

424. Wildlife Population Analyses
Spring. 4(3-2) 305 or approval of department.

Population mensuration; reproductive and survival rates; sex and age determination; handling and marking methods.

425. Wildlife Habitat Analyses
Spring. 4(2-4) BOT 450 or ZOL 389 or FOR 220.

Evaluation of environmental factors affecting wildlife species; food and cover measurements. Determination of limiting factors.

426. Ecology of Migratory Birds
Fall. 4(2-4) ZOL 461 or approval of department.

Ecological, behavioral, and physiological characteristics affecting population parameters of migratory birds and applications of these relationships to the management of migratory wildlife resources.

427. Wildlife Biology and Management
Winter. 4(2-4) 424; ZOL 389 or BOT 450.

Ecology and management of resident wildlife on farm, forest and range lands.

450. Natural Resource Administration
Fall, Spring. 4(4-0) Interdepartmental with Forestry, Parks and Recreation Resources and Resource Development Departments and Natural Resources. Administered by the Forestry Department.

Concepts and methods of administering wildland properties. The legal, economic and social environment. Benefit-cost analysis of management changes. Unit organization, personnel management and accounting. Presents a systems view of administration.

471. Ichthyology
Spring. 3(2-3) 301 or ZOL 305 or 314. Interdepartmental with Zoology Department.

Classification and natural history of fishes. Emphasis on food, game, and forage fishes.

473. Fishery Biology and Management
Fall. 5(3-3) ZOL 471.

Biology of fishes with special reference to distribution and natural history, and application of this knowledge to problems of obtaining maximum return from fishery resources.

476. Limnology
Winter. 3(3-0) B S 212. Interdepartmental with the Zoology Department.

Ecology of lakes and streams with special reference to physical, chemical, and biological factors affecting their productivity.

477. Limnological Methods
Winter. 3(0-9) 476 concurrently; ZOL 481; ENT 301, 302 recommended. Interdepartmental with the Zoology Department.

Methods and instruments of limnological field investigation on lakes and streams.

484. Outdoor Environmental Education
Fall. 4(3-2) Juniors or approval of department.

Using the outdoors as a teaching laboratory for ecological studies of plant and animal communities. Designed primarily for secondary teachers.

485. Environmental Conservation Program Design
Winter. 3(3-0) Seniors or approval of department.

Materials and methods for integrating environmental conservation into educational programs in schools, nature centers, youth groups and communities.

801. Seminar in Fisheries and Wildlife
Fall, Winter, Spring. 1(1-0)

Graduate problems and current developments of importance.

802. Advanced Topics
Fall, Winter, Spring, Summer. 1 to 6 credits. May re-enroll for a maximum of 15 credits. Approval of department.

Study of selected advanced topics in detail and depth.

821. Advanced Stream Ecology
Summer. 3 credits. 421 or approval of instructor. Given at W. K. Kellogg Biological Station. Interdepartmental with and administered by the Entomology Department.

Stream ecosystem energy budget models with emphasis on individual projects involving both laboratory and field experiments. Particular use will be made of artificial streams and locally abundant species of aquatic insects.

874. Advanced Biological Limnology
Fall. 3(4-0) 477, or approval of department.

Historical and current contributions to concepts of community structure, energy flow and materials cycling in aquatic eco-systems.

875. Chemical Limnology
Winter. 4(3-3) 476, 477 or approval of department.

Application of analytical chemistry concepts and technologies to fundamental chemical mechanisms in natural and polluted water systems. Special consideration given to selected heterogeneous equilibria.

899. Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

999. Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

FOOD SCIENCE AND HUMAN NUTRITION*

College of Agriculture and
Natural Resources
College of Human Ecology †

Food Science FSC

211. Introduction to Food Science
Spring. 3(3-0)

Modern food processing, world food problems, and the basic characteristics of processed foods.

242. Meats, Poultry and Fishery Products I
Fall. 3(2-2) Interdepartmental with the Animal Husbandry Department.

Principles of evaluation and nutritive value. Identification of grades and cuts of beef, pork, lamb and poultry products.

300. Dairy Products
Spring. 3(2-2)

Composition, use, classification and market grades, methods of storage and factors affecting keeping quality of dairy products.

331. Physical Principles of Food Processing
Fall, Winter. 4(3-2) 211; MTH 109; PHY 239 or approval of department.

Food preservation by heat, low temperature, dehydration and radiation.

*Named changed October 17, 1970. Formerly Food Science and Human Nutrition and Foods.
†Named changed July 1, 1970. Formerly College of Home Economics.

332. Food Processing II: Biological Principles
Winter. 4(3-3) MPH 200 or approval of department.

Biological problems related to food processing including waste disposal, sanitizing and bactericidal compounds, pesticides and residues, plant and animal growth regulators, radioactive elements, preservatives and toxicology of additives.

333. Chemical Principles of Food Processing
Spring. 4(3-3) 211 and CEM 241 or approval of department.

Chemical changes in foods that affect the texture, color, flavor, odor, stability, and nutritive quality during processing and storage.

400. Milk Processing Technology
(304.) Fall. 4(3-3) CEM 132 or approval of department.

The fluid milk industry. Composition, quality, sanitation, nutritive value, processing, packaging and distribution of milk and milk products.

401. Industrial Food Fermentations
Spring. 3(3-0) 440 and organic chemistry or approval of department.

Physical, microbiological and chemical procedures in utilizing microbial cultures in controlled fermentations of foods and food constituents.

402. Chemistry and Technology of Lipids
Winter. 3(2-3) One term organic chemistry.

Chemical and physical properties of edible fats and oils. Refining and processing of lipids into margarine, butter, shortening and salad oils. Chemical methods for analysis of lipids.

404. Dehydrated Foods
Spring. 3(2-3) 331; 333 concurrently or approval of department.

Concentration and dehydration of foods by roller, spray, and freeze drying and foam, puff and tunnel drying. Stability and nutritional aspects of dehydrated foods.

405. Chemistry and Technology of Dairy Products Manufacturing
Winter. 3(2-3) May re-enroll for a maximum of 6 credits if a different topic is taken. 400 or approval of department.

Physical, chemical and microbiological factors in the processing of dairy products. Ice cream, sherbets, ice milks and special frozen desserts are studied in odd-numbered years; cheese, and related dairy products in even-numbered years.

421. Food Plant Management
Spring. 3(2-3) Seniors or approval of department.

Efficiency concepts, merchandising, personnel utilization and organization.

440. Food Microbiology
(MPH 371.) Spring. 5(3-6) MPH 200 or 301 or 401, or approval of department. Interdepartmental with the Microbiology and Public Health Department.

Major groups of microorganisms of importance to the food industry are studied with emphasis on ecological, physiological, and public health aspects.

445. Meat, Poultry and Fishery Products III
Spring. 3(1-6) 333 or approval of department.

Processing, formulation and quality control.

448. Fruit, Vegetable and Cereal Products I
Fall. 4(3-3) 331 or approval of department.

Quality factors involved in canning, sugar and salt preservation and milling.

449. Fruit, Vegetable and Cereal Products II
Winter. 4(3-3) 331 or approval of department.

Quality factors involved in cooling, freezing and other preservation procedures.

455. Food Analysis I
Fall. 4(2-6) CEM 132 and 162 or approval of department.

Modern methods of analysis for fat, protein, moisture and other macroconstituents of food. Application of spectrophotometry in determination of microconstituents; use of dye-binding, complexometric and iodimetric techniques in food analysis.

456. Food Analysis II
Winter. 4(2-6) CEM 162 and 241 or approval of department.

Use of colorimetry and spectrophotometry, chromatographic methods and other techniques for the analysis of food constituents and additives.

457. Quality Control in the Food Industry
Winter of even-numbered years. 3(3-0) STT 201 or approval of department.

Organization of quality control within the food industry by case study. Use of control charts, sampling plans, flavor panel analyses.

480. Special Problems in Food Science
Fall, Winter, Spring, Summer. 1 to 3 credits. May re-enroll for a maximum of 9 credits.

Advanced undergraduates may select research work in food chemistry, food microbiology, food engineering, food plant management, processing dairy products, meat, poultry and fishery products, fruits and vegetables, cereals or beverages.

490. Seminar
Fall. 1(1-0) Approval of department.

Preparation and presentation of reports on a specialized aspect of food science.

828. Food Processing Concepts, Systems and Selected New Processes
Winter. 3(3-0) 331, 332 or 440, or approval of department.

Concepts of and requirements for processing systems and continuous processes. Use of computers in food processing; microwave heating of foods; radiation preservation of foods and related processing methods.

830. Thermal Processing of Food Products
Winter. 4(3-3) 331; 332 or 440, or approval of department.

Heating and cooling characteristics of foods in containers, thermal resistance of microorganisms, and derivation of process times and temperatures for pasteurization and sterilization.

832. Microbiology of Food Processing
Fall. 3(2-3) 440 or approval of department.

Control of food spoilage and food poisoning microorganisms in food processing and the role of bacterial spores in process selection.

850. Selected Topics in Food Science
Fall of even-numbered years. Winter and Spring of odd-numbered years. 3(3-0) May re-enroll for a maximum of 9 credits if a different topic is taken. Approval of department.

Fall: advanced food plant management.
Winter: utilization, additives and new processing methods.

Spring: flavor and color evaluation and advanced statistical quality control.

880. Special Problems in Food Science
Fall, Winter, Spring, Summer. 1 to 4 credits. May re-enroll for a maximum of 12 credits. Approval of department.

Investigation of food science areas of special interest to individual graduate students.

899. Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

932. Histological and Chemical Technique
Winter. 3(1-6) Approval of department.

Research techniques in thin-layer and gas chromatography, differential thermal analysis, isoelectric focusing, histology, histochemistry, biological testing, polarography and pH stat measurements.

933. Instrumental Methods of Analysis
(931.) Spring. 3(2-3) 455 or 456 or approval of department.

Spectroscopy (ultraviolet, visible, infrared, flame, atomic absorption, fluorescence), manometry, ion exchange, counter-current distribution, radioisotopic tracers.

934. Research Techniques with Proteins
Fall. 3(2-3) BCH 401 or 451.

Physical and chemical techniques applicable to protein characterization (including — electrophoretic techniques, thin-layer chromatography, gel filtration, ultracentrifugation and amino acid analysis).

950. Advanced Topics in Food Science
Fall, Spring. Winter of even-numbered years. 3(2-3) May re-enroll for a maximum of 15 credits if a different topic is taken. 333, BCH 401 or approval of department.

Fall of odd-numbered years: Advanced Chemical Concepts of Carbohydrates and Proteins.

Winter of even-numbered years: Lipids.
Spring of even-numbered years: Enzymatic Reactions.

Fall of even-numbered years: Chemistry of Plant Products.

Spring of odd-numbered years: Muscle Chemistry.

990. Food Science Seminar
Fall, Winter, Spring. 1(1-0) May re-enroll for a maximum of 3 credits toward M.S. and 6 credits toward the Ph.D. Approval of department.

Preparation and presentation of reports on a specialized aspect of research findings in food science.

999. Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

Human Nutrition and Foods* HNF

100. Elementary Food Preparation
(F N 100.) Fall, Winter, Spring. 4(2-4)

Composition and properties of food related to quality characteristics; methods of preparation, evaluation of quality and use of selected foods.

101. Food and Society
Fall, Winter. 3(3-0)

Analysis of the scientific, social and environmental aspects of food in determining the quality of man's life. Introduction into the principles of food preservation and safety.

102. Nutrition for Man
(F N 102.) Fall, Winter, Spring. 3(3-0)

Fundamentals of nutrition with reference to diverse ways man provides for and attaches meaning to his food.

221. Food and the Consumer
Fall, Winter, Spring. 3(3-0) Sophomores.

Factors affecting the food supply, consumer protection, food buying and management of human and material resources in feeding the family.

222. Laboratory for Food Management
Fall, Winter, Spring. 2(0-2) 221 concurrently.

Planning, organizing, preparing and serving meals with consideration of human and material resources as well as nutrient needs.

320. Food Service Systems
Fall, Winter. 5(2-6) 221. Juniors.

Management of food service systems with varying organizational patterns and objectives. Emphasis on human and material resources and their interrelationships in quality food production and service.

340. Experimental Foods
Fall. 4(2-4) CEM 132; MPH 200 or concurrently.

Physical and chemical changes occurring in foods during storage, preservation and preparation in terms of palatability, microbial safety and nutritive value. Emphasis on carbohydrates and fats.

341. Experimental Foods
Winter. 4(2-4) 340.

Continuation of 340. Emphasis on proteins.

350. Fundamental Principles of Nutrition
(F N 350.) Winter, Spring. 4(3-2) PSL 331 or BCH 200 or concurrently.

Identification, function, metabolism and food sources of specific nutrients required by man for normal growth and development.

400H. Honors Work
(F N 400H.) Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 16 credits. Seniors, approval of department.

403. Fats and Carbohydrates in Food Systems
(F N 403.) Fall. 4(3-3) 341 or approval of department.

Chemical and physical reactions in fat and carbohydrate food systems, including sols, gels, emulsions, etc. Food evaluation techniques will be introduced.

*Name changed July 1, 1970. Formerly Foods and Nutrition and Institution Administration.

404. Role of Proteins in Food Systems
(F N 404.) Winter. 4(3-3) 341 or approval of department.

Physical and chemical reactions with protein foods, meats, eggs, cheese, seeds. Emphasis on time-temperature data in relation to quality.

406. Cultural Aspects of Food
(F N 406.) Spring, Summer of odd-numbered years. 3(3-0) Juniors.

A cross cultural investigation of food and its consumption. Factors such as history, religion, food sources and socio-economic status are considered.

406L. Laboratory—Cultural Aspects of Food

(F N 406.) Spring. 1(0-3) 100 or 200; 406 or concurrently.

Art and science of cookery in relation to historical, national, regional, racial and religious customs.

407. Patterns of Food Selection
Fall. Summer of even-numbered years. 3(3-0) 350.

Sociological and psychological factors influencing food choices. Evaluation of dietary habits in relation to nutritional needs of individuals.

409. Presentations in Foods and Nutrition
(F N 409.) Winter. 4(2-4) 340; 350 or 461.

Principles and techniques of presenting foods and nutrition information as applied to teaching or promotional work.

453. Readings in Nutrition
(F N 453.) Winter. Summer of odd-numbered years. 3(3-0) 462 or approval of department.

A study of recent developments in research in human nutrition.

454. Readings in Foods
(F N 454.) Fall. Summer of even-numbered years. 340.

Selected topics in foods research. Emphasis on experimental data and basic scientific principles related to food quality.

461. Energy Nutrient and Proteins for Human Nutrition
(F N 461.) Fall. 4(4-0) BCH 200; PSL 332 or 241.

Metabolism of protein, fats and carbohydrates, as applied to nutritional requirements and food supplies of people.

462. Vitamins and Minerals for Human Nutrition
(F N 462.) Winter. 3(3-0) 461.

Metabolism of vitamins and minerals as applied to the nutritional requirements and food supplies of people.

463. Nutrition and Human Development
(F N 463.) Spring. 3(3-0) 462.

The role of nutrients in physiological systems and biochemical processes as related to the perspective of human growth and development.

469. Physical and Physiological Growth of Children
Winter, Spring. 4(3-2) HNF 102.

Three terms of Natural Science. Interdepartmental with and administered by the Family and Child Sciences Department.

Physical and physiological growth patterns. Experimental evidence for nutritional requirements. Applications to feeding practices, and physical activity of children.

470. Clinical Nutrition
Fall. 4(4-0) 462.

Changes in physiological and/or biochemical functions or processes due to illness and uses of modified diets as an essential part of treatment.

475. Community Nutrition
Spring. 4(3-3) 462 or approval of department.

Identification of nutritional needs of population groups and available resources in communities.

495. Independent Study
(I A 400.) Fall, Winter, Spring. 2 to 6 credits. May re-enroll for a maximum of 6 credits. Seniors; approval of department.

Individual study of selected topics in foods, nutrition and food service management under staff guidance.

498. Field Study
Fall, Winter, Spring, Summer. 4 to 12 credits. May re-enroll for a maximum of 12 credits. Approval of department.

Planned program of research, observation, study or work in selected organizations under staff guidance.

800. Seminar in Foods and Nutrition
(F N 800.) Fall, Winter, Spring. 1(1-0) 403 or 463.

802. Seminar in Food Service Management
(I A 800.) Winter, Summer. 1 to 3 credits. May re-enroll for a maximum of 8 credits. Approval of department.

803. Problems in Food Service Management
(I A 803.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.

805. Experimental Foods III
(F N 805.) Spring. 4(1-9) 404 or approval of department.

Planning, executing, and reporting individual research project. Data collection, evaluation and interpretation to demonstrate understanding of research techniques and attitudes, and an awareness of significant problems in the field.

813A. Special Studies in Nutrition
(F N 813A.) Fall, Winter, Spring, Summer. Variable credit. 461.

813B. Special Studies in Experimental Foods
(F N 813B.) Fall, Winter, Spring. Summer of odd-numbered years. Variable credit. 404; BCH 200 or 451 and 804.

813C. Special Studies in Food Service Management
(I A 813.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.

Special studies in facility management, manpower coordination and tools and methods of operational control.

816. Applied Human Nutrition
(F N 816.) Spring. 3(3-0) 462.

825. Techniques in Nutrition Research
(F N 825.) Winter of odd-numbered years. 1 to 3 credits. CEM 333; approval of department. Interdepartmental with and administered by the Animal Husbandry Department.

Use of specialized instruments and techniques. Laboratory safety. Management of laboratory animals. Development of abilities in areas of particular interest to individual students.

899. Research
(F N 899.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.

926. Comparative Nutrition — Lipids and Carbohydrates
Winter of odd-numbered years. 4(4-0) BCH 452. Interdepartmental with the Animal Husbandry Department.

Regulatory aspects of carbohydrate and lipid metabolism as influenced by nutrition in mammals. Emphasis on normal and abnormal physiological states such as obesity, ketosis and diabetes.

927. Comparative Nutrition — Protein Metabolism and Developmental Biology
Winter of even-numbered years. 4(4-0) BCH 452, PSL 502 or concurrently. Interdepartmental with Animal Husbandry Department.

Protein quality assessment, protein status, protein calorie malnutrition, amino acid metabolism, protein turnover, digestion and absorption, hormonal control of protein metabolism, developmental aspects of protein metabolism and growth.

928. Comparative Nutrition — Minerals
Spring of even-numbered years. 3 credits. BCH 452, PSL 502. Interdepartmental with and administered by the Animal Husbandry Department.

Forms and location in body, metabolic roles, deficiency and toxicity signs, interrelationships, requirements and biological availability of sources.

929. Comparative Nutrition — Vitamins
Winter of odd-numbered years. 3(3-0) BCH 452 and a previous course on principles of nutrition. Interdepartmental with and administered by the Animal Husbandry Department.

Chemical and physical properties, standards of activity, occurrence, metabolic roles, antivitamin deficiencies and toxicity signs, requirements and factors affecting requirements.

999. Research
(F N 999.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.

FOOD SYSTEMS ECONOMICS AND MANAGEMENT

See Agricultural Economics

FOREIGN LANGUAGES

See German and Russian, Linguistics and Oriental and African Languages, and Romance Languages.

FORESTRY

FOR

College of Agriculture and Natural Resources

200. Resource Ecology and Man
For course description, see Interdisciplinary Courses.

202. Introduction to Forestry
(101.) Fall. 3(3-0)

Forestry in its broadest sense, including: historic development, forest growth, protection and management, products, national and world economy and policy. Emphasis on multiple use concepts. One-day field trip required.