

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. ENT 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.

830. Environmental Requirements of Fish
Winter. 3(3-0) Approval of department.
Adaptations and responses of fish to environmental changes; research methods for evaluating environmental limitations and effects of pollutants on fish growth, reproduction and survival. Applications for developing water quality criteria.

871. Ecology of Fishes
Summer. 3 credits. Approval of instructor or 473 or ZOL 389. Given at the W. K. Kellogg Biological Station. Interdepartmental with and administered by the Department of Zoology.
Exploration of ecological problems in fish biology with particular emphasis on growth, food and habitat selection, population biology, niche analysis and patterns in community structure. Field and experimental investigations of fish communities.

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.

940. Quantitative Wildlife Ecology
Spring. 3(3-0) Approval of department.
Fundamentals of population demographics. Rates of increase, dynamic and static life tables, logistic theory, the Leslie matrix model, age specific and time specific parameters. Current hypotheses on mechanisms promoting population stability.

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

101. Food and Society
Fall, Winter. 3(3-0) Interdepartmental with Human Nutrition and Foods.
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.

211. Introduction to Food Science
Spring. 3(3-0)
Modern food processing, world food problems, and the basic characteristics of processed foods.

215. World Food Issues
Spring. 3(3-0) Interdepartmental with and administered by the Department of Geography.
Food resources as related to world distributions of population, soil, water, fuel and minerals. Special attention to urbanization, irrigation, and future food needs and global constraints.

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.

332. Biological Principles of Food Processing
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
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.

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

401. Industrial Food Fermentations
Fall. 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(3-4) 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 182 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.

**Descriptions — Food Science and Human Nutrition
of
Courses**

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.

833. Advanced Food Plant Management

Fall of even-numbered years. 3(3-0) 421 or approval of department.

Advanced concepts and strategy of policies and practices in the management of food plants.

834. Flavor Quality Control

Spring of odd-numbered years. 4(3-3) Approval of department.

Sensory methods used for food evaluation and panel analyses. Flavor chemistry and analytical methods. Sampling plans, control charts, and acceptance sampling for statistical quality control.

835. Carbohydrates in Foods

Fall of odd-numbered year. 3(3-0) 333.

The chemistry and food technology of mono-, oligo-, and poly-saccharides.

850. Selected Topics in Food Science

Winter of odd-number years. 3(3-0) Approval of department.

Current developments in food utilization and wholesomeness including food additives, residues, toxicants, and state and federal regulations pertaining to food processing and quality assurance.

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 Techniques

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 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, countercurrent 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).

951. Muscle Chemistry

Spring of odd-numbered years. 3(2-3) BCH 451 or approval of department.

The structure and function of living muscle. Emphasis is placed upon the chemical and energy changes of muscle in contraction. Changes occurring after death during rigor development are also discussed.

952. Advanced Lipids

Winter of even-numbered years. 3(3-0) 402 or approval of department.

A course relating composition, structure, and physical and chemical properties of lipids to processing requirements of fats and oils to their function in food systems.

953. Enzyme Reactions

Spring of even-numbered years. 4(3-3) BCH 451, or approval of department.

Comprehensive discussion of parameters which affect enzyme activity. Properties of enzymes important in food processing.

954. Chemistry of Plant Products

Fall of even-numbered years. 3(3-0) 333, BCH 451, or approval of instructor.

Chemistry and biochemistry of plant pigments, tannins, toxins and proteins.

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

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) Interdepartmental with and administered by Food Science.

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

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 or approval of department.

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(0-4) 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(3-4) 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

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

Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 16 credits. Seniors, approval of department.

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

- 403. Fats and Carbohydrates in Food Systems**
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.
- 404. Role of Proteins in Food Systems**
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**
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**
Spring. 1(0-3) 100 or 340 or approval of department; 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 or 461.
Sociological and psychological factors influencing food choices. Evaluation of dietary habits in relation to nutritional needs of individuals.
- 409. Presentations in Foods and Nutrition**
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**
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**
Fall. Summer of even-numbered years. 3(3-0) 340 or approval of department.
Selected topics in foods research. Emphasis on experimental data and basic scientific principles related to food quality.
- 461. Energy Nutrients and Proteins for Human Nutrition**
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**
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**
Winter. 3(3-0) 461.
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(4-0) 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**
Spring. 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, Summer. 1 to 3 credits. May re-enroll for a maximum of 9 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**
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**
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**
Spring. 3(3-0) 462.
- 825. Techniques in Nutrition Research**
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**
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 802 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 802. 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**
Spring 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, deficiency and toxicity signs, requirements and factors affecting requirements.
- 999. Research**
(F N 999.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.