental morphology, genetic systems, or cytotoxicology.

For work in plant pathology for minor thesis or problems, or for students wishing to develop familiarity with modern techniques in some phase of the science.

For work in plant nematology, research projects in five areas are stressed. These areas include host-parasite relations, virus transmission, nematode-fungus-bacterium relations, biology, behavior, population dynamics, reproduction and growth, morphology, taxonomy, techniques, and control.

541 Philosophy of Plant Pathology. Fall term. Credit two hours. S-U grades only. Given in alternate years. For Ph.D. students majoring in plant pathology. Prerequisite: 501, 579, and at least two other courses from 502, 505, 506, 507, and 508, or permission to register. Conferences: M W 8-10. Plant Science 422. Professor Kent.

A conference with advanced graduate students examining the concepts of plant pathology as they relate to the approach to basic and applied research problems, teaching, and extension.

579 Advanced Mycology. Spring term. Credit four hours. Given in alternate years. Prerequisite: 309 or its equivalent, a course in genetics, and permission to register. Lecture: M 10:10. Plant Science 336. Laboratory: M W 1:25-4:25 and one additional three-hour period to be arranged. Plant Science 326. Professor Korf.

A detailed study of the biology and taxonomy of the major groups of plant pathogenic fungi (rusts, smuts, Fungi Imperfecti, Peronosporales) with emphasis on mechanisms of variation in fungi. *Optional* field trips.

[599 Taxonomy of Fungi. Fall term. Credit four hours. Given in alternate years. Prerequisite: Plant Pathology 309 or its equivalent, a course in genetics, a course in plant or animal taxonomy, and permission of the

instructor to register. Lecture: M W 10:10. Plant Science 336. Laboratory: M W 1:25-4:25. Plant Science 326. Professor Korf. Not given in 1971-72.

Emphasis is placed on the principles of taxonomy and nomenclature, critical evaluation of keys and monographs, and practice in identification. The Discomycetes, from which most examples are drawn, are treated in detail. *Required* field trips.]

645-656 Current Topics. Fall and spring terms. Credit to be arranged. For graduate students with special interests in the particular area. Prerequisite: permission to register. Time to be arranged. Plant Science 422.

Weekly discussions of current topics in special areas of plant pathology and mycology. Students will be required to do extensive reading of current literature and to present oral and written reports.

645 Plant Virology. S-U grades only. Professors Ross and Rochow.

646 Plant Nematology. S-U grades only. Professor Mai.

647 Bacterial Plant Pathogens. S-U grades only. Professor Dickey.

648 Physiology of Plant Diseases. S-U grades only. Professor Bateman, Professor Millar, and Assistant Professor Van Etten.

649 Mycology. S-U grades only. Professor Korf.

Fall term, Gasteromycetes; Spring term, Zygomycetes.

650 Diseases of Vegetable Crops. S-U grades only. Associate Professors Lorbeer and Wilkinson.

653 Pathology of Trees and Shrubs. S-U grades only. Associate Professor Sinclair.

654 Diseases of Florist Crops. S-U grades only. Assistant Professor Horst.

655 Plant Diseases in Tropical Agricultural Development. S-U grades only. Professor Thurston.

656 Environmental Aspects of Plant Disease. S-U grades only. Professor Dimock.

661 Seminar. Fall and spring terms. Credit one hour. S-U grades only. Required of all majors in the Department. T 4:30-5:30. Plant Science seminar room. Associate Professor Lorbeer.

671 Plant Pathology Colloquium. Fall and spring terms. Credit one hour. S-U grades only. First and third Thursdays of each month. 8-10 p.m. Plant Science seminar room. Staff and graduate students.

Virology (Biological Sciences 498).

Pomology

The fruit industry offers opportunities for graduates in production, research, technical service, and distribution as well as teaching. Undergraduate students interested in a professional career in university teaching or in research positions at an experiment station or in industry usually continue their training at the graduate level. A variety of basic courses in science can be included in the curriculum in preparation for this. Students who desire to do their major work in pomology may obtain a suggested sequence of courses for the four-year period by consulting the Department.

General Horticulture (Vegetable Crops 103).

Intended for students who want a general course in horticulture covering flowers, fruits, and vegetables.

101 Tree Fruits. Fall term. Credit three hours. Should be preceded or accompanied by an introductory course in biological science. Lecture: T Th 8. Warren 131. Laboratory: W 2-4:25. Plant Science 107. Professor Edgerton.

A study of the general principles and practices of tree-fruit culture and their relation to the underlying sciences. Topics to be covered include propagation, varieties, orchard management, and growth and fruiting habits. Practical work is presented in grafting, pruning, site and soil selection, and planting.

102 Small Fruits. Fall term. Credit three hours. Should be preceded or accompanied by an introductory course in biological science. Lecture: M W 8. Plant Science 143. Laboratory: M 2-4:25. Plant Science 114. Associate Professor Tomkins.

A study of the general principles and practices in the culture of grapes, strawberries, brambles, and bush fruits; and their relation to the underlying sciences. Fruiting and growth habits are covered, with practical work in pruning, planting, and propagation. One all-day field trip will be taken.

201 Postharvest Physiology, Handling, and Storage of Fruits. Fall term. Credit three hours. Prerequisite: 101 or 102. Lecture: T Th 8. Plant Science 141. Laboratory: F 2-4:25. Plant Science 114. Professor Smock.

The chemistry and physiology of fruits as they affect quality and marketability are

studied. Handling methods, maturity indices, and storage practices are considered. Practical work involves grading and inspection of fruits and storage of fruit in different ways. One Saturday field trip is required.

202 Advanced Laboratory Course. Spring term. Credit two hours. Th 1:25-4:25. Plant Science 114. Professor Edgerton and Associate Professor Oberly.

Designed to give more extended practice in the various orchard operations than can be given in 101. Special attention is given to problems of pruning, grafting, orchard soil selection and management, pollination, and spray practice. One or two field trips are taken.

301 Economic Fruits of the World. Spring term. Credit three hours. Given in alternate years. Prerequisite: an introductory course in biological science, or permission to register. Lecture: M W 8. Plant Science 143. Laboratory: F 2-4:25. Plant Science 114. Professor Smock.

The more important subtropical and tropical fruit species such as citrus, banana, mango, coffee, and cacao are considered. Morphology, physiology, and adaptation to climate are stressed rather than details of culture. A broad view of world pomology is given.

[401 Advanced Pomology. Fall term. Credit three hours. Given in alternate years. Prerequisites: 101 or 102 and Biological Sciences 240. Lecture: M W F 8. Plant Science 114. Associate Professor Creasy. Not given in 1971-72.

A comprehensive study of the sources of knowledge and opinions regarding practices in pomology. The results of experiences and research pertaining to pomology are discussed, with special reference to their application in the solution of problems in commercial fruit growing.]

[501 Special Topics in Experimental Pomology. Spring term. Credit three hours. Given in alternate years. Hours to be arranged. Professors Edgerton and Smock, and Associate Professors Blanpied, Creasy, Oberly, and Powell. Not given in 1971-72.

The student is expected to review critically and to evaluate the more important original papers relating to the various phases of pomological research. Recent experimental methods applicable to the topic are fully considered.]

502 Research. Fall, spring, or both terms. Credit two or more hours a term. S-U grades optional. Prerequisite: 401. Undergraduates must attach to their preregistration material written permission from the staff member who

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will supervise the work and assign the grade. Professors Edgerton and Smock, and Associate Professors Blanpied, Creasy, Oberly, Powell, and Tomkins.

504 Growth and Development of Woody Plants. Spring term. Credit two hours. Given in alternate years. Primarily for graduate students; undergraduates admitted by prior approval of instructor. Prerequisite: introductory course in plant physiology. Lecture: T Th 9:05. Plant Science 141. Associate Professor Powell.

An advanced course dealing primarily with the growth and development of woody plants, with particular reference to fruit trees. Physiological responses will be emphasized, but morphological, cytological, and biochemical changes will be considered.

600 Seminar. Fall and spring terms. Without credit. Required of students taking 502 and graduate students in pomology. T 11:15. Plant Science seminar Room. Members of the departmental staff.

Poultry Science

The poultry industry covers opportunities in all phases of production, distribution, technical service, research, and teaching. Suggested sequences of courses are available to students interested in production or in a business allied to it, and to those interested in a career in research, teaching, or commercial work in such specialized fields as genetics, nutrition, physiology, or food technology.

100 Introduction to Poultry Science. Spring term. Credit three hours. Lecture: T Th 11:15. Laboratory: W 2-4:25. Rice 201. On the several days when there are field trips, a longer Wednesday session may be necessary. Assistant Professor Austic.

A general course designed to acquaint the student with the scope of the poultry industry with emphasis on the principles of avian biology and their application in the various phases of poultry production.

270 Poultry Hygiene and Disease. Fall term. Credit two hours. Given in alternate years. Prerequisite: Biological Sciences 290 or 290A, and permission of the instructor. Th 2-4:25. Veterinary College. Dr. Hitchner.

The nature of the infectious and parasitic diseases of poultry and the principles of hygiene applicable to poultry farming for the prevention and control of diseases.

280 Poultry Farm Management. Spring term. Credit three hours. Given in alternate years. Lecture: T Th 10:10. Rice 201. Laboratory:

M 2-4:25. Rice 201. Associate Professor Thacker.

Practical and business management problems of the commercial poultry farm and industry will be studied. Assigned farm studies. Field trips will be taken.

390 Poultry Problems. Fall or spring term. Credit one, two, or three hours. S-U grades optional. Undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade. Professor Young.

Investigation of some problem in the field of poultry science by the student under the direction of a member of the staff.

Poultry Nutrition (Animal Science 410).

415 Poultry Nutrition. Spring term. Credit one hour. Prerequisite: Animal Science 410 or permission of the instructor. F 11:15. Rice 201. Professor Nesheim.

Intended to provide a discussion of applications of principles of nutrition to feeding poultry. Feed formulations will be stressed with emphasis on linear programming and computer formulation.

420 Poultry Genetics. Spring term. Credit three hours. Given in alternate years. Open also to juniors. Prerequisite: a course in genetics and permission of the instructor. Lecture: M W F 9:05. Rice 201. Professor Cole.

A survey of inherited characters in domestic birds, cytology, linkage, inbreeding, and hybrid vigor; role of heredity in embryonic mortality, resistance to disease, infertility, endocrinology, and reproduction; and genetic principles as applied to poultry breeding.

425 Comparative Physiology of Reproduction of Vertebrates. Spring term. Credit four hours. Prerequisite: Animal Science 427 and consent of the instructor. M W 10:10. Laboratory to be arranged. Rice 300. Professor van Tienhoven.

Sex and its manifestations, endocrinology of reproduction, interactions between endocrine and nervous systems. The laboratory will provide an opportunity for students to design and execute experiments with limited objectives, independently.

430 Cytochemistry and Cytophotometry. Spring term. Credit three hours. Prerequisite: Biological Sciences 347 or the equivalent and consent of the instructor. Lecture: T Th 1:25. Rice 101. Laboratory to be arranged. Assistant Professor Bloom.

An advanced course dealing with methods for studying qualitative and quantitative

aspects of nucleic acid and protein chemistry of individual cells. Special attention is given to methods of quantitative cytophotometry. Student participation involves presenting lecture-seminars and conducting experiments oriented to solving specific biological problems.

440 Anatomy of the Fowl. Fall term. Credit three hours. Open to juniors. Prerequisites: Biological Sciences 102 or 104 and permission of the instructor. Lecture: T Th 8. Rice 201. Laboratory: F 2-4:25. Rice 201. Professor Cole.

The lectures, supplemented by laboratory periods for study and dissection, are designed to acquaint the student with the anatomy of the fowl.

450 Poultry Meat and Egg Technology. Spring term. Credit three hours. Given in alternate years. Prerequisite: Chemistry 355, or its equivalent, and Biological Sciences 290. Lecture: T Th 9:05. Laboratory to be arranged. Rice 101. Professor Baker.

A discussion and study of some of the important microbial and nonmicrobial changes in poultry meat and eggs as well as the chemical composition and preservation of these products. Development of new products is also emphasized.

Meat and Meat Products (Animal Science 290).

511 Special Topics in Nutrition. Fall or spring term. Credit and hours to be arranged. For graduate students only. Registration by permission of staff members concerned. Professors Nesheim, Scott, and Young.

For students desiring experience in planning, conducting, and reporting independent research projects in poultry nutrition.

609 Seminar in Poultry Biology. Fall and spring terms. S-U grades only. For graduate students. Th 4:15. Rice 201. Members of the Department staff.

A survey of recent literature and research in poultry biology.

619 Field of Nutrition Seminar. Fall and spring terms. No credit. M 4:30. Fall, Morrison 348. Spring, Savage 100.

Current research in nutrition presented by visitors and faculty.

Advanced Nutrition. (See description under Animal Science.)

Protein and Amino Acids (Foods and Nutrition 501). (See the *Announcement of the College of Human Ecology*.)

502 Lipids and Carbohydrates. Fall term. Credit two hours. T Th 11:15. Rice 300. Associate Professor Bensadoun.

Nutritional Energetics (Animal Science 503).

504 Vitamins and Minerals. Spring term. Credit two hours. T Th 11:15. Rice 300. Professor Scott.

Rural Sociology

Students who specialize in rural sociology may choose a sequence of courses designed (1) to provide a broad general understanding of rural societies, methods of analyzing societal systems, how they are organized, the interaction of individuals, groups, organizations, and institutions undergoing modernization and change; (2) to offer training in strategies of domestic and international development; (3) to prepare for professional careers in research, teaching, and public service roles. Graduate study is essential for those wishing to become professional sociologists.

100 General Sociology. Fall or spring term. Credit three hours. May not be taken by those who have credit for Sociology 101. T Th 10:10. Warren 45. One period. Discussion sections: fall, M or F 9:05-2:15, Warren 32; spring, M or F 9:05-2:15, Warren 361. Fall term, Associate Professor Eberts. Spring term, Assistant Professor Stockdale and staff.

A general introduction to the theory and methods of sociology. Major topics selected for discussion include culture, socialization, deviancy and social control, stratification, ideologies, and social change. Supplementary reading includes recent research assigned for illustrative purposes to assist students in analyzing topical areas as term projects.

200 Analysis of Selected Societal Field Problems. Spring term. Credit three hours. Prerequisite: 100. Enrollment limited to 100. T Th 10:10. Warren 245. Discussion sections to be arranged. Staff.

Designed to follow course 100 through a close student-teacher working relationship. The course will enable students to explore in greater depth selected societal issues and problems. The four main areas with which the course will be concerned are: (1) growth and stagnation; (2) power, class, stratification, and poverty; (3) race relations; (4) social protest. These topics will be analyzed and compared at three levels of analysis: community, national, and international.

210 Foundations for Decision Making and Social Action. Fall term. Credit three hours. S-U grades optional. Not open to freshmen. M W F 10:10. Warren 145. Professor Reeder.

The purpose is to provide the basic information essential to an understanding of decision making, social action, and planned

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change. The course is designed for two categories of students: (1) students of various fields who wish to take one or two courses in sociology and who want to gain the kind of knowledge that relates directly to human relationships in their occupation and in their activities as organization members and citizens; (2) persons whose work or interests are likely to involve them in some phase of planned change—either as administrators, organization leaders, extension agents, teachers, or community development workers—and others for whom the role of change agent is an essential part of their job.

220 Introductory Research Methods. Fall term. Credit three hours. S-U grades optional. T Th 1:25–2:55. Plant Science 143. Assistant Professor Francis.

Intended to initiate an interest in the strategies of both discovery and proof in social research, the course will be divided into four areas. Part one will deal with the strategy of theory construction, concept formation, and the establishment of logical validity in both the deterministic and probabilistic. Part two will discuss the strategies of empirical inquiry. This will entail introductory discussions of hypotheses formation, probability, and experimental design, together with a presentation of guides to the selection criteria for the use of field versus laboratory techniques. Part three will consist of discussions of the techniques of analysis, problems of inference, statistical application, and the legitimacy of evidence. It is intended that students gain some introductory familiarity with computer analysis and machine use.

221 Introductory Computer Concepts. Fall term. Credit one hour. Arrange with Assistant Professor Francis.

This course is intended primarily as a supplement to 220, though it may be taken independently. CUPL is the language used to introduce the fundamental notions of programming, the concept of an algorithm and development of iterative solutions. It is assumed that the student has no background in computer programming or mathematics.

222 Introductory Statistical Applications. Fall term. Credit one hour. Arrange with Assistant Professor Francis.

This course is intended primarily as a supplement to 220, though it may be taken independently with consent of the instructor. The course is designed for the student with no background in statistics or mathematics. Emphasis is primarily upon learning techniques, not theory, of statistics.

300 Rural Social Organization and Change. Fall term. Credit three hours. S-U grades optional. Not open to freshmen or sopho-

mores. M W F 11:15. Warren 145. Assistant Professor Stockdale.

Designed to provide an introduction to sociology and rural social organization for students with little or no background in sociology. Theory, methods, and findings in sociology are presented by relating them to such contemporary problems and topics as agricultural adjustment, rural poverty, rural-to-urban migration, social movements, change in organizations and agencies, community structure and change, and ties of rural systems to mass society. Social stratification and power are emphasized throughout the course.

[334 Rural Social Problems and Public Policy. Spring term. Credit three hours. Given in alternate years. Not open to freshmen or sophomores. M W F 9:05. Warren 160. Professor Larson. Not given in 1971–72.

Social problems in American rural life and an analysis of the policy-making process. Primary emphasis is on the sociological aspects of current public problems in the United States such as low-income farmers, migratory agricultural labor, and institutionalized social services. Each problem selected is analyzed in terms of historical background, public policy, national programs, and the consequences of the policy and program.]

350–352 Informal Study. Throughout the year. Credit one to three hours. S-U grades optional. May be repeated. Undergraduates must attach to their preregistration material written permission from the faculty member who will supervise the work and assign the grade.

350 Readings

351 Research Experience

352 Public Service Experience

353 Undergraduate Teaching Experience. Fall or spring. Credit one to three hours. S-U grades only. Assistants only. May be repeated. Participation in the ongoing teaching program of the department. Undergraduates must attach to their preregistration material written permission from the faculty member who will supervise the work and assign the grade.

380H Independent Honors Research in Social Science. Throughout the year. Credit one to six hours. Open only to candidates who have met the requirements for the Honors program listed on page 30. A maximum of six credits may be earned in the Honors Program.

405 Organization Dynamics. Spring term. Credit three hours. S-U grades optional. Prerequisite: 100 or 210 or permission of the instructor. Not open to freshmen or sopho-

mores. M W 11:15-1:10. Warren 232. Professor Reeder.

A study of the methods and techniques by which organization consultants, officers, group members, and administrators may increase the effectiveness of organizations. Five categories of organization problems are considered; (1) program problems, (2) leadership problems, (3) membership problems, (4) problems related to meetings, and (5) organizational and public relations problems. Organization theories are presented in relation to their uses in analysis, prediction, diagnosis, and in designing programs to bring about organizational changes. The first hour is a lecture-discussion period; the second hour is a group skills, group process, and group sensitivity laboratory.

411 Community and Regional Development and Planned Change. Spring term. Credit three hours. S-U grades optional. T Th 11:15-12:30. Warren 232. Professor Capener and Associate Professor Erickson.

Various strategies of development and planned change will be explored. Reviewed also will be programs, organizations, agencies, and institutions operating in communities and regions that address themselves to various development strategies. Two major emphases are stressed: (1) the structural-functional roles and processes of organizations, agencies, and institutions as they implement programs of change and development in communities and regions; and (2) roles of professionals and change agents representing and operationalizing development units.

412 Rural Society. Fall term. Credit three hours. S-U grades optional. Prerequisite: 100 or equivalent. Not open to freshmen or sophomores. M W F 9:05. Warren 101. Professor Larson.

Theoretical and methodological problems in the sociological study of rural societies. Principal emphasis is on the development of American rural society, its internal variations, and the changing relationships of the rural and urban sectors. Attention is given to demographic trends, to values, and to the structure, function, and trends of selected major social systems which serve rural people. Some consideration is given to public policy and program implications of the material presented.

420 Comparative Rural Societies. Fall term. Credit three hours. S-U grades optional. Prerequisite: a course in general sociology or anthropology. M W F 11:15. Warren 231. Professor Young.

The development of nations, regions, and communities is analyzed from a macrostructural perspective, emphasizing the pervasive nature of social communication and symbolic

transformations. Results of recent and ongoing comparative studies are reported, and previous theoretical work relevant to structural change—Marx, Durkheim, Parsons, etc.—is reviewed.

421 Community Structure and Change. Fall term. Credit three hours. Open to seniors and graduate students, others by permission. W F 1:25-2:40. Warren 261. Associate Professor Erickson.

An overview of various models in approaching communities as objects of study. Analysis will focus on the methodologies by which power structures are examined, the relation of local community units to extracommunity systems, the forms of community cohesion and autonomy, the relation of local power structures to decision making, and the relation of changes in division of labor, urbanization, suburbanization, and the values to patterns of community life.

424 Occupations and Social Issues. Fall term. Credit three hours. (S-U grades optional). Prerequisite: course 100 or equivalent. T Th 2:30-3:45. Warren 232. Professor Taietz.

Campus unrest, crime and social disorders, and other manifestations of social unrest have in recent years focused attention on certain important institutions and related occupations, especially the teacher in the educational system, the police in the judicial system, the physician in the health services, and the social worker in the welfare structure. The interrelationship between the social structure and these occupations will be studied. Particular attention will be given to analyzing the impact of social change and current controversies on the work environment of physicians, social workers, teachers, and the police; and on the processes by which these occupations select, socialize, and reward their members.

436 Social Movements and the Sociology of Confrontation. Spring term. Credit three hours. T 1:25-2:40 and Th 1:25-2:40 or 2:40-3:55. Warren 32. Enrollment limited to 25. Professor Bauder.

Designed to provide opportunity for maximum student participation. Students under faculty supervision will plan and organize the course which will follow a seminar format.

The course content will be on interaction between available theories of collective behavior and selected comprehensive case studies. The theories of Blumer, Heberle, the Longs, Smelzer, Toch, Turner, Yound and others will be used to help understand selected cases from a wide range of social movements such as the Black Power movement, National Farms Organizations, and various student movements.

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437 The Sociology of Aging. Spring term. Credit three hours. Open to seniors and graduate students. S-U grades optional. T 2:30-5. Warren 261. Professor Taietz.

The theory and research in the sociology of aging will be examined. A major focus will be a critical examination of the disengagement and activity theories of the aging process. A current research project directed by the instructor will be utilized to investigate the effect of differential structural contexts on disengagement, morale, and community integration of the aged. Methodological problems in research on aging will be explored.

[443 Politics, Social Control, and Pluralism. Fall term. Credit three hours. S-U grades optional. Open to upperclassmen and graduate students. Prerequisite: 100 or equivalent. T Th 11:15-12:30. Warren 232. Associate Professor Eberts. Not given in 1971-72.

Comparative analyses of substantive and methodological issues in social control processes within the political economies of primarily Western democracies, but with illustrative attention to Communist and developing societies. Pluralism and control will be viewed relative to productive, allocative, and staffing processes of society, as they affect various occupational categories, communities of different size, and institutions primarily responsible for maintaining social order.]

500 Seminar: Community Development in the United States. Fall term. Credit three hours. Graduate students on consent of instructor. T 2:30-5:30. Warren 32. Professor Cummings.

A review of contemporary theories and practices with a view to identifying propositions relevant to research and social action.

510 Seminar on Decision Making and Social Action. Fall term. M F 10:10 and a weekly two-hour laboratory. Time to be arranged. Warren 145. Professor Reeder.

An introduction to research and theory on decision making and social action at the graduate level. The lectures for 210 are used to provide a systematic presentation of the subject, and the two-hour weekly laboratory is used to discuss additional research and theory related to the topics presented.

[511 The Metropolitan Community. Fall term. Credit three hours. Graduate student status or consent of an instructor. F 1:25-4:00. Warren 231. Associate Professor Eberts. Not given in 1971-72.

An interdisciplinary course focused upon social, political, and economic aspects of metropolitan America. Viewed from the perspective of demography, ecology, social organization, and planning, the emergence of a new society form and its implications for contemporary America will be considered.]

(This course is also given as Sociology 501 with Assistant Professor Marden and as Planning 714 with Associate Professor Feldt. Students registering for this course must do so under their respective college course number.)

515 Research Design. Spring term. Credit three hours. Prerequisite: an introductory methods course or a statistics course. T Th 1:25-2:55. Warren 232. Assistant Professor Francis.

An intermediate level treatment of the following topics: measurement, regression and analysis of variance, causal models, and maybe sampling. A classic piece of sociological research will be one source of illustrations and laboratory exercises.

516 Cross-Cultural Research Methods. Spring term. Credit three hours. T Th 10:10-11:25. Warren 101. Professor Young.

The comparative study of large social systems is presented as a new research style that is especially appropriate to research in and on developing countries. The field technique of macrosurveys and the uses of available data such as national social accounting, documents, ethnographic reports, and aerial photographs are emphasized. Special attention is given to trend studies; the assumptions of macrostructural analysis; rapid, low-cost research procedures; and the mechanics of data archives.

522 Social Power and Community Decision Making. Spring term. Credit three hours. M W 9:05-10:20. Warren 101. Assistant Professor Stockdale.

A sociological approach to power as an aspect of community life. The methodology and the theoretical approaches of recent community power studies are analyzed. The importance of social power in community decision making and action programs is considered, and the influence of community power structures in instigating and retarding change is analyzed.

528 Applications of Sociology to Development Programs. Spring term. Credit four hours. Open to graduate students only. M W F 11:15-12:30. Warren 261. Staff.

Application of sociological theory and methods to the problems of institutions and agencies concerned with rural development. Special emphasis is placed on community development in low-income countries.

540 Introduction to Computer Use. Fall and spring terms. Credit three hours. S-U grades optional. Prerequisite: one course in statistics. T Th 11:15. Warren 261. Laboratory to be arranged. Associate Professor Eberts.

The purpose is to introduce the student who wishes to use the computer in his

research but who does not necessarily want to become a programmer to the system at Cornell.

The course is divided into two parts. The first part is designed to give the student a working knowledge of the elementary aspects of Fortran IV so that he will be able to do preliminary transformations of his data and simple Fortran programs.

The second part deals with the various "canned" programs which are most often used by social scientists. The student is introduced to program packages such as Michigan, Bimed, and SSP. Examples will be given on how to run the programs as well as discussions on the differences between them.

550(A, B, C, or D) Informal Study. Throughout the year. Credit to be arranged. Prerequisite: graduate standing and permission of the graduate field member concerned.

- A Rural Sociology
- B Development Sociology
- C Organization Behavior and Social Action
- D Methods of Sociological Research

551(A, B, or C) Research. Throughout the year. Credit to be arranged. Prerequisite: graduate standing and permission of the graduate field member concerned.

- A Rural Sociology
- B Development Sociology
- C Organization Behavior and Social Action

552 Teaching Experience. Fall or spring. Credit one to three hours. Prerequisite: graduate standing. Participation in the ongoing teaching program of the department.

553 Public Service Experience. Throughout the year. Credit to be arranged. Prerequisite: graduate standing. Participation in the ongoing public service activities of the department.

[624 Seminar: Macro Systems Theory. Spring term. Credit three hours. S-U grades optional. M W 10:10. Warren 232. Associate Professor Eberts. Not given in 1971-72.

Analysis of major theoretical and research problems related to conceptualizing stress areas in society's changing organizational processes. Topics will be covered by reports on major classical and contemporary theorists, paying particular attention to their potentiality, using modern analytic techniques on current issues in political economy.]

630 Seminar, Contemporary Social Theory I. Fall term. Credit three hours. T Th 11:15-12:30. Warren 232. Professor Reeder.

The focus of this course is on: (1) intra- and inter-personal theories; (2) intra- and inter-organization theories; (3) intra- and inter-system theories.

631 Seminar, Contemporary Social Theory II. Spring term. Credit three hours. W F 1:25-2:45. Warren 261. Professor Reeder.

The focus of this course is on: (1) intra- and inter-community and regional theories; (2) intra- and inter-relations of national societies; (3) intra- and inter-cultural change.

636 Seminar in Social Change and Development. Spring term. Credit three hours. By permission of instructor. W 1:25-3:20. Warren 361. Associate Professor Erickson.

Review of selected theories of social change; an analysis of recent social and cultural changes occurring in new nations and developing economies; problems of traditional social structures undergoing modernization; and the social factors in economic growth, changes in caste and class, nation building, education, family, and religion.

651 Seminar in Occupational Structure. Spring term. Credit three hours. By permission of the instructor. T Th 9:05-10:20. Warren 232. Professor Bauder.

A survey of theory and research concerned with the organization of work roles in industrial societies. Special attention will be given to (1) variations in the content and organization of work roles at different levels of the occupational structure and in different segments of the economy; and (2) changes in the meaning of work associated with such factors as automation, professionalization, bureaucratization, increased leisure time, and increased participation of women in the labor force.

699 Seminar. Fall and spring term. No credit. For graduate students majoring in development sociology. Second and fourth Monday of each month, 3:35-5:05. Warren 32. Departmental staff.

Special Program for Peace Corps Colombia Intern Program*

335 Survey of Agricultural, Nutritional, and Home Development Projects in Colombia. Fall term. Credit one hour. Professor Cummings.

Orientation in Colombian geography, politics, and culture.

356 Study of Socio-Economic-Political Environment of Colombia. Spring term. Credit three hours. Professor Cummings.

Study of socio-economic-political environment of Colombia and how intern volunteers might better relate to this environment as agricultural, nutritional, or home development specialists.

* An Intern trainee may participate in any or all of these courses.

120 Statistics and Biometry

357 Idiomatic Spanish Terminology. Fall term. Credit two hours. Professor Cummings.

Idiomatic Spanish terminology basic to an understanding of Colombian peasant culture.

358 Idiomatic Spanish Terminology. Spring term. Credit three hours. Professor Cummings.

Idiomatic Spanish terminology, basic structures, and conversational patterns of Spanish used by Colombian peasants. Agricultural and nutritional terminology and usages basic to the work of agricultural, nutritional, or home development extensionists.

359 Intersession Program. Intersession. Credit one hour. Professor Cummings.

Interim period intensive training program. Exercises in cross-cultural communications, structured to facilitate adaptation to living conditions within a Latin culture and develop cultural sensitivity. Community field experience in upstate New York.

Statistics and Biometry

Four-year students interested in specializing in biometry may obtain suggested sequences of courses by consulting members of the Biometrics Unit, Department of Plant Breeding and Biometry. This biometry program provides both training for numerous positions which are available at the Bachelor's degree level and preparation for graduate study in statistics and biometry. It is recommended that the student be competent in mathematics and at least one other area of specialization in the College. Students should consult faculty of the Biometrics Unit for additional courses in quantitative methods suited to their interests; for example, courses in computer science, mathematics, statistics, systems analysis and others, given elsewhere on campus.

200 Statistics and the World We Live in. Spring term. Credit three hours. M W F 8. Warren 245. Preliminary examinations to be given on Thursday evening, 7:30-9:00, of the fourth, eighth, and twelfth weeks of the term. Professor to be appointed.

Emphasis is on numbers and the use of numbers as related to the many aspects of society. An introduction is given to the basic concepts and definitions in measurement, the principles of scientific experimentation, and graphical presentations. A historical resume of experimentation will be presented, together with methods for obtaining data related to a phenomenon of interest. Elementary definitions and concepts of sample survey and experimental design will be presented; considerable emphasis will be placed on obtaining meaningful data and upon designing information into data. Elementary methods

of summarizing meaningful facts from the data will involve the use of graphs, tables and ranks and the arithmetic mean, median, mode, variance, and range. Elementary concepts of populations, sampling from populations, model building, probability, frequency distributions, and interval estimation of population parameters will be presented. Emphasis will be on ideas, concepts, and understanding rather than on methods. The material in this course is complementary to the material presented in Industrial and Labor Relations 210, and nonrepetitive.

407 Introductory Computer Techniques for Statistics and Biology. Fall term. Credit two hours. Prerequisite or corequisite: an introductory course in statistics. Lecture: M 11:15. Warren 201. Laboratory: M 2-4:30. Warren 160. Professor Searle.

Introduction to computers, computing languages, and number representation. Preparation and running of computer programs using CUPL, the Cornell University Programming Language; elementary statistical analyses, and techniques of sampling and simulation in statistics and biology.

408 Probability and Statistics I. Fall term. Credit three hours. Prerequisite: Mathematics 112 or consent of instructor. M W F 10:10. Warren 345. Assistant Professor Solomon.

Elementary probability, random variables, and probability distributions are considered; biological and statistical applications serve to motivate the presentation.

409 Probability and Statistics II. Spring term. Credit three hours. Prerequisite: course 408. Lectures, M W F 10:10. Warren 345. Assistant Professor Solomon.

The concepts developed in 408 are applied to provide an introduction to the theory of statistical inference; biological applications again serve to motivate the presentation.

[411 Stochastic Models in Biology. Spring term. Credit three hours. Given in alternate years. Prerequisite: 409. Lectures: M W F 10:10. Discussion period to be arranged. Professor to be appointed. Not given in 1971-72.

An introduction to stochastic processes in biology. The necessary mathematics and statistics will be introduced as needed. Recurrent events, random walk models, Markovian processes, birth-and-death processes, epidemic processes, competition and predation, diffusion processes, and other models currently used in biological theory will be discussed and applied. Special emphasis will be given the various processes applied to genetics.]

[412 Deterministic Models in Biology. Spring term. Credit three hours. Given in alternate years. Prerequisite: 409. Lectures: M W F

10:10. Discussion period to be arranged. Professor to be appointed. Not given in 1971-72.

An introduction to deterministic mathematical models in biology. The application will be from the biological viewpoint. The necessary mathematics will be introduced as needed. Finite differences, differential equations, logistic, growth and decay, and other deterministic models corresponding to those introduced in 411 will be discussed.]

417 Matrix Algebra. Fall term. Credit three hours. Prerequisite: the equivalent of one year of college algebra. M W F 9:05. Warren 201. Professor Searle.

Basic matrix algebra with applications in biology, business, economics, and statistics. Arithmetic procedures and other matrix operations; determinants, rank and linear independence, latent roots and vectors, solving linear equations, generalized inverses, direct sums and products. Use of matrices in regression analysis and linear statistical models.

510 Statistical Methods I. Fall term. Credit four hours. Prerequisite: graduate status or permission of instructor. M W F 9:05. Stocking 204. Laboratory to be arranged. Examinations will be held at 7:30 p.m. on Wednesday evenings. Professor to be appointed.

The distributions of statistics encountered in biological and other fields are considered from the point of view of elementary probability notions and by sampling from known populations. The results, with principles of experimentation, are applied to the conduct of experiments and interpretation of results. Topics include point and interval estimation, tests of hypotheses and of significance, the treatment of discrete data, methods involving rank sum procedures, the consideration of normal populations, the one-way analysis of variance and simple linear regression. Emphasis is placed on basic statistical principles, criteria for selection of statistical techniques and the application of these techniques to a wide variety of biological situations.

511 Statistical Methods II. Spring term. Credit four hours. Prerequisite: 510 or the equivalent. M W F 9:05. Plant Science 233. Laboratory to be arranged. Examinations will be held at 7:30 p. m. on Wednesday evenings. Professor to be appointed.

The work of 510 is continued. Topics include multiple and curvilinear regression, complex analysis of variance and covariance. The analysis of variance discussion considers treatment designs, single degree of freedom contrasts, the simpler experimental designs, sampling errors, fixed, mixed and random models, and the effect of disproportionate numbers. When appropriate, the computer is considered as the reasonable way to have calculations done.

[513 Design of Experiments I. Fall term. Credit four hours. Prerequisites: 417 and 511, or the equivalent. M W F 8. Warren 232. Discussion period to be arranged. Professor Federer. Given in alternate years. Not given in 1971-72.

Principles and techniques of experimentation, theoretical concepts, extensions and variations of the completely randomized, randomized complete block, and latin square designs, the factorial experiment and confounding, fractional replication including response surface designs, lattice designs, crossover designs, augmented and other designs, covariance analyses, error rates, tests and interval estimation for ranked means, sample size, variance component analyses, unequal number analyses, the place of orthogonality in design, and advanced statistical methodology under various fixed, mixed, and random models.]

[514 Design of Experiments II. Spring term. Credit four hours. Prerequisite: 513. M W F 8. Warren 232. Discussion period to be arranged. Professor Federer. Not given in 1971-72.

A continuation of the work in 513 with emphasis on the role of confounding in experimental and treatment designs. Generalized forms of analyses and construction are presented followed by a discussion from selected topics on long-term experiments, combination of results from several experiments, sequential experimentation, variance component analyses, estimation procedures, linear hypotheses, heritability studies, multivariate analyses, unequal numbers analyses, and related topics.]

517 Linear Models. Spring term. Credit three hours. S-U grades only. Prerequisite: 417, 511, and Mathematics 370 or 371. T Th 12:20. Warren 201. Professor Searle. Given in alternate years. Not given 1972-73.

Introduction to multinormal variables and distribution of quadratic forms; linear statistical models, estimable functions, and testable hypotheses; regression models, experimental design models, variance components models, and combinations thereof.

518 Selected Topics in Biometry. Spring term. Credit three hours. Prerequisite: 511 or the equivalent. Time and place to be arranged. Professor Robson.

Topics will be selected from a list including the principles and methodology of bioassay, discriminant functions, sequential analysis, nonparametric methods, mark-recapture methods, and statistical genetics.

520 Design of Experiment III. Fall term. Credit three hours. Prerequisite: 417 and Mathematics 431-432 or the equivalent. M W

122 Vegetable Crops

F 8. Warren 245. Professors Federer and Raktoe, and Assistant Professor Hedayat.

A mathematical development of the properties, construction, and analysis of experiment and treatment designs. Proofs to be given for known results and problems to be formulated in mathematical terms.

499 Special Problems in Statistics and Biometry. Fall, spring, or summer. Credit one or more hours by arrangement with instructor. Prerequisite: permission to register. Biometrics Unit staff.

Vegetable Crops

Students planning to specialize to a greater or lesser extent in vegetable crops should consult the department regarding choice and sequence of courses. An outline of suggestions is available.

103 General Horticulture. Spring term. Credit four hours. Lectures, M W F 8. E. Caldwell 100. Laboratory, M W or Th 2-4:25. Guterman 110. Professor Sheldrake.

An introductory course in general horticulture, including flower, fruit, and vegetable growing. Intended primarily for students who want a general knowledge of the subject, and for those who wish to specialize in some field of horticulture but have limited background either in practical experience or in training in botany and agronomy.

210 Vegetable Types and Identification. Fall term. Credit two hours. T 2-4:25. Guterman 110. Associate Professor Topoleski.

Designed to acquaint the student with the vegetable species grown in the Northeast and the pests and disorders encountered in their production. Subjects covered include identification of economically destructive weeds, diseases and insects of vegetables; identification of vegetables and weed seeds, seedlings, nutrient deficiencies and vegetable judging, grading and grade defects.

211 Commercial Vegetable Crops. Fall term. Credit four hours. Should be preceded by elementary courses in agronomy, botany, and chemistry. Prerequisite: 103 or its equivalent. Lectures: M W F 11:15. E. Roberts 222. Laboratory, W 2-4:25. Guterman 110. Professor Oyer.

Intended for those interested in the commercial vegetable industry from the viewpoint of production, processing, marketing, or the related service industries. Topics included are techniques, problems and trends in the culture, harvesting, storage, and marketing of the major vegetable crops including potatoes. Several field trips are taken during the laboratory period and one or two week-end field trips are taken early in the fall.

312 Post Harvest Handling, and Marketing Vegetables. Fall term. Credit three hours. Lectures, T Th 9:05. Plant Science 141. Laboratory Th 2-4:25. Guterman 110. Professor Isenberg.

Practices and procedures used in marketing and shipping vegetables. Topics covered include legal structure of the market system, grade standards and methods of grading, the physical and legal aspects of packages, harvesting methods, hydrocooling, vacuum cooling and refrigeration principals, storage techniques and market preparation, use of sprout inhibitors and other chemicals, and objective methods used in quality control. Several field trips will be taken in early fall.

331 Undergraduate Research. Fall and spring terms. Credit one or more hours a term, by arrangement. Undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade. Any member of the staff.

Special problems may be elected in any line of vegetable work.

401 Vegetable Crop Physiology. Fall term. Credit five hours. Prerequisite: 211 and Biological Sciences 240 or their equivalent. Lecture, M W F 11:15. Plant Science 143. Laboratory, M 2-4:25. Discussion period to be arranged. T and F afternoons. Professor Kelly.

The physiological bases of cultural practice and the application of these principles to problems in vegetable production. Original literature is used to illustrate the principles involved. Experimental material is studied in the laboratory to amplify lecture topics. Subjects discussed include mineral nutrition as influenced by fertilization programs and crop sequence; nutrient interactions and induced deficiencies; growth and development; flowering; fruit setting; growth correlation; senescence; sex expression; photoperiodism; vernalization; and environmental factors affecting growth.

[413 Kinds and Varieties of Vegetables. Fall term. Credit three hours. Given in alternate years. Prerequisite: 103 and 211 or permission to register. Laboratories, Th F 2-4:25. Fieldhouse, Maple Av. Professor Minges and staff. Not given in 1971-72.

Designed to help students achieve proficiency in the evaluation of vegetable varieties through study of their origin, characteristics, adaptation, and usage. An important part of the course is the study of crops in the field. The vegetable seed industry is also discussed.]

429 Special Topics in Plant Science Extension. Spring term. Credit one hour. (Addition credit by special arrangement.) Given in alternate years. Lecture, F 8. Plant Science 141. Discussion period, F 2-4. Plant Science 37. Professor Minges.

Designed for graduate students and advanced undergraduate in the several plant science fields who wish to acquire a knowledge of extension activities in preparation for careers in extension and associated work, such as research and technical work in both public and commercial organizations. Topics are related to extension in other countries as well as in the United States. Staff members from other plant science departments collaborate in teaching the course.

[501 Research Methods in Applied Plant Science. Spring term. Credit three hours. Given in alternate years. Prerequisite: permission of the instructor. Combined lectures and discussions T Th 9:05. Plant Science 404. Professor Kelly. Not given in 1971-72.

The planning of research programs as influenced by various economic, administrative, political, and geographic environments. The advantages and limitations of conventional experimental designs as they apply to specific research problems. Discussions include a critical interpretation of experimental results from the literature. Many topics are directly

applicable to the student's thesis research program.]

601 Seminar. Fall and spring terms. Required of graduate students taking either a major or minor in this department. Undergraduates are welcome. Th 4:30. Plant Science 404. Members of Department staff.

610 Special Topics in Vegetable Crops. Fall and spring terms. Credit to be arranged. Prerequisite: permission to register. Time to be arranged. East Roberts 222. Associate Professor Ozbun.

512 Principles of Grade and Quality Estimation and Measurement. Fall term. Credit one hour. Lecture and demonstrations. Time and place to be arranged. Professor Hartman.

Study of grade and quality estimation and measurement of vegetables and vegetable products from the standpoint of the reactions of everyone involved in the handling and marketing channels and in consumption. For graduate students, especially in horticulture and food science. Studies of the data on the reactions of dealers, regulatory officials, and consumers to vegetables and vegetable products and the correlation of such data with the results of instrumental methods of measuring quality.

Financial Aid

Scholarships

Scholarships awarded by the College of Agriculture and available only to students in the College of Agriculture are listed on the following pages. *Applications for these scholarships should be made on the Cornell University Financial Aid Form.* This form must be supplemented by the parents' confidential financial statement. Entering students must apply before January 15, and students in residence are expected to pick up application forms at the Office of Scholarships and Financial Aid, 105 Day Hall, before spring vacation and to see that these are filed before April 15.

Financial aid in the form of University scholarships, jobs, and loans is also awarded from other funds on a competitive basis to students entering or enrolled in any undergraduate division of the University. Brochures describing this aid are available from the Office of Scholarships and Financial Aid.

Recipients of Scholar Incentive Awards, Regents College Scholarships, Regents Scholarships for Children of Deceased or Disabled Veterans, and Special State Scholarships for Children of Disabled or Deceased Soldiers, Sailors, or Marines, who enroll at the New York State College of Agriculture, may apply the amount of money they receive toward their college expenses.

GEORGE O. ADAMS SCHOLARSHIP. An annual scholarship is provided by the Western New York Nurserymen's Association Foundation in memory of George O. Adams, a prominent member of the Association.

Students in any class who are specializing in the Department of Floriculture and Ornamental Horticulture and who are recommended by that Department are eligible. The selection from among those eligible is based on character, scholastic record, and financial need.

ROBERT M. ADAMS 4-H MEMORIAL SCHOLARSHIP. The Robert M. Adams 4-H Memorial Scholarship was established in memory of Professor R. M. Adams by the 4-H Clubs of the state. The endowment yields approximately \$50 a year. Students who are New York State residents are eligible to apply after their first year in the College, and those who have been 4-H Club members are given first consideration. The award is based on financial need, character, ability, and scholarship.

COLLEGE OF AGRICULTURE FUND SCHOLARSHIPS. The income from an endowment fund established through the efforts of the Alumni Association of the New York State College of Agriculture provides scholarships for students in the College. Preference will be given to students transferring from two-year colleges in New York State. Selection is based on character, academic achievements, and financial need.

AMERICAN AGRICULTURIST FOUNDATION SCHOLARSHIP. Six scholarships of \$200 each are provided each year by the American Agriculturist Foundation, Inc. Students entering or in any class in the College of Agri-

culture are eligible. The selection will be based on character, scholastic record, and financial need with preference given to students transferring from two-year colleges.

BABCOCK POULTRY AND BUSINESS SCHOLARSHIP. Babcock Poultry Farms Inc. provides one annual scholarship of \$500 to a student majoring in poultry science (or with a poultry background), with plans for further study in business management. Preference will be given to entering freshmen. If the recipient of the award later decides to double register in his senior year in the Graduate School of Business and Public Administration he will then receive an additional \$500.

BEATTY AGRICULTURAL SCHOLARSHIP. The Beatty Agricultural Scholarship fund, a gift of the late Harrison L. Beatty, provides a scholarship of approximately \$300 to a student entering the College of Agriculture from the Town of Bainbridge or from Chenango County. Grades in Regents Examinations receive major consideration in making the award.

HENRY H. BUCKLEY STUDENT AID FUND. A fund is provided by the Henry H. Buckley Foundation in memory of Mr. Buckley, a well-known farmer of Oneonta, New York, who died in 1942. The purpose is to aid worthy students, of any class, who need financial assistance. In making awards, preference will be given to applicants from Chenango, Delaware, Herkimer, Madison, Montgomery, Oneida, Otsego, and Schoharie counties.

WALTER R. CLARKE MEMORIAL ENDOWMENT. The Walter R. Clarke Memorial Endowment in memory of Mr. Clarke, a prominent fruit farmer who lived at Milton, New York, provides a scholarship of \$150 each year for a student, of any class, in the College of Agriculture, who is primarily interested in fruit growing. Promise of successful work in this field is the basis for an award. Preference is given to students from the Hudson Valley area.

CORNELL-ARGENTINE EXCHANGE SCHOLARSHIP. A male freshman is chosen each May to spend a year at the University of Buenos Aires. Most expenses, other than transportation, are paid by the sponsors in Argentina. In exchange, a student enrolled with the Faculty of Agronomy and Veterinary of the University of Buenos Aires is chosen to come to Cornell to study for one year in the College of Agriculture. His expenses here are paid by the Office of Foreign Students, the College, and students.

Information is available at the Office of Resident Instruction. To be eligible, a freshman must have an average of C+ or above and must file an application by the end of the first week in April. The selection is made by a student-faculty committee.

CORNELL-MEXICAN EXCHANGE SCHOLARSHIP. This exchange with the Instituto Tecnológico y de Estudios Superiores de Monterrey provides an opportunity for a male junior to spend a year studying at an outstanding technical university in Mexico. The out-of-pocket cost to the Cornell student

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is estimated at \$1,000 for transportation, books, and personal expenses. The balance is covered by scholarships from the College of Agriculture and Monterrey Tech, and by a contribution from the Mexican student coming to Cornell.

In exchange a Mexican student chosen by the Monterrey Tech comes to Cornell to study for one year in the College of Agriculture. A comparable part of his expenses are paid by the College and by students.

Information is available at the Office of Resident Instruction. To be eligible, a freshman must have an average of C+ or above and must file an application by the end of the first week in April. The selection is made by a student-faculty committee.

CORNELL POMOLOGY CLUB SCHOLARSHIP OR GRANT-IN-AID. The Pomology Club provides a scholarship or grant-in-aid of \$400 each year, to be awarded to a sophomore, junior, or senior student who is specializing in pomology or has major interest in that field. Scholarship and financial need receive equal consideration in making awards, and qualified students are eligible for awards in succeeding years.

CORNELL-SWEDISH EXCHANGE SCHOLARSHIP. A sophomore is chosen each year to spend his third college year at the Agricultural College of Sweden, Ultuna, Sweden. All expenses except transportation are paid by the Swedish students. In exchange a student from the Agricultural College of Sweden is chosen to come to Cornell, and the students of the College of Agriculture pay the expenses.

Information and application blanks are available at the Office of Resident Instruction. To be eligible, a sophomore must have an average of C+ or above, and must file an application by the end of the first week in January. The selection is made by a student-faculty committee early in February.

J. CARLTON CORWITH MEMORIAL SCHOLARSHIPS. The endowment fund which supports these scholarships was provided as a memorial to Mr. and Mrs. Corwith by their family, by friends and business colleagues, and by organizations which they had served. The awards are made to men and women of any class who have demonstrated an interest in careers related to the broad field of agriculture.

Selection is based on character, scholastic achievement, potential for leadership in agriculture and financial need.

DAIRYLEA COOPERATIVE SCHOLARSHIP. The Dairymen's League Co-operative Association, Inc., provides a \$500 scholarship each year for a student who has completed two years in the College with a demonstrated interest in dairy technology or dairy marketing. In addition, students who have completed three years and who are preregistered for student teaching courses in preparation for teaching agriculture in high school are also considered. The final selection is based on character, scholastic record, and financial need, with preference being given to the student who is most likely to make a contribution to agricultural education, dairy marketing, or dairy technology.

WILLIAM FREDERICK DREER FUND. A fund from the estate of William Frederick Dreer has been established to provide a worthy student, specializing in floriculture or ornamental horticulture, an opportunity for study and directed practice in foreign countries for approximately one year. The award is approximately \$2,500 and is available to either an undergraduate or graduate student within the period of his college course or upon its conclusion. Scholarship, character, maturity, seriousness of purpose, and promise of ability to make contributions to his field are considered in making awards. Applications should be on file at the Office of the Department of Floriculture and Ornamental Horticulture by December 1 preceding the June in which travel will start.

LEONARD A. DUDLEY SCHOLARSHIP ENDOWMENT. The Leonard A. Dudley Scholarship Endowment was established by gifts from Leonard A. Dudley of Binghamton, New York. The income from the fund provides scholarships for members of any class in the College of Agriculture. Awards are made to deserving men or women with demonstrated financial need who are specializing in agricultural engineering, agricultural business, or agricultural science.

In selecting recipients, the Scholarship Committee gives first preference to students from Broome County and second preference to students from Tioga, Cortland, Chenango, and Delaware Counties.

EASTERN MILK PRODUCERS COOPERATIVE SCHOLARSHIPS. Three annual scholarships of \$250 each are provided by the Eastern Milk Producers Cooperative Association, Inc. Their purpose is to assist worthy students of any class in the College of Agriculture, with preference to be given to sons or daughters of members of Eastern Milk Producers Cooperative Association. In order to qualify, students must rank in the upper two-fifths of their high school graduating class or of their class in college. They must also establish a need for financial assistance and show evidence of outstanding character and leadership ability.

FEDERATED GARDEN CLUBS OF NEW YORK STATE SCHOLARSHIPS. Two annual scholarships of \$250 are provided by the Federated Garden Clubs of New York State, Inc. They may be awarded to worthy four-year students in any class who are residents of New York State, who intend to specialize in floriculture and ornamental horticulture, and who are of good moral character. Both need and scholastic promise are considered in selecting the recipients.

GENERAL FOODS FUND SCHOLARSHIPS. The General Foods Fund, Inc., has provided four scholarships for freshmen. The scholarships are for one year and are valued at \$400 each. In making the selection, two scholarships will be given to students specializing in food science, and two to students specializing in agricultural engineering, biochemistry, biological science, or microbiology.

GERBER SCHOLARSHIP IN HORTICULTURE. The Gerber Baby Foods Fund, Fremont, Michigan has established an annual scholarship of \$500. The

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scholarship will be awarded to a resident of New York State who will be enrolled as an upperclassman in the College of Agriculture. The selection will be based on character, promise for leadership in horticulture and with equal consideration given to scholarship and financial need. In making the selection, preference will be given to students specializing in agronomy, entomology, plant pathology, pomology, and vegetable crops. The application should substantiate the applicant's interest in horticulture.

HEATLEY GREEN SCHOLARSHIP. The Heatley Green Scholarship Endowment was established under the will of Mrs. Green in memory of her husband, who had been a New York State farm boy and was a graduate of the College of Engineering at Cornell in the class of 1901. Mr. Green believed strongly in proper training for successful farming, and this scholarship is used to help and encourage worthy undergraduate students of moderate means. Awards are on an annual basis and may be made to one student or divided between two or more students of any class in the College of Agriculture.

HERVEY S. HALL SCHOLARSHIP. The Hervey S. Hall Scholarship, established by bequest of Miss Mary F. Hall of Spencer, New York, and having an annual value of \$150, is awarded to a properly qualified student of either sex, a resident of New York State pursuing a course in agriculture leading to the degree of Bachelor of Science, and in need of financial aid. It is "to be granted first to a student from the town of Spencer, New York, should a suitable candidate appear, or a student from Tioga County, or from the State at large."

ANNIE M. HATCH INDIAN SCHOLARSHIP ENDOWMENT. The income from this endowment, established by a gift from Annie M. Hatch, supports scholarships and grants-in-aid to needy students enrolled in any class in the College of Agriculture. Preference will always be given to applications from New York State Indians.

H. J. HEINZ SCHOLARSHIPS. The H. J. Heinz Company has provided two scholarships for students participating in the Food Industry Management Program. One is for \$1,100 and the other for \$800. An additional \$600 has been provided to expand the Program. The awards are made on the basis of scholastic achievement or promise, character, financial need, and the student's desire to pursue a career in the food industry. They are not available to students on leave of absence from food companies.

FREDERICK F. HORTON SCHOLARSHIP. This endowment in honor of Frederick F. Horton who was Experimentalist in the Department of Floriculture and Ornamental Horticulture for forty-one years was established by his friends and by former graduate students in the Department. The income supports an annual award for undergraduate students specializing in floriculture. Selection of the recipient will be based on academic ability, character, need for financial assistance, and promise for future leadership in floriculture.

ALFRED C. HOTTES AMATEUR GARDENING SCHOLARSHIP. The Alfred C. Hottes Amateur Gardening Scholarship Fund, a gift of the late Alfred C. Hottes, provides one or two scholarships of \$300. Eligible candidates are undergraduate students in the College of Agriculture who, by reason of their academic records, character, and activities, show promise of advancing through their study and work the subject of floriculture and ornamental horticulture as an amateur activity. In the application each applicant should point out how he might be expected to do this.

BURTON A. JENNINGS MEMORIAL ENDOWMENT FUND. The Burton A. Jennings Memorial Endowment Fund was established in memory of Professor Emeritus Burton A. Jennings, a faculty member of the Department of Agricultural Engineering from 1922 until his retirement in 1958. Income from the fund is to provide a scholarship or grant-in-aid for a deserving student. First preference is given to a student specializing in agricultural engineering who has completed the sophomore year.

JEWEL FOUNDATION SCHOLARSHIPS. The Jewel Foundation has established two \$500 scholarships. One scholarship will be awarded to a senior specializing in food industry management who has a career objective in the food industry. The second scholarship will be awarded at the end of the senior year to a student specializing in food industry management with a career objective in the food industry, and who is pursuing the combined course in the Graduate School of Business and Public Administration.

DAVID KENNEDY JOHNSTON ENDOWMENT FUND. This fund, established by a bequest under the will of Nettie J. Huey, provides scholarships and grants-in-aid for worthy students entering the College, or already enrolled, and specializing in animal science. Preference is given to residents of Venango County, Pennsylvania.

CARL E. LADD MEMORIAL SCHOLARSHIPS. A fund in memory of Carl E. Ladd, Dean of the College from 1932 until his death in 1943, provides a number of scholarships which are open to young men and women from New York farms who are members of any class in the College of Agriculture. The awards are made on the basis of character, financial need, promise for future leadership, and school record.

GEORGE LAMONT EDUCATIONAL FUND. The George LaMont Educational Fund was established by gifts from the late George B. LaMont and his son T. E. LaMont, owners of the LaMont Fruit Farm in Albion, Orleans County, New York. The income from the fund provides one or two scholarships of \$300 each, for Orleans County farm boys of good moral character, who have a record in school and out that shows ability and application, and who are in need of financial assistance. Awards are for one year and usually are made only to young men entering college.

MARION A. AND A. PERCY LEON FOUNDATION SCHOLARSHIP. The Foundation supports two scholarships of \$500 each through annual grants. Undergraduate students of good character and with commendable academic

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achievement who are in need of financial assistance are eligible for these awards.

LOBLAW SCHOLARSHIPS. Loblaw Incorporated provides two scholarships of \$500 to be granted to freshmen students in the Food Industry Management Program each year. The scholarships may be retained during four years of undergraduate study provided that the students' academic records are satisfactory.

The awards are based on financial need, character, and scholastic record. Preference will be given to employees and children of employees of Loblaw Incorporated. Applicants must identify this relationship on the financial aid section of the application for admission and verification from the personnel department of Loblaw Incorporated must be attached.

HUDSON H. LYON MEMORIAL SCHOLARSHIP. The endowment for this scholarship fund was established by the late H. H. Lyon of Bainbridge, New York. The income, amounting to about \$1,600 a year, is to be used to aid students who are preparing for Protestant Christian missionary service, with preference to those who include agriculture in their training.

ROBERT N. MARSHALL MEMORIAL POULTRY SCHOLARSHIP. This fund, given by friends of Robert N. Marshall, a prominent poultryman, provides an annual scholarship or grant-in-aid to help a deserving student. In making the selection, first preference is given to an entering freshman who intends to specialize in poultry science. Otherwise, it is to go to an upperclassman in the Department of Poultry Science.

FRANK W. MASON AGRICULTURAL SCHOLARSHIP. The Frank W. Mason Agricultural Scholarship was established by gifts from Frank W. Mason, a prominent fruit farmer of Albion, Orleans County, New York. The income provides an annual scholarship of \$200 for a young man or woman from Orleans County, with preference given to graduates of the Albion Central School and those who are interested in fruit growing or marketing. In making awards, consideration is given to need for financial assistance, academic ability, moral character, and promise for future leadership in the broad relationships of agriculture.

OSCAR MAYER SCHOLARSHIPS. The Oscar Mayer Foundation Inc. has established two \$1,000 scholarships for students specializing in Food Industry Management. The scholarships are to be awarded on the basis of character, scholarship and a career interest in the food industry.

W. S. MIDDAGH-ALPHA ZETA MEMORIAL SCHOLARSHIP. In order to recognize those students dedicated to making a real contribution to agricultural business or international agriculture, the W. S. Middaugh-Alpha Zeta Memorial Scholarship of \$500 is granted in memory of Wessels S. Middaugh, '26, who dedicated his life to service through a career in international agriculture.

The award is made to a student who ranks in the upper two-fifths of his class, is of good character, and who has demonstrated leadership ability.

Financial need is not considered. Preference is given to members of Alpha Zeta, the national professional agricultural honorary fraternity. Ordinarily, the award is made at the end of the junior year.

FRANK B. MORRISON MEMORIAL SCHOLARSHIPS. An endowment fund, established by Mrs. Frank B. Morrison in memory of her husband, a former head of the Department of Animal Science, provides two annual awards of \$300 each. They are made to juniors or seniors of outstanding ability whose major interests are in animal science. A committee from the faculty of the Department of Animal Science considers both academic achievement and personal qualities of leadership and character in recommending awards.

H. B. MUNGER MEMORIAL ENDOWMENT. This memorial to H. B. Munger was initiated by the Farm Credit Banks of Springfield with which he was affiliated from 1934 to 1952. Contributions to the fund came from organizations, friends, and colleagues. The income supports one or more scholarships for students specializing in some field of agriculture or agri-business. In selecting recipients, scholastic achievement, character, leadership potential and financial need will be considered.

NEW YORK FARMERS SCHOLARSHIPS. This fund is provided by the New York Farmers for the purpose of assisting young men with good ability, who need financial aid, to continue their agricultural education. Preference in making awards will be given to farm boys, those who wish to farm, and those who expect to serve farmers directly.

NEW YORK LIME ASSOCIATION SCHOLARSHIPS. The New York Lime Association provides \$2,200 each year for scholarships to be awarded to members of the three upper classes. In selecting students for awards, major interest in agronomy, scholastic achievement especially in the sciences, potential ability for leadership, and need for financial assistance are considered, with preference being given to residents of New York State. The awards are normally given for one year but may be renewed if the student qualifies in competition with other members of his class.

NFBA FOUNDATION, INC., SCHOLARSHIP. The National Food Brokers Association Foundation, Inc., has made available this scholarship. It is provided for students participating in the Food Industry Management Program. The value of the scholarship is \$750. The award is made on the basis of scholastic achievement, financial need, character, and the student's desire to pursue a career in the food industry.

ALFRED M. S. PRIDHAM SCHOLARSHIP. The New York State Nurserymen's Association provides an annual award of \$500 to encourage outstanding undergraduate students of good character with limited financial means. Preference is given to those who are specializing in ornamental horticulture (growing, wholesaling, retailing, or educational fields) and/or landscape design. A student in any class may receive the award on the recommendation of the Department of Floriculture and Ornamental Horticulture.

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RALSTON PURINA AIDS TO EDUCATION. The Ralston Purina Company has provided the following two scholarships: *Ralston Purina Scholarship:* The Company offers an annual scholarship of \$500 to an outstanding undergraduate student in agriculture. The award is made each year to a student who will be entering his senior year or, under unusual circumstances, his junior year. The recipient must rank in the upper 25 percent of his class scholastically. Evidence of leadership ability, moral character, participation in extracurricular affairs, sincerity of purpose, and financial need are taken into account in making an award. Applications must be filed by June 1. *Danforth Leadership Training Scholarship for Agricultural Freshmen:* An outstanding freshman is selected to represent the College at Camp Miniwanca, Stony Lake, Michigan. He joins freshmen from other U.S. Land-Grant Colleges and from three Canadian agricultural colleges for two weeks of leadership training in August. Full tuition is paid by the Ralston Purina Company. The selection is made in May from those freshmen with outstanding records in the fall semester.

ROBERTS SCHOLARSHIPS. The Roberts Scholarship Fund, a gift of the late Dr. Charles H. Roberts, of Oakes, Ulster County, New York, provides five scholarships, each retainable for one year, but not open to entering students. As expressed by the founder, the purpose of these scholarships is to furnish financial assistance to students in the College of Agriculture who are of good moral character, who show native ability, tact, and application, and who are in need of such assistance, especially students coming from rural districts. The awards are made after the close of each year. The present value of each scholarship is \$300.

ROHM AND HAAS COMPANY SCHOLARSHIP. The Rohm and Haas Company has established scholarships in the College of Agriculture to encourage outstanding undergraduate students specializing in the biological sciences. To be eligible in their junior or senior year, students should be in the upper fifth of their classes. Financial need is a secondary consideration. Ordinarily there will be two awards each year with a value of \$500.

AARON H. RUBENFELD MEMORIAL SCHOLARSHIP. The Aaron H. Rubenfeld Memorial Scholarship was established by the Middletown Milk & Cream and Dellwood Dairy Divisions of Deltown Foods, Inc., of Yonkers, New York, in memory of their late president and founder, who believed in actively encouraging progress in the dairy industry. Candidates for this \$500 award must have completed their sophomore year in the College, must show evidence of need for the financial assistance, must have demonstrated interest in the dairy industry, and must possess characteristics that indicate potential ability to contribute to improvement in the production, marketing, and manufacture of milk and milk products. With other qualifications equal, preference will be given to children of employees of either of these two companies and of producers shipping their milk to Middletown Milk & Cream Division or its affiliates. Payment of \$125 is made to the recipient at the beginning of each semester in the junior and senior year.

C. W. SADD MEMORIAL SCHOLARSHIP. The endowment fund which supports this scholarship was provided as a memorial to Mr. C. W. Sadd by his family, by friends and business colleagues, and by organizations which he had served. The award is made to men and women of any class who have demonstrated an interest in careers related to food distribution, marketing, and business management.

Selection is based on character, scholastic achievement, and potential for leadership in business.

SENECA-WAYNE EASTERN A. I. COOPERATIVE SCHOLARSHIP. An endowment fund established by the Seneca-Wayne Eastern A. I. Cooperative provides one annual scholarship to a deserving student from Seneca or Wayne County. Preference will be given to sons or daughters of members of this Cooperative. Students must indicate this information on their scholarship application. Further preference will be given to students with an interest in the broad field of dairying, including, but not restricted to, dairy farming or any of the related industries. Selection will be based on character, financial need, scholarship, and potential for leadership in the dairy industry.

LELAND SPENCER DAIRY MARKETING RESEARCH FUND SCHOLARSHIP. The Dairy Marketing Research Fund has established this scholarship in recognition of Professor Emeritus Leland Spencer and his contributions in the dairy marketing field. The scholarship is available to an undergraduate student in the New York State College of Agriculture who has demonstrated his potential for making a contribution in the field of dairy marketing. In selecting recipients, the Scholarship Committee will give special consideration to those who have completed the work of the junior year; have achieved a rank in the upper third of their class; have taken courses in dairy marketing, dairy industry, dairy husbandry, and farm management; or have otherwise demonstrated a special interest in the area of dairy marketing.

WARD W. STEVENS HOLSTEIN SCHOLARSHIP. A fund in honor of Ward W. Stevens provides a scholarship to a male undergraduate student in the College of Agriculture, who has completed at least one-half of his course. The value of the scholarship is \$750. It may be awarded to one student or divided between two students. A student who has held the scholarship is eligible to reapply. The award is based on character, exceptional ability in the judging and handling of dairy cattle, high scholastic rank in dairy husbandry courses, need of financial assistance, and special interest in the Holstein breed of cattle.

TURNSTYLE RETAILING FELLOWSHIP. The Turnstyle Corporation, a Jewel Company, has established a \$500 fellowship. The fellowship will be awarded to a senior specializing in food industry management with a career objective and potential for management in retailing.

The award is made on the basis of character, scholarship, financial need and promise for future management ability.

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ULLMAN SCHOLARSHIP FUND. The residue of a trust fund established by S. Edward Ullman supports a scholarship or scholarships for students pursuing as a specialty the study of forestry. The recipients are chosen each year on the recommendation of the professors (not assistant professors) of forestry in the Department of Conservation.

MAY WALKER AGRICULTURAL SCHOLARSHIP FUND. The May Walker Agricultural Scholarship Fund was established under the will of May Walker in gratitude for the assistance given her by the University in 1919 and 1920. An annual award will be made by the Scholarship Committee for the benefit of a student from the United Kingdom or the British Commonwealth who is attending the College of Agriculture. The applicant must clarify his place of residence on the application form.

WOMAN'S NATIONAL FARM AND GARDEN ASSOCIATION SCHOLARSHIPS. The New York State division of this Association has provided the following two scholarships: *A Scholarship in Honor of Its First President, Mrs. Francis King:* The value of the scholarship is \$250. The award is made biennially to a woman of the sophomore class in the College of Agriculture, who is then given preference for the award in her junior year. Character, interest in agriculture, scholarship, and financial need are considered. *A Scholarship in Memory of Its Former Honorary President, Mrs. Walter Douglas:* Junior or senior women in the College of Agriculture who have achieved high standing are eligible to apply for the award of \$200. Character and financial need are considered, with preference given to girls who have been active in a 4-H Club.

SCHOLARSHIPS FOR NONRESIDENTS. Twenty tuition scholarships are available for nonresidents of the State. They are awarded annually, and evidence of need is required.

OTHER SCHOLARSHIPS. Information about other scholarships open under certain conditions to undergraduates in the College of Agriculture may be obtained in the Office of Scholarships and Financial Aid, Day Hall.

Awards

ALPHA ZETA SCHOLARSHIP KEY. The Alpha Zeta Fraternity presents a scholarship key to the student who made the highest scholastic average in the first year of the four-year course. The name of the recipient is also inscribed on a plaque in the Office of Resident Instruction. The key is presented at the annual barbecue in the fall.

ALUMNI PRIZES. The Alumni Association of the College of Agriculture provides two annual prizes of \$50. These are awarded by the faculty, one to the junior who had the highest cumulative average at the end of the sophomore year, and one to the senior who had the highest cumulative average at the end of the junior year.

BURPEE AWARD IN HORTICULTURE. An annual award of \$100 is made possible through a grant from the W. Atlee Burpee Company, Seed Growers, Philadelphia, Pennsylvania, and Clinton, Iowa. The purpose is to encourage outstanding students in the study of vegetable growing and flower growing. The award is made at the beginning of the senior year and is divided equally between two students, one in the field of floriculture and ornamental horticulture and the other in vegetable crop production. To be eligible, the student shall have completed Biological Sciences 240 or its equivalent, and at least two courses in the department concerned, and shall have signified intention of specializing in that department.

EASTMAN-RICE PRIZES FOR PUBLIC SPEAKING. The Eastman-Rice prizes for public speaking of \$100, \$50, and \$25 are awarded by a committee of judges to any regular or special student in the College of Agriculture for public speaking on topics of their choice. Elimination contests are held beginning approximately December 1, with the final contest taking place during the spring semester. Contestants sign up before December 1 in the Communication Arts Office, 510 Mann Hall, where additional information may be obtained.

PAUL R. GULDIN MEMORIAL ENDOWMENT. The Paul R. Guldin Memorial Endowment, established by Mrs. Paul R. Guldin as a memorial to her husband, a graduate of the College in 1912, is to encourage undergraduate students in the Colleges of Agriculture and Human Ecology to become interested, and to take part, in the development of a more adequate rural leadership. The income supports a contest for the best original articles or stories, written by undergraduates in these Colleges and published in the *Cornell Countryman*, that contribute to the purpose of the endowment. The awards will be made twice a year, the first award being based on the articles in the October, November, December, and January issues and the second awards on the February, March, April, and May issues. In each instance the awards will be \$75 for first place, \$50 for second place, \$25 for third place, and \$10 for honorable mention. The selection will be made by a committee from the faculty appointed by the Dean.

FRANK B. MORRISON MEMORIAL PRIZES. The Frank B. Morrison Memorial Prizes, totaling \$100 annually, are given to students winning top awards in the Students' Fitting and Showmanship Contest.

NEW YORK FLORISTS' CLUB AWARDS IN FLORICULTURE. Three annual awards of \$200, \$150, and \$100, respectively, are made possible through a grant from the New York Florists' Club, New York, New York.

The purpose of the award for \$200 is to encourage outstanding students in commercial floriculture (growing, wholesaling, retailing, or educational fields). To be eligible the student shall have a specialization in commercial floriculture and shall have completed the junior year. The award shall be based on the combined average of all courses taken in the University, as well as interest in, and potential for, continuation in the field of commercial

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floriculture. The award will be made at the beginning of the senior year by the Faculty Committee on Scholarships on recommendations of the Department of Floriculture and Ornamental Horticulture.

The second award of \$150 is to recognize and encourage an outstanding undergraduate student specializing in any subject area in the Department of Floriculture and Ornamental Horticulture. He should have demonstrated exceptional interest, enthusiasm, and leadership and should have given distinguished service to the Department. Academic standing, although important, is not the primary criterion. The award will ordinarily be given to an upperclassman.

The third award of \$100 will also be given to any undergraduate student within the Department who has given distinguished service.

CHARLES LATHROP PACK FOUNDATION FORESTRY PRIZE. The Charles Lathrop Pack Foundation Forestry Prize of \$100 is awarded annually in April for the best essay on forestry submitted by a resident student who has taken some course in forestry during the current college year. The purpose of the prize is to aid in training men and women to write articles that will arouse in the public an interest in forestry and an appreciation of what forestry means to the country. The award is made by a committee appointed by the President of the University. The detailed regulations are furnished by the Department of Conservation. The essay must be deposited at the office of the head of the Department of Conservation by noon on April 15.

RING MEMORIAL FUND PRIZE. The Ring Memorial Fund was established under the will of Charles A. Ring to advance horticultural science. The income is used for a prize of approximately \$50 to be awarded to an outstanding sophomore student specializing in plant or horticultural science.

Instructors and advisers of students in the plant sciences are requested to nominate, in writing, sophomores who show promise of advancing horticultural science. Consideration is to be given to grades in horticultural and supporting science courses; attitude toward education, horticulture, and scientific work; demonstrated ability for leadership; and character and personality. Nominations must be received at the Office of Resident Instruction before May 1.

SAMUEL L. STEWART PRIZE. The Samuel L. Stewart Prize of \$100 is offered annually in an essay contest, to promote the production and distribution of high-quality milk, and to acquaint producers and handlers with the factors which may affect its palatability. The contest is open to undergraduate students in the College of Agriculture. Essays of 600 to 800 words must be filed at the Office of Resident Instruction by May 1.

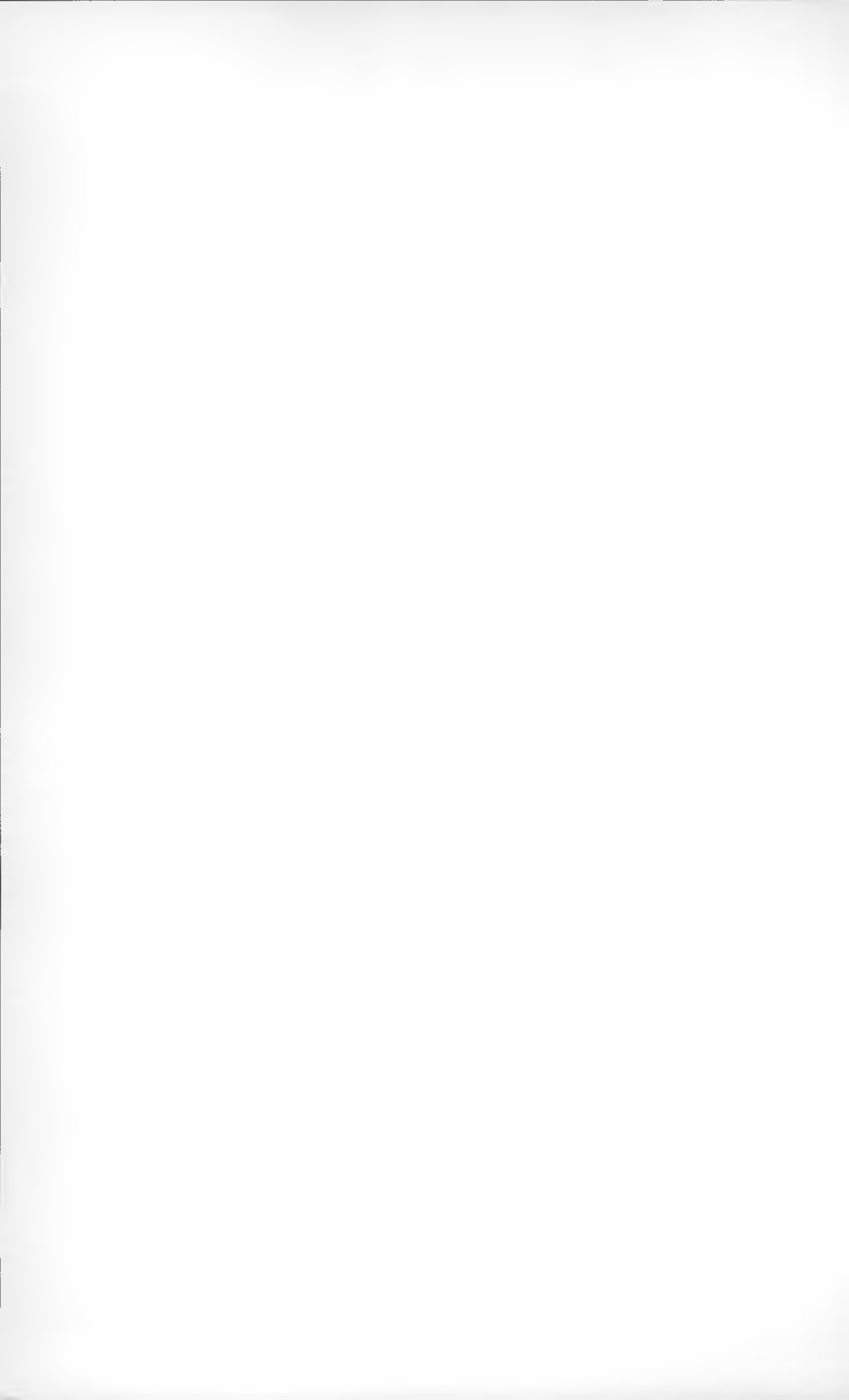
OTHER PRIZES. Information concerning other prizes open to students enrolled in the University is given in the *Announcement of Prize Competitions*. Copies may be obtained at the Visitor Information Center, Day Hall.

Loans

A fund contributed by students of the College is available for small, short-time, emergency loans. Applications may be made to the College Secretary.

A fund, the interest on which is available for loans to students specializing in floriculture, has been established by Mr. Max Schling of New York City. Another loan fund for students of floriculture, with principal and interest available, has been contributed by the New York Florists Club. Applications for loans from both these funds may be made to the College Secretary.

For other loan funds, available to students of all colleges at Cornell, application should be made at the Office of Scholarships and Financial Aid, Day Hall.



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CORNELL UNIVERSITY ANNOUNCEMENTS

The Cornell *Announcements* are designed to give prospective students and others information about the University. The prospective student should have a copy of the *Announcement of General Information*; after consulting that, he may wish to write for one or more of the following *Announcements*:

- New York State College of Agriculture
- College of Architecture, Art, and Planning
- College of Arts and Sciences
- Department of Asian Studies
- Education
- College of Engineering
- New York State College of Human Ecology
- School of Hotel Administration
- New York State School of Industrial and Labor Relations
- Officer Education (ROTC)
- Summer Session

Undergraduate preparation in a recognized college or university is required for admission to certain Cornell divisions, for which the following *Announcements* are available:

- Graduate School: Biological Sciences
- Graduate School: Humanities
- Graduate School: Physical Sciences
- Graduate School: Social Sciences
- Law School
- Veterinary College
- Graduate School of Business and Public Administration
- Graduate School of Nutrition
- Medical College (New York City)
- Cornell University–New York Hospital School of Nursing (New York City)
- Graduate School of Medical Sciences (New York City)

Requests for the publications listed above may be addressed to
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Edmund Ezra Day Hall, Ithaca, New York 14850

(The writer should include his zip code.)