

The Pennsylvania State University
Department Of Food Science
Undergraduate Program Handbook

Program Year 2015

Prepared by:

The Undergraduate Program Coordinator &

Department of Food Science

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What Is Food Science?

Food Science is the application of science and technology to the development, processing, packaging, storage and distribution of food products from the farm to the consumer. This professional field covers many disciplines, including chemistry, microbiology, nutrition, and engineering. Food Science also plays an important role in the health, welfare, and economic status of individuals and nations. Food Science serves society by assuring availability, abundance, affordability, wholesomeness, and safety of food. Food Science is considered an independent professional discipline with its own professional society, *The Institute of Food Technologists* (<http://www.ift.org>).

Why Major In Food Science?

Food Science offers a lifetime vocation in the maintenance of the never-ending stream of quality food products. Food Science would be an applicable career if you are interested in the sciences and want to apply them to real-world problems. You can do this by:

- researching the biological, chemical, and physical nature of food and food components.
- developing new food products, processing methods, or distribution techniques.
- improving the nutritive value of food products.
- supervising raw material procurement or managing any aspect of a food processing operation.
- maintaining high standards of safety and sanitation and managing quality of an ever-increasing variety of food products.

What Are Some Career Opportunities In Food Science?

Penn State food scientists have found employment throughout the United States and around the world. Because of the constant need for qualified food scientists, salaries are generally equal to or higher than salaries of other professions requiring equivalent levels of education. The following listing provides insight into the types of positions available.

Product Development: Graduates are involved in developing new food products or improving the quality, performance, and/or safety of existing products. These positions require a creative flair, sensory evaluation expertise, and the ability to work in teams.

Research and Development: Persons employed in research and development for a food company use their microbiology, chemistry, engineering, or nutrition skills to investigate scientific principles and phenomena as they pertain to specific food components, food products, or food processes.

Technical Support: Graduates in technical support combine their knowledge of raw materials and ingredients with food processing applications. Often they work closely with product development specialists in the manufacture of food products.

Management: Managers of manufacturing facilities are involved in the organization, operation, and development of food processing companies. Their key role is to oversee employees and operations in the processing of specific foods.

Quality Assurance: Quality assurance and quality control specialists analyze the components of food products and monitor the finished product for conformity to company and government standards.

Regulation: Graduates are involved at the state or federal government level with agencies such as the USDA, FDA, EPA, Homeland Security and the Patent Office. Positions include policy development, enforcing food sanitation and labeling regulations, or ensuring the safety of the U.S. food supply.

Extension Education: Extension educators specializing in food safety, food processing, or human nutrition use a variety of educational methods, including group meetings, workshops, mass media, and electronic methods, to deliver educational information.

International: Many larger food companies are multinational and employ graduates with international experience or who speak multiple languages. Graduates looking to expand their horizons can be involved with helping citizens of developing nations improve their food handling and storage procedures through agencies such as the Food and Agriculture Organization, World Health Organization, or the Peace Corps.

Academia: Food scientists with an interest in teaching and research may find rewarding scholarly careers in educational institutions. An academic career usually requires an advanced degree and research specialization in a particular area, such as food chemistry, microbiology, toxicology, engineering or nutrition.

What Are The Course Requirements For A Food Science Major?

Prerequisite courses in chemistry, mathematics, physics, biology and microbiology are usually completed within the first two years of the program. These courses are a vital part of the curriculum. These prerequisite courses ensure that the student has the necessary background in each discipline to understand how to connect and apply them to food. Supporting courses are chosen according to your academic and career interests, and allow you to individualize your academic experience. For the full list of all required courses, see the recommended academic plan on the next page.

Recommended Academic Plan for Food Science (FD SC) at University Park

Effective Date: Fall 2015

SEMESTER 1 (Fall)

COURSE DETAILS	CREDITS
CHEM 110 Chemical Principles I †	3
CHEM 111 Experimental Chemistry I †	1
BIOL 110 Biology: Basic Concepts and Biodiversity †	4
ENGL 015 Rhetoric and Composition or ENGL 030 Honors Freshman Composition †	3
First-Year Seminar	2
Social and Behavioral Sciences (GS) ¹	3

SEMESTER 2 (Spring)

COURSE DETAILS	CREDITS
MATH 110 Techniques of Calculus I or MATH 140 Calculus with Analytic Geometry I †	4
CHEM 112 Chemical Principles II †	3
CHEM 113 Experimental Chemistry II	1
Social and Behavioral Sciences (GS) ¹	3
Health and Physical Activity (GHA) ¹	3
Arts (GA) ¹	3

SEMESTER 3

COURSE DETAILS	CREDITS
CHEM 202 Fundamentals of Organic Chemistry I or CHEM 210 Organic Chemistry I	3
FD SC 200 Introductory Food Science*	3
FD SC 201 Introductory Food Science Practicum*	1
MICRB 201 Introductory Microbiology	3
MICRB 202 Introductory Microbiology Laboratory	2
Humanities (GH) ¹ (IL) ²	3
TOTAL CREDITS	15

SEMESTER 4

COURSE DETAILS	CREDITS
CHEM 203 Fundamentals of Organic Chemistry II or CHEM 212 Organic Chemistry II AND CHEM 213 Laboratory in Organic Chemistry	3 or 5
B M B 211 Elementary Biochemistry	3
PHYS 250 Introductory Physics I	4
Arts (GA) ¹	3
STAT 250 Introduction to Biostatistics or STAT 240 Introduction to Biometry †	3
TOTAL CREDITS	16 or 18

SEMESTER 5

COURSE DETAILS	CREDITS
FD SC 400 Food Chemistry*	4
FD SC 408 Food Microbiology*	2
FD SC 409W Laboratory in Food Microbiology*	3
B M B 212 Elementary Biochemistry Laboratory	1
ENGL 202C Effective Writing: Technical Writing or ENGL 202D Effective Writing: Business Writing †	3
CAS100A Effective Speech †	3
TOTAL CREDITS	16

SEMESTER 6

COURSE DETAILS	CREDITS
FD SC 405 Food Engineering Principles*	3
FD SC 410 Chemical Methods of Food Analysis*	3
FD SC 406 Physiology of Nutrition*	3
Humanities (GH) ¹ (US) ²	3
Career Interest Course (see page 10)	2
Career Interest Course (see page 10)	3
TOTAL CREDITS	17

SEMESTER 7

COURSE DETAILS	CREDITS
FD SC 413 Science and Technology of Plant Foods	3
FD SC 411 Managing Food Quality	2
Career Interest Course	3
Career Interest Course	3
Elective	3
TOTAL CREDITS	14

SEMESTER 8

COURSE DETAILS	CREDITS
FD SC 414 Science and Technology of Dairy Foods	3
FD SC 415 Science and Technology of Muscle Foods	3
FD SC 430 Unit Operations in Food Processing	3
Career Interest Course	3
Elective	3
TOTAL CREDITS	15

*Course requires a grade of C or better

†Course satisfies General Education and degree requirements

¹The general education courses not covered by the food science curriculum are the Humanities (GH), Arts (GA), Health and Physical Activities (GHA), and Social and Behavioral Sciences (GS). These courses may be taken in any semester and in any order, but they must each have a total of 6 credits, with the exception of the GHA, which needs a total of 3 credits.

²Three credits of both the United States Cultures (US) and International Cultures (IL) requirements are needed for graduation. These credits may be satisfied by any course that offers the US or IL curriculum, but six credits must be taken (one course that satisfies both IL and US requirements will only be used for one or the other).

What Undergraduate Courses Are Offered By The Department Of Food Science?

Course titles followed by (*) indicate required courses.

Course titles followed by (**) indicate career interest courses.

Pay particular attention to the pre-requisites for the required courses and plan your schedule accordingly!

FD SC 105 Food Facts and Fads (GHA, 3 cr.) Professor: Milillo
Impact of society and the individual on modern food technology, food laws, additives, etc.; historical, current, futuristic aspects. *(Fall, Spring and Summer)*

FD SC 200. Introductory Food Science* (3 cr.) Professor: Milillo
General overview and principles; food constituents and properties; quality and safety; preservation methods; processing animal and plant products. *(Fall only)*
Prerequisite: CHEM 110

FD SC 201. Introductory Food Science Practicum* (1 cr.) Professor: Ziegler
Demonstrations to illustrate actual chemical reactions in food systems and visits to campus and area food production and processing operations. *(Fall only)*
Prerequisite or concurrent: FD SC 200.

FD SC 207. (AN SC 207) Animal Products Technology** Professor: Mills
Composition, safety, palatability, preservation, and processing of foods from animals; impact of animal production and handling practices on product properties. *(Fall only)*

FD SC 208. (AN SC 208) Animal Products Technology Laboratory** Professor: Mills
Harvesting and processing of foods from animals; demonstrations and hands-on exercises; industry procedures for processing meat, milk, and egg products. *(Fall only)*
Prerequisite or concurrent: AN SC 207

FD SC 400. Food Chemistry* (4 cr.) Professor: Coupland
Chemical properties of food constituents as influenced by processing and storage. Selected experiments and demonstrations to illustrate chemical reactions of importance in foods. *(Fall only)*
Prerequisite or concurrent: CHEM 202, BMB 211, BMB 212

FD SC 404. Sensory Evaluation of Foods** (3 cr.) Professor: Hayes
Sensory evaluation of food, methods of test analysis, panel selection and training, taste sensation theory, consumer testing methods. *(Fall only)*
Prerequisite: STAT 250 or STAT 240.

FD SC 405. Food Engineering Principles* (3 cr.) Professor: Anantheswaran
Engineering principles of importance to food manufacturing, including units, dimensions, mass and energy balance, fluid flow, rheology, heat transfer, and psychrometrics. *(Spring Only)*
Prerequisites: MATH 110, PHYS 250

FD SC 406. Physiology of Nutrition* (3 cr.) Professor: Lambert/Keller
Physiological mechanisms involved in thirst and appetite, digestion, absorption, utilization of nutrients, respiration, and body temperature regulation.

- Prerequisite:** B M B 211 (Spring only)
- FD SC 407. Food Toxins**** (2 cr.) Professor: Lambert
Microbiological and chemical aspects of food poisoning; toxicological principles; case histories and prevention of problems.
- Prerequisite:** senior standing in food science or related majors (Fall only)
- FD SC 408. Food Microbiology*** (2 cr.) Professor: Dudley
Significance of microorganisms in food commodities, microbial spoilage, food-borne infections, and intoxications; methods of preservation, processing, and control. **Prerequisite:** MICRB 201, 202. (Fall only)
- FD SC 409W. Food Microbiology Laboratory*** (3 cr.) Professor: Doores
Writing intensive course that covers methods of isolation and detection of spoilage and pathogenic microorganisms in foods; effects of processing and preservation on survival of food microorganisms.
- Prerequisite:** MICRB 202. **Prerequisite or concurrent:** FD SC 408. (Fall and Spring)
- FD SC 410. Chemical Methods of Food Analysis*** (3 cr.) Professor: Vanamala
Qualitative and quantitative determination of food constituents.
- Prerequisite:** BMB 212, FD SC 400. (Spring only)
- FD SC 411. Managing Food Quality*** (2 cr.) Professor: Ziegler
Principles and applications of Hazard Analysis Critical Control Points. Statistical tools for the control and improvement of food quality.
- Prerequisite:** FDSC 408, STAT 250. (Fall only)
- FD SC 413. Science and Technology of Plant Foods*** (3 cr.) Professor: Elias
Physical and chemical behavior of plant-based raw materials and ingredients, with emphasis on parameters influencing finished product quality.
- Prerequisite:** FD SC 400, 405, 408, 410. (Fall only)
- FD SC 414. Science and Technology of Dairy Foods*** (3 cr.) Professor: Harte
Physical and chemical behavior of dairy-based raw materials and ingredients, with emphasis on parameters influencing finished product specifications.
- Prerequisite:** FD SC 400, 405, 408, 410. (Spring only)
- FD SC 415. Science and Technology of Muscle Foods*** (3 cr.) Professor: Mills
Physical and chemical behavior of muscle food commodities, with emphasis on muscle-based ingredients in formulated foods.
- Prerequisite:** FD SC 400, 405, 408, 410. (Spring only)
- FD SC 430. Unit Operations in Food Processing*** (3 cr.) Professor: Anantheswaran
Thermal processing, refrigeration, freezing, dehydration, and concentration in the food industry, including effects on food quality, food packaging and waste management.
- Prerequisite:** FD SC 400, 405, 408. (Spring only)
- FD SC 495. Internship**** Professor: Doores
Supervised off-campus, non-group instruction including field experiences, practical, or internships. Written and oral critique of activity required.

Prerequisite: PRIOR APPROVAL REQUIRED

(All Semesters)

FD SC 496. Independent Studies**

Various instructors

Creative projects, including research and design, which are supervised on an individual basis and which fall outside the scope of formal courses. A specific title may be used in each instance and will be entered on the student's transcript. Students must discuss with an advisor. *(All semesters)*

FD SC 497. Special Topics**

Various instructors

Formal courses given infrequently to explore, in depth, a comparatively narrow subject which may be topical or of special interest. Several different topics may be taught in one year or semester. A specific title may be used in each instance and will be entered on the student's transcript. Students must discuss with an advisor. *(Semester varies)*

What Career Interest Courses Are Available To The Food Science Major?

Career Interest courses are chosen according to a student's career goals. These courses allow the student to individualize his or her academic experience. **Any course that will help prepare students for their specific career goal can be considered a career interest course, as long as it has been discussed with their advisor.** Common Career Interest courses are listed below. The number of career interest course credits required varies between 12 and 14 credits (see p. 5). Please refer to the University Bulletin for the most up to date listings.

<http://bulletins.psu.edu/bulletins/bluebook/>

FD SC Career Interest Courses		
Department	Course number	Title
FD SC	404	Sensory evaluation of foods
FD SC	407	Food toxins
Interest in Business		
Department	Course number	Title
AG	400	Biometry/statistics in the life sciences
ACCTG	211	Financial and managerial accounting for decision making
AG BM	102	Economics of the food system
AG BM	106	Agribusiness problem solving
AG BM	200	Introduction to agricultural business management
AG BM	302	Food product marketing
AG BM	320	Markets and prices: analysis and forecasting
AG BM (IL)	338	Agribusiness in the global economy
AG BM	440	Food product innovation management
AG BM	460	Managing the food system
B A	250	Small business management
B LAW	243	Legal environment of business
I B	403	International business and national policies
FIN	100	Introduction to finance
MGMT	100	Survey of management
MKTG	220	Introduction to selling techniques
MKTG	221	Contemporary American marketing

MKTG	301	Principles of marketing
MKTG	342	Marketing research
Interest in Plant Science and the Environment		
Department	Course number	Title
AGECO	134	Sustainable agriculture science and policy
BIOTC (AGRO)	460	Advances and applications of plant biotechnology
AGRO (BIOTC)	460	Advances and applications of plant biotechnology
AN SC	100	Introduction to Animal Industries
E R M	210	Environmental factors and their effect on your food supply
E R M	431	Environmental toxicology
HIST (NUTR)	230	American food system: history/technology and culture
HORT	101	Horticultural science
HORT	412W	Post-harvest physiology
Interest in Microbiology, Cell Biology		
Department	Course number	Title
B M B	251	Molecular and cell biology I
B M B (MICRB)	252	Molecular and cell biology II
B M B	401	General biochemistry
B M B	402	General biochemistry
B M B (VB SC)	433	Molecular and cellular toxicology
BIOTC (MICRB)	416	Microbial biotechnology
BIOTC	479	Methods in biofermentations
CHEM	450	Physical chemistry - thermodynamics
CHEM	452	Physical chemistry – quantum chemistry
MICRB (B M B)	251	Molecular and Cell Biology I
MICRB (BMB)	252	Molecular and cell biology II
MICRB	401	Microbial physiology and structure
MICRB	410	Principles of immunology
MICRB	412	Medical microbiology
MICRB	413	Microbial diversity
MICRB	415	General virology: bacterial and animal viruses
MICRB (BIOTC)	416	Microbial biotechnology
MICRB	421W	Laboratory of general and applied microbiology

MICRB	422	Medical microbiology laboratory
VB SC	303	Principles of animal disease
VB SC	430	Principles of toxicology
VB SC (B M B)	433	Molecular and cellular toxicology
BIOL	141	Introductory Physiology
BIOL	142	Physiology laboratory
Interest in Nutrition & Public Policy		
Department	Course number	Title
NUTR	120	Food preparation
NUTR (HIST)	230	American food system: history/technology and culture
NUTR (US, IL)	421	Food culture and health trends
NUTR (IL)	430	Global food strategies; problems and prospects for reducing world hunger
NUTR	451	Nutrition throughout the life cycle
NUTR	452	Nutritional aspects of disease
PL SC	460	Science, technology, and public policy
R SOC (AGECO)	134	Sustainable agriculture science and policy
Interest in Technology and Computing		
Department	Course number	Title
CMPS	101	Introduction to C++ programming
IST	210	Organization of data
MATH	111	Techniques of calculus II
MATH	141	Calculus with analytic geometry II

Who Are the Department of Food Science Faculty Members and What Are Their Research Interests?

Robert F. Roberts, Ph.D. (University of Minnesota) Department Head and Professor of Food Science. Technology of dairy products processing. E-mail address: rfr3@psu.edu

Ramaswamy C. Anantheswaran, Ph.D. (Cornell University) Professor of Food Science. Microwave processing of foods; Dielectric properties of food materials; Ingredient interactions during microwave heating of foods; Moisture and fat migration in confectionery products; Modified atmosphere and modified humidity packaging of fresh produce; Rapid cooling of shell eggs. E-mail address: rca3@psu.edu

C. Daniel Azzara, Ph.D. (Pennsylvania State University) Alan R. Warehime Professor of Agribusiness. Email address: cxa22@psu.edu

John N. Coupland, Ph.D. (University of Leeds) Professor of Food Science. Physical chemistry of foods. Food emulsions and biopolymers and their behavior during processing. Ultrasonic sensors. E-mail address: jnc3@psu.edu

Catherine N. Cutter, Ph.D. (Clemson University) Professor of Food Science. Processing and manufacturing of muscle foods with an emphasis on food safety; pathogen reduction, application of antimicrobials or interventions to muscle foods; understanding the mechanisms of bacterial attachment to muscle foods. E-mail address: cnc3@psu.edu

Stephanie Doores, Ph.D. (University of Maryland) Associate Professor of Food Science. Growth and survival of *Listeria monocytogenes* in food, particularly dairy and meat products; predicting the thermal kinetics and destructive force of microwave heating on food-borne pathogens; characterization of *Sporolactobacillus* and other *Bacillus-Lactobacillus* intermediates. E-mail address: sxd11@psu.edu

Edward G. Dudley, Ph.D. (University of Wisconsin) Associate Professor of Food Science. Molecular biology and genomics of foodborne pathogens. Mechanisms of environmental survival and pathogenicity of *Escherichia coli* O157:H7 and enteroaggregative *Escherichia coli*. Molecular biology methods of detecting and characterizing bacteria in food. Email address: egd100@psu.edu

Ryan J. Elias, Ph.D. (University of Massachusetts) Frederik Sr. and Faith E. Rasmussen Professor of Food Science, Associate Professor of Food Science. Free radical chemistry of foods: Metal-catalyzed lipid and protein oxidation in complex foods; development and evaluation of novel antioxidants; oxidative stability of wine and beer. E-mail address: rje12@psu.edu

Hassan Gourama, Ph.D. (University of Nebraska) Associate Professor of Food Science (Berks Campus). Significance of molds and mycotoxins in foods: Identification of molds, mold growth and mycotoxin production, control of mold contaminants and development of rapid detection methods for molds. Occurrence and control of bacterial pathogens in foods. E-mail address: hxg7@psu.edu

Federico Harte, Ph.D. (Washington State University) Associate Professor of Food Science.

Research focuses on: the structure-function properties of milk proteins, with a strong emphasis on casein proteins and nonthermal technologies for fluid foods: valve homogenization. Email address: fmh14@psu.edu

John Hayes, Ph.D. (University of Connecticut) Associate Professor of Food Science.

Flavor perception, behavioral genetics and food choice; impact of genetic variation on sensation and reward; understanding factors that influence consumption of food or beverages with potential health impact; acquisition of preference for initially aversive stimuli (chiles, coffee, alcohol). E-mail address: jeh40@psu.edu

Kerry E. Kaylegian Ph.D. (Cornell University) Dairy Foods Research & Extension Associate. Provides technical support and outreach programs to improve the safety and quality of value-added dairy products. International cheese and dairy product judge, and coach of the Penn State Collegiate Dairy Products Evaluation Team. Email address: kek14@psu.edu

Kathleen L. Keller, Ph.D. (Rutgers University) Assistant Professor, Nutritional Sciences and Food Science. Eating behaviors in children; neural mechanisms of taste preference and eating behaviors in children; food marketing and childhood obesity; genetic and neural influences in taste in children. Email address: klk37@psu.edu

Stephen J. Knabel, Ph.D. (Iowa State University) Professor of Food Science. Recovery and detection of injured foodborne pathogens; heat resistance of *Listeria monocytogenes*; control of food-borne pathogens; biological function of heat-shock proteins and their role in thermotolerance; microbiology of poultry, eggs, dairy products, fish, red meats and mushrooms. E-mail address: sjk9@psu.edu

Luke LaBorde, Ph.D. (University of Wisconsin) Associate Professor of Food Science. Quality and safety of minimally processed and shelf-stable fruits and vegetables. Development of food safety extension programs for fruit, vegetable, and mushroom producers. E-mail address: lf15@psu.edu

Joshua D. Lambert, Ph.D. (University of Arizona) Associate Professor of Food Science. Prevention of obesity, fatty liver disease, and cancer by dietary phytochemicals. Potential toxicities of high dose dietary polyphenols. Bioavailability and biotransformation of dietary phytochemicals. Email address: jdl134@psu.edu

Sara R. Milillo, Ph.D. (Cornell University) Instructor and Undergraduate Program Coordinator. Understanding how the bacterial foodborne pathogens *Listeria monocytogenes* and *Salmonella* Typhimurium survive within the food system and subsequently cause disease; using elements of microbiology, genetics, molecular biology, and ecology to study their pathogenicity and transmission. Email address: srm226@psu.edu

Edward Mills, Ph.D. (Purdue University) Associate Professor of Meat Science. Meat composition and processing with emphasis on prerigor processing techniques. E-mail: ewm3@psu.edu

Jairam Vanamala, Ph.D. (Texas A&M University) Associate Professor of Food Science. Food processing effects on anti-inflammatory/anti-cancer properties of foods; obesity and

cancer prevention; extraction of health-benefiting extracts/compounds from agricultural/green energy industry byproducts. Email address: juv4@psu.edu

Gregory R. Ziegler, Ph.D. (Cornell University) Professor of Food Science. Graduate Program Coordinator. Foods as composite materials. Physical properties and processing of polymeric and particulate foods, with an emphasis on chocolate and confectionery products. E-mail address: grz1@psu.edu

Who are the Supporting Staff Members and What Are Their Specialties?

Juanita Wolfe, Undergraduate Program Assistant, Department of Food Science.

Juanita Wolfe is the main support person for the undergraduate program. She is a great person to contact with any questions that you have when you do not know who else to ask! She also handles administrative paperwork, such as change of major forms, academic petition forms, and independent study forms. Jmw5@psu.edu

Jared Smith, Instructional Laboratory Support Specialist, Department of Food Science.

Jared Smith is a graduate of the Penn State Food Science program and a good resource for questions, as well as our teaching lab/pilot plant guru. If you have questions about lab equipment or questions regarding the pilot plant (including scheduling time to use it), he is a great person to ask! Jcs5324@psu.edu

Richard Rateau, Ph.D. Coordinator of Experiential Learning and Career Services, College of Agricultural Sciences.

In addition to speaking with your adviser, Dr. Rateau is a resource to turn to with any questions regarding professional development. If you are looking to get help constructing your resume or need to brush up on your interview skills, Dr. Rateau is a valuable resource. Furthermore, he has contacts with many agriculture and food related companies. He also coordinates the Ag Career Day event. Rjr20@psu.edu

What Facilities Are Available For The Teaching of Food Science?

Food Processing and Pilot Facilities

Pilot plants are available and equipped for processing of many types of foods, in particular dairy products, fruits, vegetables, mushrooms, chocolate and table wines. The Sensory Evaluation Lab includes a fully equipped kitchen and 12 testing booths.

Processing facilities for poultry consist of killing, picking, eviscerating, chilling and freezing equipment. Product development and quality control facilities are also included in this area. Federally inspected slaughter and red meat processing facilities are available to handle 20 head of cattle or 40 hogs daily and include holding pens, killing floor, refrigerated storage, cutting and processing areas, and an automated smokehouse.

The Berkey Creamery processes more than 4.5 million pounds of milk annually for the manufacture of beverage milks, frozen desserts, cheese and other processed products. The Creamery serves as a site for class projects, research and extension programs in food processing.

Research Facilities

Over twenty laboratories are available for the instruction, research, and graduate programs of the Department of Food Science. These laboratories are specifically designated and/or equipped for the study of food engineering, biotechnology, sensory evaluation, managing quality, food contaminants, food chemistry and food microbiology.

Major research equipment available includes a differential scanning calorimeter, viscometer, supercritical fluid extractor, gas- and high-pressure liquid chromatographic apparatus, spectrophotometers, color difference meters, scanning electron-, phase-contrast-, light- and fluorescence microscopes, refrigerated ultra-centrifuge, electrophoresis and electrofocusing equipment, shear presses, cryostats and continuous and batch fermentation systems.

Is There A Student Club For Food Science Majors At Penn State?

The Penn State Food Science Club was organized in 1973 to promote leadership and interest in Food Science as a profession and to foster a closer relationship among Food Science undergraduate students and faculty. The club is also open to students who wish to learn more about activities in this field. The club is an affiliated student chapter of the Institute of Food Technologists (IFT), a professional association.

The Food Science Club sponsors speakers from industry, government, and academia to acquaint students with all aspects of the field. Other activities include discussion sessions between students and Food Science faculty members, departmental delegations to Institute of Food Technologists' national and regional competitions and meetings, and other IFT-related student events. The activities in which club members are engaged include service and fund-raising projects.

What Financial Aid Is Available To Food Science Majors?

Various sources of financial aid are available to Penn State students, whether they are enrolled at University Park or at a commonwealth campus. This financial aid includes federally funded grants, loans and work-study support, such as Pell Grants, National Defense Student Loans and the College Work Study Program. In addition, state-funded grants and loans can be obtained through the Pennsylvania Higher Education Assistance Agency (PHEAA), as well as through the University. Detailed information on financial aid can be found in the Office of Student Aid, 314 Shields Building, or on the Office of Student Aid website: <http://studentaid.psu.edu>.

Financial assistance information for students in the College of Agricultural Sciences can be accessed at the College's website, <http://agsci.psu.edu/students/scholarships>. Note, there is just one application for both College and Department level scholarships. To be eligible for need-based sources of College and Departmental financial support, a FAFSA (Free Application for Federal Student Aid) form **must be on file** with the University (you do not need to file a copy of your FAFSA with the College).

In addition, a number of competitive national scholarships sponsored by the Institute of Food Technologists and other national groups are awarded annually, including entering students, pursuing a Bachelor of Science degree in Food Science. For example, information can be accessed at www.ift.org/scholarships

How Can I Enhance My Food Science Degree?

All students graduate with the same basic Food Science coursework, so what makes you stand out? The following are opportunities to enhance your degree. If any of these opportunities interest you, talk with your advisor for further information.

- Multiple Degrees (Double/Concurrent Major) – A plan of study meeting the requirements of two majors that combines two distinct fields. Depending on the second major, the credits required for graduation could necessitate additional time before graduation. The following degrees may be of interest to Food Science Students:

In the College of Agricultural Sciences:

Agribusiness Management
Agricultural Education
Animal Science
Biological Engineering
Environmental Resource Management

In other University Colleges:

Nutrition (College of Health and Human Development)
Biological Engineering (College of Engineering)

- Minor – A supplemental academic program. Students should explore the requirements of the proposed minor, then meet with an advisor from the prospective minor. The following minor programs may be of interest to Food Science students:

College of Agricultural Sciences

Agribusiness Management
Agricultural Communications
Agricultural Economics and Rural Sociology
Agricultural Systems Management
Agronomy
Animal Sciences
Arboriculture
Biological Engineering
Entrepreneurship and Innovation
Environmental and Renewable Resource Economics
Environmental Resource Management
Environmental Soil Science
Horticulture
International Agriculture
Leadership Development
Mushroom Science and Technology
Plant Pathology
Poultry and Avian Science
Youth and Family Education

College of Earth and Mineral Sciences

Polymer Science

College of Engineering
Biological Engineering
Biomedical Engineering
Engineering Leadership Development

College of Health and Human Development
Nutritional Sciences

Eberly College of Science
Biochemistry and Molecular Biology
Biology
Chemistry
Microbiology

- Independent Research (FD SC 496) – Subject to agreement by a faculty member, research can be conducted in an area of food science of interest to the student, and students can earn credit through FD SC 496 for this activity. Students should speak with an individual faculty member to determine the feasibility of a project, including scope and length of the project, the number of credits that would be appropriate, and what would be expected. Competitive funding for research can be sought through the Department of Food Science and College of Agricultural Sciences funding programs for research projects (For example, Undergraduate Student Research Award – <http://agsci.psu.edu/students/research>).
- Co-operative and Summer Internships for academic credit (FD SC 495) – Students who are interested in obtaining industry experience for academic credit. Generally, a co-op program is 6-8 months in length and spans a spring-summer or summer-fall period. This opportunity provides a more in-depth exposure for the student than a summer internship. **Students wishing to enroll in FD SC 495 should first consult with Dr. Stephanie Doores three months prior to the start of the internship.**
- Summer work experience (**sometimes referred to as “internships,” not for academic credit**) – Students are strongly encouraged to gain experience during at least one summer working for a food or food-related business, laboratory or regulatory agency. Such experiences offer insight into typical jobs a student might encounter in the field. Many food science students take a summer work experience job between their third and fourth year.
- Study Abroad – Students are often interested in spending a semester abroad. Although the department does not have any formal agreements with foreign institutions, the College and University do. For the Food Science major, it is difficult to study abroad and graduate in the four expected years. **If interested in this option, consider going abroad sophomore year (while you’re still taking mostly general education courses) and plan accordingly.** In addition, shorter length international programs are available during spring break, thanksgiving break, and summers. Anyone interested in a study abroad experience should speak with his or her advisor or, Ms. Ketja Lingenfelter, Education Abroad Advisor, 122 Agricultural Administration Building, kmw209@psu.edu
- Spanish for Students in the Field of Agricultural Sciences is a three-course sequence developed for students whose future involves working in management positions in

agricultural industries such as mushroom production, dairy, animal sciences, and poultry, to name a few. Interested students should begin researching this program early so that they can plan their travel around their major required classes
<http://agsci.psu.edu/international/study-abroad/study-abroad/embedded-courses/spanish-in-agriculture-courses-and-immersion-experience>

- Student Poster Competitions – Students have the opportunity to present their research results at the College and/or University Undergraduate Research Exposition(s) throughout the year. The Institute of Food Technologist also holds a Student Association Undergraduate Research Paper Competition.
<http://www.ift.org/community/students/competitions/undergraduate-research-paper.aspx>

How Can I Learn More About The Major?

For further information about the Food Science Major contact:

Dr. Sara Milillo
Undergraduate Program Coordinator
437 Rodney A. Erickson Food Science Building
University Park, PA 16802
E-mail: milillo@psu.edu

Or visit the Food Science Department at: <http://www.foodscience.psu.edu>

How Can I Arrange a Visit with the Department?

Schedule a visit at: <http://agsci.psu.edu/futurestudents/visit>

How Can I Learn More About How To Apply?

For information on Penn State admissions procedures contact:

Office of Admissions
The Pennsylvania State University
201 Shields Building
University Park, PA 16802

Or visit the Penn State Admissions at: <http://admissions.psu.edu>

The University is committed to equal access to programs, facilities, admission, and employment for all persons. It is the policy of the University to maintain an environment free of harassment and free of discrimination against any person because of age, race, color, ancestry, national origin, religion, creed, service in the uniformed services (as defined in state and federal law), veteran status, sex, sexual orientation, marital or family status, pregnancy, pregnancy-related conditions, physical or mental disability, gender, perceived gender, gender identity, genetic information, or political ideas. Discriminatory conduct and harassment, as well as sexual misconduct and relationship violence, violates the dignity of individuals, impedes the realization of the University's educational mission, and will not be tolerated. Direct all inquiries regarding the nondiscrimination policy to Dr. Kenneth Lehrman III, Vice Provost for Affirmative Action, Affirmative Action Office, The Pennsylvania State University, 328 Boucke Building, University Park, PA 16802-5901; email: kfl2@psu.edu; Tel 814-863-0471.