**Food Science (FDSC)**

**Faculty**

Griffiths Odhiambo Atungulu, Assistant Professor  
Jamie I. Baum, Assistant Professor  
Franck Carbonero, Assistant Professor  
Philip G. Crandall, Professor  
Kristen Elizabeth Gibson, Associate Professor  
Navam S. Hettiarachchy, University Professor  
Luke R. Howard, Professor  
Sun-Ok Lee, Associate Professor  
Jean-François Meullenet, Professor, Endowed Professorship in Food Sensory Science  
Ruben O. Morawicki, Associate Professor  
Andy Proctor, University Professor  
Steven C. Ricke, Professor, Donald “Buddy” Wray Chair in Food Safety  
Han-Seok Seo, Associate Professor  
Terrence J. Siebenmorgen, Distinguished Professor  
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Department of Food Science website (http://food-science.uark.edu)

**Degrees Conferred:**  
M.S.; Ph.D. (FDSC)

**Program Description:** The M.S. and Ph.D. programs in Food Science provide students with graduate education and research experience, both fundamental and applied, aimed at enhancing production and processing techniques, assuring food safety, utilizing co-products of food processing, improving the sensory and nutritional quality of food and understanding the role of nutrition in health and disease. Interdisciplinary faculty with comprehensive expertise in the food and food-related sciences, along with state-of-the-art facilities, are capable of addressing the most complex fundamental and applied research problems.

**Primary Areas of Faculty Research:** Post-harvest technologies; food engineering; new value-added products and process development; methodology and assessment of quality attributes of raw and processed foods; food biochemistry; food microbiology; food processing and packaging; lipid, protein, and carbohydrate chemistry; food enzymology; functional foods; nutraceuticals; food safety; sensory analysis, human nutrition and chronic diseases.

**Master of Science Degree in Food Science**

**Admission to Master of Science Degree Program:** The student must have a B.S. degree from an accredited institution with a grade-point average of no less than 3.00, GRE score of 146 verbal, 144 quantitative and 4.0 writing, suitable preparation in food science or related areas, and be acceptable to the department. International students must also have a TOEFL score of no less than 237 (computer)/580 (paper)/92 (Internet) and no less than 4.5/6 on the TWE score of the TOEFL test.

**Requirements for the Master of Science Degree:** A minimum of 24 semester hours of course work and 6 semester hours of thesis are required for the M.S. degree. Course deficiencies, if any, will be identified at the time of acceptance. At least 14 course credits of the 24 credits required must be from 5000-level or higher courses. In addition to coursework, the student will be required to conduct research and prepare an acceptable thesis. Upon admission to this program the candidate will be assigned to a thesis director, who in consultation with the department head will select a graduate committee. This committee will assist with developing a suitable program for the candidate and will serve as the examination committee.

Students should also be aware of Graduate School requirements with regard to master’s degrees (http://catalog.uark.edu/graduatecatalog/degreerequirements/#mastersdegreecontents).

**Doctor of Philosophy Degree in Food Science**

**Admission to Doctor of Philosophy Degree Program:** Applicants for acceptance into the interdepartmental doctoral program in food science must meet all of the requirements for admission to the Graduate School and the Department of Food Science. Students with a research thesis M.S. degree in Food Science or related sciences from an accredited institution should have an M.S. GPA of no less than 3.5. Students with a B.S. will be considered for the Ph.D. program if their UGPA is no less than 3.65 and they have had research experience with publishable research results. All applicants to the Ph.D. program (B.S. and M.S.) should have a GRE score of 153 verbal, 148 quantitative and 4.0 writing, suitable preparation for the food science graduate program, and be acceptable to the department. International students must also have a TOEFL score of no less than 237 (computer)/580 (paper)/92 (Internet) and no less than 4.5/6.0 on the TWE score of the TOEFL test.

**Requirements for the Doctor of Philosophy Degree:** Upon acceptance to this program, the student will be assigned to a dissertation director from the department representing the student’s selected area of concentration. The dissertation director in consultation with the student and with the department head will select at least two suitable graduate faculty members from outside the student’s own department to complete a committee of five members. The doctoral advisory committee chaired by the dissertation director will be responsible for supervision of the student’s program development, and will serve as the examination committee for candidacy and final examinations.

The student’s course work and dissertation topic will be supervised by the doctoral advisory committee. For students holding an M.S. degree in a science discipline and aside from deficiencies identified upon acceptance to the program, a minimum of 24 semester hours of course credit and a minimum of 18 semester hours of Ph.D. dissertation research credit will be required. Requirements include a minimum of 18 hours of 5000- and 6000-level courses. For students holding a B.S. degree and aside from deficiencies identified upon acceptance to the program, a minimum of 42 semester hours of course credit and a minimum of 18 semester hours of...
Ph.D. dissertation research credit will be required. Requirements include a minimum of 30 hours of 5000- and 6000-level courses and up to six hours from the Food Science core courses can be counted toward the 42 hours. The student must maintain a grade-point average of 3.00 or higher. General requirements pertaining to the declaration of intent, admission to candidacy and residency are in accordance with the requirements set forth by the Graduate School of the University of Arkansas.

Students should also be aware of Graduate School requirements with regard to doctoral degrees (http://catalog.uark.edu/graduatemajor/ degreerequirements/#phdandedddegreetext).

Courses
FDSC 5001. Seminar (Sp, Fa). 1 Hour.
Presentation and discussion of graduate student research. Prerequisite: Graduate standing.

FDSC 509V. Special Problems Research (Sp, Su, Fa). 1-4 Hour.
Original investigation on assigned problems in food science. Prerequisite: Graduate standing.

FDSC 5111L. Food Analysis Lab (Sp). 1 Hour.
(Formerly FDSC 4111L.) Laboratory exercises providing students with experience of analytical techniques and instrumentation used in food analysis. Laboratory 3 hours per week. Graduate degree credit will not be given for both FDSC 4111L and FDSC 5111L. Corequisite: FDSC 4113 or FDSC 5113 (formerly FDSC 4113). Prerequisite: FDSC 4304 or FDSC 5304 (formerly FDSC 4304) and CHEM 1123 and CHEM 1121L and CHEM 2613 and CHEM 2611L or (CHEM 3603 and CHEM 3601L).

FDSC 5113. Food Analysis (Sp). 3 Hours.
(Formerly FDSC 4113.) Methods of analysis, instrumentation, and laboratory techniques for measuring the chemical composition of raw and value-added products. Lecture 3 hours. Graduate degree credit will not be given for both FDSC 4113 and FDSC 5113. Corequisite: FDSC 4111L or FDSC 5111L (formerly FDSC 4111L). Prerequisite: FDSC 4304 or FDSC 5304 (formerly FDSC 4304) and CHEM 1123 and CHEM 1121L and CHEM 2613 and CHEM 2611L or (CHEM 3603 and CHEM 3601L).

FDSC 5212L. Food Microbiology Lab (Fa). 1 Hour.
(Formerly FDSC 4212L.) A hands-on laboratory course designed to teach students microbiological techniques and certain enumeration and plating techniques of specific food spoilage and pathogenic bacteria. Graduate degree credit will not be given for both FDSC 4212L and FDSC 5212L. Pre- or Corequisite: FDSC 4212 or FDSC 5212 (formerly FDSC 4212).

FDSC 5212. Food Microbiology (Fa). 2 Hours.
(Formerly FDSC 4212.) The study of food microbiology including classification/taxonomy, contamination, preservation and spoilage of different kinds of foods, pathogenic microorganisms, food poisoning, sanitation, control and inspection and beneficial uses of microorganisms. Graduate degree credit will not be given for both FDSC 4212 and FDSC 5212. Prerequisite: BIOL 2013 and 2011L or BIOL 2533.

FDSC 5223. Food Biosecurity (Irregular). 3 Hours.
This course is the study of the security of agricultural products and the protection of our food supply from intentional and accidental, domestic and international contamination. Prerequisite: Graduate standing.

FDSC 5304. Food Chemistry (Fa). 4 Hours.
(Formerly FDSC 4304.) Water, carbohydrates, lipids, proteins, vitamins, and minerals in foods; biochemical and functional properties, enzymes, food additives (emulsifiers, pigments, colors, flavors, preservatives, and sweeteners) and texture as related to properties in food systems and during processing. Lecture 3 hours, laboratory 3 hours per week. Graduate degree credit will not be given for both FDSC 4304 and FDSC 5304. Corequisite: Lab component. Prerequisite: CHEM 1123 and CHEM 1121L and CHEM 2613 and CHEM 2611L or (CHEM 3603 and CHEM 3601L).

FDSC 531V. Internship in Food Science (Sp, Su, Fa). 1-4 Hour.
(Formerly FDSC 431V.) The Food Science Internship is a supervised practical work experience with a food industry, research program or governmental agency to gain professional experience and insight into career opportunities. Graduate degree credit will not be given for both FDSC 431V and FDSC 531V. Prerequisite: Completion of first year of graduate studies and instructor consent. May be repeated for up to 4 hours of degree credit.

FDSC 5333. Molecular Biology Techniques Applied to Nutrition and Food Science (Fa). 3 Hours.
This course will provide advanced knowledge on current molecular biology techniques and how they can be used in nutrition and food science. A specific emphasis will be given on learning how to understand and interpret results generated through these methods. Therefore, the course is of interest to a wider audience, as such analytic skills are valuable for a diverse array of disciplines. Methods covered will include DNA and RNA-based techniques (PCR, microarrays, sequencing, genomics and metagenomics), protein-based techniques (blots, proteomics) and other molecules-based techniques (metabolomics, immunoblots). Prerequisite: Graduate standing.

FDSC 5413. Sensory Evaluation of Food (Fa). 3 Hours.
(Formerly FDSC 4413.) Principles and procedures for sensory evaluation of food. Appropriate uses of specific tests are discussed, along with physiological, psychological, and environmental factors affecting sensory verdicts. Lecture 2 hours, laboratory 2 hours per week. Graduate degree credit will not be given for both FDSC 4413 and FDSC 5413. Corequisite: Lab component. Prerequisite: STAT 2023 or WCOB 1033 or AGST 4023 or AGST 5023 (formerly AGST 4023) or STAT 2023 or PSYC 2013.

FDSC 5423. Foodborne Diseases (Odd years, Su). 3 Hours.
This course will introduce students to the major pathogens associated with foodborne diseases, their epidemiology, and approaches to outbreak investigation and control of foodborne illness. An emphasis will be placed on understanding the relationships between the host, the etiologic agent, and the environment as they relate to disease causation. The student will gain knowledge through lectures, case studies, readings, and an individual project. Prerequisite: BIOL 1543 or equivalent.

FDSC 5503. Safety and Sanitation for the Food Industry (Irregular). 3 Hours.
This web-based course will provide an appreciation of the need for sanitation in food processing and increase the students' knowledge of sanitary techniques. Prerequisite: CHEM 1123 and CHEM 1121L and CHEM 2613 and CHEM 2611L or (CHEM 3603 and CHEM 3601L).

FDSC 5563. Experiencing the Food Industry (Irregular). 3 Hours.
(Formerly FDSC 4563.) This course will expose students to the food industry by providing insight into the food processing, packaging, distribution and retailing components of the food industry. The course will include local and regional food industry related tours. Graduate degree credit will not be given for both FDSC 4563 and FDSC 5563. May be repeated for up to 6 hours of degree credit.
FDSC 5713. Product Innovation for the Food Scientist (Sp). 3 Hours. 
(Formerly FDSC 4713.) This is a capstone course integrating knowledge developed in Food Science to the development of new food products. This course will take an integrated multidisciplinary approach to developing innovative food products and will provide learning experiences in new product development and Research & Development. Topics include product formulation, ingredient interactions, sensory analysis, packaging, labeling, food safety and food law. Graduate degree credit will not be given for both FDSC 4713 and FDSC 5713. Corequisite: Lab component. Pre- or Corequisite: FDSC 4113 or FDSC 5113 (formerly FDSC 4113) and FDSC 4111L or FDSC 5111L (formerly FDSC 4111L). Prerequisite: FDSC 4304 or FDSC 5304 (formerly FDSC 4304), FDSC 3103, and FDSC 4413 or FDSC 5413 (formerly FDSC 4413).

FDSC 5754. Engineering Principles of Food Processing (Even years, Sp). 4 Hours. 
(Formerly FDSC 4754.) Basic mechanics of refrigeration, temperature controls, materials handling and mechanical problems as applied to foods and food processing. Lecture 3 hours, laboratory 3 hours per week. Graduate degree credit will not be given for both FDSC 4754 and FDSC 5754. Corequisite: Lab component. Prerequisite: MATH 1213, PHYS 2013, and PHYS 2011L.

FDSC 5823. Principles of Food Microbiology (Irregular). 3 Hours. 
(Formerly FDSC 4823.) This web-based course is a study of the fundamentals of food microbiology to include its history, classifications, spores and their importance, and the most common and serious pathogenic food microorganisms. Fermentation, spoilage microorganisms and control methodology are also discussed. Graduate degree credit will not be given for both FDSC 4823 and FDSC 5823.

FDSC 600V. Master's Thesis (Sp, Su, Fa). 1-6 Hour. 
Master's Thesis. Prerequisite: Graduate standing. May be repeated for degree credit.

FDSC 602V. Special Topics (Irregular). 1-3 Hour. 
Discussions focused on selected topics of particular fields of raw product physiology and food processing, chemistry, physiology, microbiology, evaluation, sensory analysis and preservation. Prerequisite: Graduate standing. May be repeated for degree credit.

FDSC 6033. Food Biochemistry (Odd years, Fa). 3 Hours. 
Biochemical characteristics, functions, regulation and impact of components in raw and processed foods of plant origin. Lecture/discussion 3 hours per week. Prerequisite: CHEM 3813.

FDSC 6123. Food Carbohydrate Chemistry (Even years, Fa). 3 Hours. 
Focus is on carbohydrate chemistry including molecular structures and physical properties, production and food applications, analytical methods for food carbohydrates, and interactions among food polysaccharides. Prerequisite: FDSC 4304 or FDSC 5304 (formerly FDSC 4304).

FDSC 6133. Food Lipid Chemistry (Odd years, Sp). 3 Hours. 
Chemistry and technology of commercial fats and oils in food systems with discussion of lipid changes affecting food quality and human health. Prerequisite: FDSC 4304 or FDSC 5304 (formerly FDSC 4304).

FDSC 6143. Advanced Food Processing and Packaging and their Environmental Impact (Even years, Sp). 3 Hours. 
The course is directed to graduate students in food science and related fields. Students will learn advanced food processing technologies and packaging as well as the environmental issues associated to food production, processing, and distribution. Prerequisite: FDSC 3103 or equivalent, or food processing/engineering background with knowledge of basic food processing operations.

FDSC 6323. Nutraceuticals and Functional Foods (Even years, Sp). 3 Hours. 
Course will include past, present and future of nutraceuticals and functional foods, chemistry, mechanism, novel technologies, nutrigenomics, processing, healthy lifestyle, regulation, safety, marketing, international aspects, and industry project. Prerequisite: CHEM 2613 (or CHEM 3603) and CHEM 3813 and FDSC 4304 or instructor consent.

FDSC 6333. Food Protein Chemistry and Functionality (Odd years, Sp). 3 Hours. 
This course is a study in advanced food protein chemistry, including molecular structures, characterization, physicochemical bases of food protein functionality, structure-function relationship, processing technologies to improve functionality, as well as hands-on experiences with timely, practical projects related to food proteins. Lecture and problem solving projects for 3 hours per week. Pre- or Corequisite: FDSC 4304 or FDSC 5304 (formerly FDSC 4304).

FDSC 6403. Epidemiologic Principles in Food Safety and Public Health (Even years, Fa). 3 Hours. 
This course will provide an introduction to epidemiologic methods used in foodborne disease outbreak investigations. The importance of surveillance systems in detecting outbreaks and in the development of effective disease prevention and control strategies will also be presented. An emphasis will be placed on understanding the relationships between the host, the etiologic agent, and the environment as they relate to disease causation. In addition, molecular methods utilized for the identification of etiologic agents will be discussed. Selected important foodborne diseases will be discussed in detail to clarify the role of epidemiology in understanding the pathogenesis of infectious processes in individuals and communities. Prerequisite: FDSC 4122 or FDSC 5122 (formerly FDSC 4122) or equivalent.

FDSC 6443. Metabolism of Xenobiotics (Even years, Fa). 3 Hours. 
This course is designed to provide in-depth knowledge of the integration of molecular, cellular, and physiologic aspects of xenobiotics (e.g phytochemicals)/micronutrients and metabolism. This course will also discuss the current understanding of the mechanism and regulation of gene expression by xenobiotics/micronutrients. Examination of current research literature to understand how xenobiotics/micronutrients and physiological states metabolize and influence gene expression, as well as the research methodology used to address these relations. Prerequisite: CHEM 3813.

FDSC 700V. Doctoral Dissertation (Sp, Su, Fa). 1-18 Hour. 
The doctoral program in food science is an interdepartmental program offered by the departments of Food Science, Animal and Poultry Sciences, and Human Environmental Sciences. Prerequisite: Graduate standing. May be repeated for degree credit.