Brewing Science Option
The Brewing Science option prepares students for careers in production or quality assurance within the brewing industry or other food fermentation industries (e.g., other alcoholic beverages, vinegar and cheese). The option also prepares students for graduate study in food science or related programs, exposes the students to diverse topics, including chemistry, biochemistry, microbiology and processing.

Specific course requirements

| Food Science and Technology 102A, 102B, 109, 123 | 18 |

Selected additional courses

Select courses from a master list available from the department Advising Center.

Total Units for the Degree

132

Major Adviser
A. E. Mitchell (Food Science and Technology)

Advising Center
For the major is located in 1208 RMI South Building 530-752-8368.

Graduate Study
A program of study and research leading to the M.S. and Ph.D. degrees in Food Science is available (see below). For further information on graduate study, contact the graduate adviser.

Food Science (A Graduate Group)
Gary M. Smith, Ph.D., Chairperson of the Group

Group Office
1204 RMI South Building 530-752-8035; Fax 530-752-0382; http://www.foodscience.ucdavis.edu

Faculty
Includes members from twelve departments in the Colleges of Agricultural and Environmental Sciences and Engineering, and the Schools of Medicine and Veterinary Medicine.

Graduate Study
The interdepartmental Graduate Group in Food Science offers programs of study leading to the M.S. degree and to the Ph.D. degree. Graduate study stresses the application of the biological, chemical, physical, and behavioral sciences to the processing, preservation, quality evaluation, public health aspects, and utilization of foods. For the M.S. degree, there are four areas of specialization: chemistry-biochemistry; microbiology, engineering-technology and sensory science; individually designed programs are also acceptable. For the Ph.D. degree, there are four areas of emphasis: biochemistry, chemistry, microbiology/fermentation, and sensory science. Detailed information regarding graduate study is available through the Graduate Adviser or the Group Office.

Graduate Advisers
Contact the Food Science Graduate Group office at jlblevins@ucdavis.edu.

Food Science and Technology

[College of Agricultural and Environmental Sciences]
Michael J. McCarthy, Ph.D., Chairperson of the Department

Department Office
1136 RMI North Building 530-752-1482; http://foodscience.ucdavis.edu

Faculty
Charles W. Bamforth, Ph.D. D.SC., Dist. Professor
Daniela Barile, Ph.D., Assistant Professor

Charlotte Bilkeoff, Ph.D., Assistant Professor
Stephanie R. Dungan, Ph.D., Professor
J. Bruce Gennery, Ph.D., Professor
Jean-Xavier Guinand, Ph.D., Professor
Maria L. Marco, Ph.D., Assistant Professor
Kathryn L. McCarthy, Ph.D., Professor
Michael A. O'Mahony, Ph.D., Professor
David A. Mills, Ph.D., Professor
Nitin N. Nilit, Ph.D., Assistant Professor
Alyson Mitchell, Ph.D., Professor
Robert Powell, Ph.D., Professor
Carolyn L. Slupsky, Ph.D., Associate Professor
Michael A. O’Mahony, Ph.D., Professor
Gary M. Smith, Ph.D., Professor
Glenn M. Young, Ph.D., Professor

Emeriti Faculty
Everett Bandman, Ph.D., Professor Emeritus
Ericka L. Barrett, Ph.D., Professor Emeritus
R. Larry Merson, Ph.D., Professor Emeritus
David S. Reid, Ph.D., Professor Emeritus
Gerald F. Russell, Ph.D., Professor Emeritus
Barbara O. Schneeman, Ph.D., Professor Emeritus
Robert A. Young, Ph.D., Professor Emeritus

Food Science and Technology

Selected additional courses

For the major is located in 1208 RMI South Building 530-752-8368.

313

Major Adviser
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Graduate Study
A program of study and research leading to the M.S. degree and to the Ph.D. degree. Graduate study stresses the application of the biological, chemical, physical, and behavioral sciences to the processing, preservation, quality evaluation, public health aspects, and utilization of foods. For the M.S. degree, there are four areas of specialization: chemistry-biochemistry; microbiology, engineering-technology and sensory science; individually designed programs are also acceptable. For the Ph.D. degree, there are four areas of emphasis: biochemistry, chemistry, microbiology/fermentation, and sensory science. Detailed information regarding graduate study is available through the Graduate Adviser or the Group Office.

Graduate Advisers
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Food Science and Technology

[College of Agricultural and Environmental Sciences]
Michael J. McCarthy, Ph.D., Chairperson of the Department

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Food Science and Technology

Selected additional courses

For the major is located in 1208 RMI South Building 530-752-8368.

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102B. Practical Malting and Brewing (4) Lecture/discussion—2 hours; laboratory—6 hours. Prerequisite: course 102A and analytical experience beyond Chemistry 2C, such as Viticulture and Enology 123, Food Science and Technology 103, 123L, Molecular and Cellular Biology 120L. Open to seniors only in Fermentation Science or Food Science and Technology. Provides practical working knowledge of analytical methods used in malting and brewing experience with brewing materials and processes and production of samples that illustrate the range of values experienced in practice and pilot scale brewing. GE credit: SciEng | QL, SE, — II. (II.) Bamforth

103. Physical and Chemical Methods for Food Analysis (4) Lecture—2 hours; discussion—1 hour; laboratory—3 hours. Prerequisite: Chemistry 2C, BB, Biological Sciences or Animal Biology 102 (may be taken concurrently). Course 101A, 101A (may be taken concurrently). Theory and application of physical and chemical methods for determining the constituents of foods. Modern separation and instrumental analysis techniques will be used. GE credit: SciEng | QL, SE, WE,— II. (II.) Mitchell

104. Food Microbiology (3) Lecture—3 hours. Prerequisite: Biological Sciences 1A, 102. Microorganisms in food safety, spoilage, and production of harmful disease agents and their control. Growth parameters of food spoilage agents. Destruction of microbes in food. Food fermentation. The development of microbes as a resource for the food industry. GE credit: SciEng | QL, SE, VL,— II. (II.) Marcol

104L. Food Microbiology Laboratory (4) Lecture—1 hour; discussion—1 hour; laboratory—6 hours. Prerequisite: Biological Sciences 1A, course 104. Cultural and morphological characteristics of microorganisms involved in food spoilage, in foodborne disease, and food fermentation. Analysis of microbiological quality of foods. GE credit: SciEng | QL, SE, VL, WE,— III. (III.) Young

107. Food Sensory Science (4) Lecture—3 hours; laboratory—3 hours. Prerequisite: Agricultural Management and Rangeland Resources 120 or course 117 (may be taken concurrently). Critical examination of theories and techniques of sensory measurement of food; measures of consumer perception and acceptance. An introduction to the sensory and cognitive systems associated with the perception of food. Not open for credit to students who have completed course 107PA. GE credit: SciEng | QL, SE, WE,— I. (I.) O'Mahony

108. Food Processing Plant Sanitation (2) Lecture—2 hours. Prerequisite: Chemistry 8B, Biological Sciences 1A, course 104 (may be taken concurrently). Sanitary control of food processing, including water treatment, chemical and physical sanitizing agents; principles of cleaning and hard surface detergent, metal corrosion, pest control, and waste disposal; role of regulatory agencies. GE credit: SciEng | SE.

109. Principles of Quality Assurance in Food Processing (3) Lecture—2 hours discussion—1 hour. Prerequisite: Statistics 1 or Agricultural Management and Rangeland Resources 120. Quality assurance measurement techniques applied to selected food processed products emphasized. Rationale for establishing valid quality assurance programs including selection of samples at critical points. Statistical problems in quality assurance programs used by the food industry. GE credit: SciEng | QL, SE, SL, VL,— III. (III.)

110. Food Processing (4) Lecture—3 hours; discussion—1 hour. Prerequisite: Physics 7A, 7B,C or the equivalent; Mathematics 16A, 16B, 16C or the equivalent; course 50 (may be taken concurrently). Open to credit to students enrolled in College of Engineering Application of the conservation of mass and energy to food processing. Elements of engineering thermodynamics, fluid mechanics, heat and mass transfer. Quantitative analysis through problem solving and simulation. GE credit: SciEng | QL, SE, VL,— I. (I.) McCarthy

110A. Physical Principles in Food Processing (3) Lecture—2 hours; laboratory—2 hours. Prerequisite: Physics 5A and 5B or 7A, 7B, 7C or the equivalent; calculus recommended. GE credit: SciEng | QL, SE, VL,— I. (I.) McCarthy

110B. Heat and Mass Transfer in Food Processing (3) Lecture—2 hours; laboratory—2 hours. Prerequisite: course 110A or the equivalent. Modern Biological Systems Technology 110L recommended (may be taken concurrently). Rate processes: conduction, convection, and radiation heat transfer; microwave heating, refrigeration, freezing temperatures, mass transfer during drying and storage. GE credit: SciEng | QL, SE, VL,— III. (III.) Singh

110L. Food Processing Laboratory (2) Laboratory—3 hours; discussion—1 hour. Prerequisite: course 110A or the equivalent. Students will gain experience with common food processing operations at the bench and pilot plant scales. GE credit: SciEng | QL, SE, VL,— I. (I.) Rishworth

117. Design and Analysis for Sensory Food Science (4) Lecture—3 hours; discussion—1 hour. Methods of design and analysis for sensory food science. Experimental design and statistical models to analyze consumer testing data. Analysis and computation including the relative merits and limitations of parametric and nonparametric approaches. Modifications for quality assurance. GE credit: SciEng | QL, SE,— I. (I.) O'Mahony

119. Chemistry and Technology of Milk and Dairy Products (4) Lecture—4 hours; demonstrations and a field trip. Prerequisite: Biological Sciences 1A and 102, or consent of instructor. Composition, structure and properties of milk and products derived from milk. Relates chemical, microbiological, and technological principles to commercial practices in processing of milk and its products. GE credit: SciEng | QL, SE, VL,— III. Rosenberg

120. Principles of Meat Science (3) Lecture—3 hours. Prerequisite: Biological Sciences 1A. Anatomical, physiological, developmental, and biochemical aspects of muscle underlying the conversion of muscle to meat. Includes meat processing, preservation, microbiology and public health issues associated with meat products. Same course as Animal Science 120J. GE credit: SciEng.

120L. Meat Science Laboratory (2) Discussion—1 hour; laboratory—3 hours. Prerequisite: Biological Sciences 1A; course 120 (may be taken concurrently). Laboratory exercises and student participation in transformation of live animal to carcass and meat, structure and biochemical changes related to meat quality, chemical and sensory evaluation. GE credit: SciEng | QL, SE, VL,— III. Rosenberg

121. Introduction to Enzymology (3) Lecture—3 hours. Prerequisite: Biological Sciences 103. Principles of physical, chemical and catalytic properties of enzymes and their importance. Purification, characterization, and quantitative evaluation of reaction conditions on activity are stressed. Specificity and mechanism of action may be used by selected enzymes. (Former course Biochemistry and Biophysics 123.) GE credit: SciEng | QL, SE, VL,— III. (III.) G. Smith

123L. Enzymology Laboratory (2) Lecture—1 hour; laboratory—3 hours. Prerequisite: Biological Sciences 103, course 123L (sop concurrently). Laboratory procedures involved in detection, purification and characterization of enzymes. (Former course Biochemistry and Biophysics 123L.) GE credit: SciEng | QL, SE, VL,— III. (III.) G. Smith

127. Sensory Evaluation of Foods (4) Lecture—3 hours; laboratory—3 hours. Prerequisite: Agricultural Management and Rangeland Resources 120 or course 117. A critical examination of methods of sensory measurement applied to food and beverage systems; descriptive analysis and consumer tests and their application to quality assurance, product development and optimization. GE credit: SciEng | QL, SE, WE,— II. (II.)

128. Food Toxicology (3) Lecture—3 hours. Prerequisite: Biological Sciences 102, 103. Chemistry and biochemistry of toxins occurring in foods, including plant and animal toxins, intentional and unintentional food additives. The assessment of food safety and toxic hazards. (Same course as Environmental Toxicology 128.) GE credit: SciEng | SE.— III. (III.) Mitchell, Shibamoto

131. Food Packaging (4) Lecture—3 hours; discussion—1 hour. Prerequisite: Chemistry 8B, Biological Sciences 1A, Physics 7C. Principles of food packaging. Functions of packaging. Properties of metal, glass, paper and plastic materials and packages. Design, fabrication, and applications of food packaging. Packaging of fresh and processed foods, including fruits and vegetables, dairy foods, beer and wine. GE credit: SciEng | QL, SE, WE.

151Y. Food Freezing (1) Discussion—1 hour; web virtual lecture. Prerequisite: course 110A or the equivalent. Mechanisms of ice crystallization, interpretation of freezing diagrams, and models of heat transfer in freezing temperatures, refrigeration requirements, and estimation of freezing times. Industrial systems used in freezing foods. GE credit: SciEng | QL, SE, WE.— I. (I.) Biltz-Koff

159. New Food Product Ideas (3) Lecture—3 hours. Prerequisite: upper division standing with background coursework in food science (course 50 or 100A), biological sciences (Biological Sciences 2A, 2B, 2C), or the physical sciences (Physics 7A, 7B, 7C or Chemistry 2A, 2B, 2C). Create, refine, test and present viable ideas for new food products. Activities include trend monitoring, consumer research, idea generation, concept screening, and new product concept presentations. GE credit: ArtHum or SocSci | AH or SS, OL, WE,— I. (I.) Biltz-Koff

160. Food Product Development (4) Lecture—1 hour; discussion—1 hour; laboratory—6 hours. Prerequisite: upper division standing with background coursework in food science (course 50 or 100A), biological sciences (Biological Sciences 2A, 2B, 2C), or the physical sciences (Physics 7A, 7B, 7C or Chemistry 2A, 2B, 2C). Product implementation stage of food product development including preliminary product description, prototype development, product testing, and formal presentation of a new food product development. GE credit: SciEng | OL, SE, VL,— III. (III.)

190. Senior Seminar (1) Seminar—1 hour. Prerequisite: senior standing or consent of instructor. Select topics for projects that allow students on recent advances in food science and technology. Reports and discussions covering oral and written presentations, literature sources and career opportunities. GE credit: SciEng | QL, SE,— III. (III.)

192. Internship for Advanced Undergraduates (1-12) Internship—3.5-36 hours. Prerequisite: consent of instructor. Work experience on or off campus in the practical application of food science. (P/NP grading only.) GE credit: SE.

198. Directed Group Study (1-5) Prerequisite: consent of instructor. (P/NP grading only.) GE credit: SE.
Food Service Management

(Graduate)

199. Special Study for Advanced Undergraduates (1-5)

P/NP grading only. GE credit. SE.

Graduate

201. Food Chemistry and Biochemistry (4)
Lecture—4 hours. Prerequisite: graduate courses in organic chemistry and biochemistry; undergraduate course in food chemistry is recommended. Advanced topics in food chemistry and biochemistry, emphasizing the application of the basic principles of chemistry and biochemistry to food composition, properties, preservation and processing. Chemical structures, interactions, reaction mechanisms and experimental methods are stressed. —I. (I) G. Smith

202. Chemical and Physical Changes in Food (4)
Lecture—3 hours; term paper. Prerequisite: Biological Sciences 103, Chemistry 107B. Fundamental principles of chemistry and physics of foods are applied to a study of changes in water binding properties and activity, changes in proteins, nutrients, toxic constituents, and other compounds during storage, heating, freezing, dehydrating, and concentrating of food materials. —III. (III.) Dungan

203. Food Processing (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: course 110A, Physics 5C or 7C, Chemistry 107B, or consent of instructor. Principles of food engineering applied to food processing. Relationship of Newtonian and non-Newtonian fluid properties to heat and momentum transfer. Application of mass transfer in controlling kinetics and quality changes of foods. —II. (II.) Nilin

204. Advanced Food Microbiology (3)
Lecture—3 hours. Prerequisite: Biological Sciences 1C, 103, course 104 or a course in microbiology. Principles of and recent developments in food microbiology, including food pathogen virulence and detection, parameters of microbial growth in food, and the microbiology of food and beverage fermentations. —III. (III.) Marco, Young

205. Industrial Microbiology (3)
Lecture—3 hours. Prerequisite: Biological Sciences 1A, 102, 103, Microbiology 130A, 130B or Biological Sciences 101 recommended. Use of microorganisms for producing substances such as amino acids, peptides, enzymes, antibiotics and organic acids. Emphasis on metabolic regulation of pathways leading to fermentation products, on yeast fermentations, and on genetic manipulations (including recombinant DNA techniques) of industrial microorganisms. Offered in alternate years.

207. Advanced Sensory-Instrumental Analyses (3)
Lecture—2 hours; laboratory—3 hours. Prerequisite: course 107 and consent of instructor. Basic principles of measurement of color, texture, and flavor of foods by sensory and instrumental methods. Advanced study of relate of colorimetry, texturometry, and chemistry of volatile compounds to perception of appearance, texture, flavor. Offered in alternate years.

210. Proteins: Functional Activities and Interactions (3)
Lecture—3 hours. Prerequisite: Biological Sciences 103. The relationships of structure of proteins to their biological functions. Structural proteins, complexing proteins, and catalytic proteins in plant and animal materials and products.

211. Lipids: Chemistry and Nutrition (3)
Lecture—3 hours. Prerequisite: Biological Sciences 103, Chemistry 107B, 128B. Chemistry of lipids as it pertains to research in food and nutrition. Relations between lipid structure and their physical properties in tissues and foods. Regulation of absorption, transport, and metabolism of lipids. Implications of dietary fats and oils. —II. (II.) Gering

213. Flavor Chemistry of Foods and Beverages (3)
Lecture/discussion—3 hours. Prerequisite: Chemistry 88, Viticulture and Enology 123, Viticulture and Enology 123L or course 102 or consent of instructor. Students will become familiar with basic principles of flavor chemistry, analysis, and formation in fresh and processed foods. Students will be required to read and critically evaluate flavor chemistry literature. [Same course as Viticulture and Enology 213]. —III. (III.) Ebeler, Heymann

217. Advanced Food Sensory Science (3)
Lecture—3 hours. Prerequisite: course 107 (may be taken concurrently) or consent of instructor. Advanced study of the techniques and theory of the sensory measurement of food as an analytical tool and as a measure of consumer perception and acceptance. Advanced examination of the sensory and cognitive systems associated with the perception of food. —I. (I) O’Mahony

219. Biochemistry, Microbiology and Technology of Cheeses of the World (4)
Lecture—4 hours. Prerequisite: course 119 and Biological Sciences 103 or course 100A, 123, Biological Sciences 103, Chemistry 107B, 128B or consent of instructor. Restricted to graduate level students or senior undergraduate students with appropriate background in biochemistry and microbiology. Composition and physicochemical aspects of milk and their implications on cheesemaking; enzymatic, microbiological and physical aspects of cheese making; cheese as a biological composite; designing cheese quality attributes; cheese aging. Cheese from all over the world will be tasted and discussed. Offered in alternate years. —III. (III.) Rosenblatt

227. Food Perception and the Chemical Senses (2)
Lecture—2 hours. Prerequisite: course 107B (may be taken concurrently), or consent of instructor. Examination of the anatomy and physiology of the chemical senses (taste, smell, and the trigeminal senses) and how they are involved in the perception of food and food intake. —II. Guinand

290. Seminar (1)
Seminar—1 hour. May be repeated for credit. (S/U grading only.) —I, II, III. (I, II, III.)

290C. Advanced Research Conference (1)
Discussion—1 hour. Prerequisite: graduate standing and consent of instructor. Critical presentation and evaluation of original research by graduate students. Planning of research programs and proposals. Discussion led by individual major instructors for their research group. (S/U grading only.) —I, II, III. (I, II, III.)

291. Advanced Food Science Seminar (1)
Seminar—1 hour. Prerequisite: completion of at least one quarter of course 290. Oral presentation of student’s original research, discussion, and critical evaluation. (S/U grading only.) —III. (III.)

298. Group Study (1-5)
(S/U grading only)

299. Research (1-12)
(S/U grading only)

Professional

396. Teaching Assistant Training Practicum (1-4)
Prerequisite: graduate standing. May be repeated for credit. (S/U grading only.) —I, II, III. (I, II, III.)

Food Service Management

(College of Agricultural and Environmental Sciences)

Faculty. See under the Department of Nutrition, on page 454.

The Major Program and Graduate Study. Food Service Management is incorporated within the major of Clinical Nutrition. If you are interested in preparing for a career in commercial organizations such as hotels, restaurants, industrial cafeterias, or contract food services, as well as in public or private institutions such as hospitals, correctional institutions, schools, or colleges, consult the Department of Nutrition.

Related Courses. See Nutrition.

Courses in Food Service Management (FSM)

Questions pertaining to the following courses should be directed to the instructor or to the Nutrition Department Advising office in 3202 Meyer Hall 530-752-2512.

Upper Division

120. Principles of Quantity Food Production (4)
Lecture—3 hours; independent study—1 hour. Prerequisite: Food Science and Technology 100B and 101B. Restricted to upper division Clinical Nutrition students only. Fundamental principles of food service management, including quantity food preparation, institutional equipment, receiving and storage, service, menu planning, merchandising, and safety. Students will earn food safety certification. —II. (II.) Frank

120L. Quantity Food Production Laboratory (2)
Laboratory—6 hours. Prerequisite: course 120. Laboratory experience in quantity food production and service. —II. (II.) Frank

122. Food Service Systems Management (3)
Lecture—3 hours. Prerequisite: Agricultural and Resource Economics 112, courses 120, 120L, 121. Principles of quantity food production management: production schedules, portion control, financial management, layout and equipment planning, evaluation of alternative systems, and computer applications. —II. (II.) Frank

192. Internship (1-12)
Internship—3.36 hours. Prerequisite: one upper division course in Food Service Management and consent of instructor. Work experience on or off campus in practical aspects of food service management, supervised by a faculty member. (P/NP grading only.) —Steinberg

197T. Tutoring in Food Service Management (1-2)
Discussion/laboratory—3 or 6 hours. Prerequisite: Dietetics or related major; completion of the Food Service Management course in which tutoring is done. Tutoring of students in food service management assistance with discussion groups or laboratory sections; weekly conference with instructor in charge of course; written evaluations. May be repeated if tutoring a different course. (P/NP grading only.) —Steinberg

198. Directed Group Study (1-5)
(P/NP grading only)—Steinberg

199. Special Study for Advanced Undergraduates (1-5)
(P/NP grading only)—Steinberg