

UMassAmherst  
**FOOD**  
SCIENCE

**Undergraduate  
Handbook**

UMassAmherst

College of  
Natural Sciences

## *What is Food Science*

A major goal of the U.S. is to provide a sufficient variety of foods throughout the year to meet the energy and nutritional needs of its citizens, promote health, and export value-added food products that improve our international competitiveness and trade balance and create jobs. Our food supply must be safe and adequately preserved to maintain high quality yet must be low enough in cost for all to have access to a nutritionally adequate diet, irrespective of income. This responsibility is in the hands of the Food Scientist.

Food Scientists work on the scientific and technological aspects of processing food and related products. Using their pooled knowledge of chemistry, biochemistry, microbiology, and engineering, they create high-tech foods to reduce the risk of disease and determine how safe and nutritious our food will be and how long and well it will keep. They also explore and analyze the many questions that have to be asked -- and answered -- before a new product can go on the market.

Next time you walk into a supermarket, take a closer look at all those shelves of cereals, fruit juices, dairy products, and microwavable convenience foods. These are some everyday items available because food scientists find ways to keep plant and animal products appetizing and nutritious and stop them from spoiling.

At the international level, food scientists play a crucial role in the never-ending quest for wholesome, plentiful, inexpensive food for the world's growing population. As the United States strives to remain the world's leading food supplier, food science will continue to be vital to the food industry. Technology is the answer, and it will be up to the food scientist to provide this.

## *The advantages of being a Food Science major*

- The food processing industry is the largest manufacturing industry in the United States. Employing over 14 million people, it accounts for 20% of the gross national product.
- The Department of Food Science at the University of Massachusetts at Amherst is the oldest in the U.S. and is currently **ranked the #1 Ph.D. program in the Nation** by Academic Analytics.
- Food Science is a unique field that integrates many aspects of science and health. Each student can select from a number of options to reflect his or her personal interests in nutrition, health, food safety, or food technology.
- The Department of Food Science strives for excellence in teaching by having small classes where each student is given personal guidance. Laboratories are included in upper-level classes giving hands-on experience with the latest techniques and food processing technologies. In addition, undergraduate research and internship opportunities are available.
- For the past 10 years, graduating seniors ranked the **Department of Food Science among the top departments in Graduating Student Satisfaction**. We are proud our graduates ranked us highly in the following areas: faculty accessibility, quality of teaching, academic advising, concern for progress, access to classes, and overall experience in major. Of these graduates, 83% had an industrial internship, and 69% had independent research experience.

Graduates from the B.S. Program at the Department of Food Science has an excellent job placement record with a starting salary range between \$45,000-\$60,000 or may continue in graduate school to obtain M.S., Ph.D., or professional degree.

## *Undergraduate Learning Objectives*

### **Obtain the following:**

1. A strong understanding of basic science, including math, chemistry, physics, and biology.
2. A thorough knowledge of food processing, food microbiology, and food chemistry principles and techniques.
3. Appreciating the need for an integrated, multidisciplinary approach to Food Science.
4. The following critical thinking skills to solve complex problems in Food Science.
  - a. Ability to identify and characterize problems.
  - b. Ability to develop a rational and systematic approach to solving problems.
  - c. Skills to identify, collect, and analyze relevant data.
  - d. Ability to utilize the above skills and abilities(a-c) and apply them for creative solutions to complex problems.
  - e. Ability to identify and critically evaluate appropriate resources to guide scientific and regulatory decisions.
  - f. Competence and confidence to generate conclusions, implement solutions and evaluate new outcomes.
  - g. Strong verbal and written communication skills.
  - h. Ability to work independently and in teams.

## ***Food Science Major Concentrations***

There are three concentrations for Food Science majors at the University of Massachusetts Amherst.

**Concentration in Food Science and Technology.** This curriculum is accredited by the Institute of Food Technologists. It is suggested for students who know they want a job in the food industry and may, in the future, be interested in graduate or professional school.

**Concentration in Food Studies.** Students who want the training to work in the food industry but are also interested in Health and Wellness. This curriculum allows students to choose program electives to gain a broadened education with coursework from the Departments of Nutrition, Public Health & Exercise Science, and the Environmental Science Program.

**Concentration in Culinary Science.** This concentration is only available to students who have received a two-year Culinary Arts degree or an equivalent to be accepted in the program.

## ***First Year Courses***

***Regardless of the concentration, Food Science majors should take the following courses in their first year:***

### **First Semester**

CHEM 111	General Chemistry I*
ENGLWRIT 112	College Writing
MATH (depending on concentration)	
FD SCI 103	Introduction to Food Science

### **Second Semester**

CHEM 112	General Chemistry II
BIOLOGY 110 **	Introductory Biology for Science Majors

\*CHEM 111 requires MATH 104 or a score of 20 on the math placement exam. Students should take MATH 104 first semester if needed and register for CHEM 111 second semester.

\*\*BIOLOGY 110 is only offered during the Spring semester. Food Science requires ONE biology course. Students wishing to go into medical or dental school should take the two-semester biology sequence: BIOLOGY 151 (Fall), then BIOLOGY 152 and 153 (Spring).

## *Suggested coursework for Transfer Students*

**Transferring from a Community College or other traditional 4-year institution:** *All transfer students wishing to study Food Science will be admitted to the program regardless of previous coursework.*

However, to complete the Food Science program without delaying graduation, it is suggested that students focus their coursework on introductory chemistry, organic chemistry, biology, and math before transferring to the University of Massachusetts.

**Transferring into the Culinary Arts Concentration.** *Students interested in the Culinary Arts Concentration must have a two-year Culinary Arts degree or its equivalent to be accepted in the program.*

**See more at:**

<http://www.umass.edu/foodsci/undergraduate/curriculum/food-science-degree-concentration-culinary-science>

# Graduation Checklist: Food Science and Technology

<b>Math, Statistics, and Computer Sciences</b>	
MATH 127 Calculus for the Life & Social Sci I***	_____
MATH 128 Calculus for the Life & Social Sci II***	_____
RES EC 212 Intro Statistics for the Social Sciences or STATS 240 Introduction to Statistics	_____
Chemistry, Biochemistry, and Physics	
CHEM 111 General Chemistry for Sci & Eng Majors	_____
CHEM 112 General Chemistry for Sci & Eng Majors	_____
CHEM 261 Organic Chemistry I for Non-Majors	_____
CHEM 262 Organic Chemistry II for Non-Majors	_____
CHEM 269 Organic Lab for Non-Major	_____
BIOCHEM 320 Elementary Biochemistry	_____
BIOCHEM 321 Biochemistry Lab	_____
Physics 131 Intro to Physics 1 with lab	_____
Physics 132 Intro to Physics 2 with lab	_____
<b>Biology and Microbiology</b>	
Bio 110 Introductory Biology for Sci Majors (or Bio 151)	_____
FD SCI 466&467 Nutritional Microbiology&Lab (or Microbio 310&265)	_____
<b>Nutrition</b>	
Fd Sci 270 Biology of Food in Human Health or Nutr 230 Basic Nutrition	_____
<b>Required Food Science Courses</b>	
Fd Sci 103 Introduction to Food Science (or another 100-level FS class)	_____
Fd Sci 265 Survey of Food Science	_____
Fd Sci 266 Survey of Food Science Lab	_____
Fd Sci 391C Junior Year Writing	_____
Fd Sci 541 Food Chemistry	_____
Fd Sci 542 Food Chemistry 2	_____
Fd Sci 544 Food Chemistry Lab	_____
Fd Sci 567 Food Microbiology	_____
Fd Sci 566 Food Microbiology Lab	_____
Fd Sci 575 Elements of Food Process Engineering	_____
Fd Sci 561 Food Processing (IE)	_____
Fd Sci 563 Food Processing Lab (IE)	_____
Fd Sci 581 Food Analysis	_____
Fd Sci 583 Food Analysis Lab	_____
<b>Electives</b>	
Fd Sci 391R Undergraduate Research (1 cr, offered every semester) <i>Strongly suggested for students participating in undergraduate laboratory independent study.</i>	
Fd Sci 590B Food Quality (4 cr, offered in Fall)	
Fd Sci 590A Food Science Policy (3 cr, offered in Spring)	

Students must take 120 credits to graduate and complete the Gen Ed requirements of the University.



## Suggested Curriculum for Concentration in Food Science and Technology/Pre-Graduate School

### Freshman Year

Fall Semester	Credits	Spring Semester	Credits
CHEM 111 General Chemistry for Sci & Eng Majors***	4	CHEM 112 General Chemistry for Sci & Eng Majors	4
MATH 127 Calculus for the Life & Social Sci I***	3	MATH 128 Calculus for Life & Social Sci II	3
ENGLWRIT 112 College Writing	3	◆BIOL 110 Introductory Biology for Sci Majors	4
◆FD SCI 103 Introduction to Food Science	4	GEN ED Requirement	4

\*\*\*Chem 111 and Math 127 require Math 104 or a score of 20 on the Math Placement exam. If needed, take Math104 in the Fall and take Chem 111 Spring semester.

### Sophomore Year

Fall Semester	Credits	Spring Semester	Credits
PHYSICS 131 Intro Physics I w/Lab	4	PHYSICS 132 Intro Physics II w/Lab	4
CHEM 261 Organic Chemistry I for Non-Majors	3	CHEM 262 Organic Chemistry II for Non-Majors	3
◆RES EC 107 Hunger in the Global Economy (SBG, suggested)	4	CHEM 269 Organic Lab for Non-Major (may be taken another semester)	2
GEN ED Requirement	4	◆FD SCI 265 Survey of Food Science	3
		◆FD SCI 266 Survey of Food Science Lab	1

### Junior Year

Fall Semester	Credits	Spring Semester	Credits
◆FD SCI 270 Biology in Food in Human Health or NUTR 230 Basic Nutrition	3	◆FD SCI 575 Elements of Food Process Engineering	4
		◆FD SCI 466&467 Nutritional Microbiology & Lab Or MICROBIO 310&265 General Microbiology & Lab	4
◆FD SCI 391C Junior Writing <sup>1</sup>	3	◆FD SCI 541 Food Chemistry	3
◆RES EC 212 Intro Statistics for the Social Sciences or STATS 240 Introduction to Statistics	4		
RES EC 102 Intro to Resource Economics (SB, suggested)	4	BIOCHEM 320 Elementary Biochemistry	3
FD SCI 391R Undergraduate Research <sup>2</sup>	1	◆BIOCHEM 321 Biochemistry Lab	2

### Senior Year

Fall Semester	Credits	Spring Semester	Credits
◆FD SCI 542 Food Chemistry 2	3	◆FD SCI 561 Food Processing (IE)	3
◆FD SCI 544 Food Chemistry Lab	1	◆FD SCI 563 Processing Laboratory (IE)	2
◆FD SCI 567 Food Microbiology	3	◆FD SCI 581 Analysis of Food Products	3
◆FD SCI 566 Food Microbiology Lab	2	◆FD SCI 583 Food Analysis Laboratory	1
◆FD SCI 590B Food Quality <sup>3</sup>	4	◆FD SCI 590A Food Science Policy <sup>4</sup>	3

<sup>1</sup>Fd Sci 391C may be taken fall of junior or senior year

<sup>2</sup>Fd Sci 391R is not required but is strongly recommended for students participating in *undergraduate research independent study*. It can be taken anytime.

<sup>3</sup>Fd Sci 590B is not required but is strongly recommended for students who want to obtain FSPCA Qualified Individual Certifications. Prerequisites: Basic Microbiology (FS 466&467 or MICROBIO 310&265) and Organic Chemistry (CHEM 261 or 250).

<sup>4</sup>Fd Sci 590A is not required but is strongly recommended for students who want to learn about Food Policy and Entrepreneurship. Requirements: Food Science Seniors.

KEY: ◆ Generally only offered the semester listed.

## Graduation Checklist: Concentration in Food Studies

<b>Math, Statistics, and Computer Sciences</b>	
MATH 104 Algebra, Analytic Geometry & Trigonometry	_____
RES EC 212 Intro Statistics for the Social Sciences	
or STATS 240 Introduction to Statistics	_____
<b>Chemistry, Biochemistry, and Physics</b>	
CHEM 111 General Chemistry for Sci & Eng Majors	_____
CHEM 112 General Chemistry for Sci & Eng Majors	_____
CHEM 250 Organic Chemistry	_____
BIOCHEM 320 Elementary Biochemistry	_____
Physics 131 Intro to Physics I with lab	_____
<b>Biology and Microbiology</b>	
Bio 110 Introductory Biology for Sci Majors (or Bio 151)	_____
FD SCI 466&467 Nutritional Microbiology&Lab (or Microbio 310&265)	_____
<b>Required Food Science Courses</b>	
Fd Sci 103 Introduction to Food Science (or another 100-level FS class)	_____
Fd Sci 265 Survey of Food Science	_____
Fd Sci 266 Survey of Food Science Lab	_____
Fd Sci 270 Biology of Food in Human Health	_____
Fd Sci 391C Junior Year Writing	_____
Fd Sci 541 Food Chemistry	_____
Fd Sci 544 Food Chemistry Lab	_____
Fd Sci 567 Food Microbiology	_____
Fd Sci 566 Food Microbiology Lab	_____
Fd Sci 561 Food Processing (IE)	_____
Fd Sci 563 Food Processing Lab (IE)	_____
Fd Sci 575 Elements of Food Process Engineering	_____
Fd Sci 581 Food Analysis	_____
Fd Sci 583 Food Analysis Lab	_____
<b>Electives</b>	
Four program electives are listed on the curriculum (only <u>one</u> of which can be 100 level):	
1)	
2)	
3)	
4)	

Students must take 120 credits to graduate and complete the Gen Ed requirements of the University.

## Suggested Curriculum for Concentration in Food Studies

### Freshman Year

Fall Semester	Credits	Spring Semester	Credits
MATH 104 Algebra, Analytic Geometry & Trigonometry	3	PROGRAM Elective	3-4
ENGLWRIT 112 College Writing	3	◆BIOL 110 Introductory Biology for Sci Majors	4
◆FD SCI 103 Introduction to Food Science	4	CHEM 111 General Chemistry for Sci & Eng Majors***	4
GEN ED Requirement	4	GEN ED Requirement	4

\*\*\*If you get a score of 20 or greater on the Math Placement Exam, Chem 111 can be taken fall semester if desired.

### Sophomore Year

Fall Semester	Credits	Spring Semester	Credits
CHEM 112 General Chemistry for Sci & Eng Majors	4	◆CHEM 250 Organic Chemistry	3
◆PHYSICS 131 Intro to Physics I with lab	4	◆FD SCI 265 Survey of Food Science	3
◆FD SCI 270 Biology of Food in Human Health	3	◆FD SCI 266 Survey of Food Science Lab	1
PROGRAM Elective	3-4	RES EC 102 Intro to Resource Economics (suggested, SB)	4
		General ED Requirement	4

### Junior Year

Fall Semester	Credits	Spring Semester	Credits
RES EC 212 Intro Statistics for the Social Sciences	4	◆FD SCI 466&467 Nutritional Microbiology & Lab	4
or STATS 240 Intro to Statistics		or MICROBIO 310&265 General Microbiology & Lab	
BIOCHEM 320 Elementary Biochemistry	3	◆FD SCI 541 Food Chemistry	3
◆RES EC 107 Hunger in the Global Economy (SBG, suggested)	4	◆FD SCI 575 Elements of Food Process Engineering	4
PROGRAM Elective	3-4	FD SCI 391R Undergraduate Research <sup>2</sup>	1
		General ED Requirement	4

### Senior Year

Fall Semester	Credits	Spring Semester	Credits
◆FD SCI 567 Food Microbiology	3	◆FD SCI 561 Food Processing (IE)	3
◆FD SCI 566 Food Microbiology Lab	2	◆FD SCI 563 Processing Laboratory (IE)	2
◆FD SCI 544 Food Chemistry Lab	1	◆FD SCI 581 Analysis of Food Products	3
◆FD SCI 391C Junior Writing <sup>1</sup>	3	◆FD SCI 583 Food Analysis Laboratory	1
◆FD SCI 542 Food Chemistry 2	3-4	◆FD SCI 590A Food Science Policy <sup>4</sup>	3
or FD SCI 590B Food Quality (suggested, PROGRAM Elective) <sup>3</sup>		PROGRAM Elective	3-4

<sup>1</sup>Fd Sci 391C may be taken fall of junior or senior year

<sup>2</sup>Fd Sci 391R is not required but is strongly recommended for students participating in *undergraduate research independent study*. It can be taken anytime.

<sup>3</sup>Fd Sci 590B is a program elective and is strongly recommended for students who would like to obtain FSPCA Qualified Individual Certifications. Prerequisites: Basic Microbiology (FS 466&467 or MICROBIO 310&265) and Organic Chemistry (CHEM 261 or 250).

<sup>4</sup>Fd Sci 590A is not required but is strongly recommended for students who want to learn about Food Policy and Entrepreneurship. Requirements: Food Science Seniors.

KEY: ◆ Generally only offered the semester listed.

## Elective List for Concentration in Food Studies

Take four classes, only one of which can be at 100-level.

Food Science Electives	Credits
FDSCI 542 Food Chemistry 2	3
FDSCI 590B Food Quality	4
<b>Nutrition and Kinesiology Electives</b>	
NUTRITN 130 Nutrition for a Healthy Lifestyle	4
NUTRITN 230 Basic Nutrition	3
NUTRITN 430 Nutrition and Metabolism	3
KIN 110 Human Performance and Nutrition	4
<b>Public Health Electives</b>	
SPHHS 150 Great Challenges in Public Health & Health Sciences	4
PUBHLTH 203 Introduction to Environmental Health Sciences	3
PUBHLTH 223 Introduction to Biostatistics for Public Health	3
PUBHLTH 224 Epidemiology in Public Health	3
PUBHLTH 390AS Food Toxicology	3
<b>Agriculture Electives</b>	
STOCKSCH 120 Organic Farming and Gardening	4
STOCKSCH 165 Sustainable Agriculture	3
STOCKSCH 171 Plagues, Food and People: Ecology of Food and Disease	4
STOCKSCH 356 Food Justice and Policy	3

# General Education Requirements Checklist for Food Science Majors

For Students Admitted as Freshman\* to UMass Fall 2010 or later

*Department-required or suggested courses meeting University GenEd Graduation Requirements are in RED*

## WRITING: 2 COURSES

- \_\_\_\_\_ College Writing (CW, 0-3 credits); Completion of either EnglWrit 112 (CW) or a satisfactory score on the Writing placement test, combined SAT I Critical Reading and Writing Tests, or Advanced Placement Exam (Language and Composition, only)
- \_\_\_\_\_ Junior Year Writing **FD SCI 391C**

BASIC MATH AND ANALYTICAL REASONING: 2 COURSES required by the University. Students must complete either one R1 level course or get a 20 or greater on the Basic Mathematics Skills Exemption Test during summer orientation.

- \_\_\_\_\_ Basic Mathematics (R1) **MATH 104**
- \_\_\_\_\_ Analytical Reasoning (R2) **MATH 127, MATH 128, RES EC 212**

## BIOLOGICAL AND PHYSICAL WORLD: 2 COURSES

- \_\_\_\_\_ Biological Science (BS) **BIO 110**
- \_\_\_\_\_ Physical Science (PS) **CHEM 111, CHEM 112, PHYSICS 131, PHYSICS 132, PHYSICS 139**

SOCIAL WORLD: 4 COURSES. These requirements can be combined with the Social and Diversity Requirements.

- \_\_\_\_\_ Literature (AL) or Arts (AT)
- \_\_\_\_\_ Historical Studies (HS)
- \_\_\_\_\_ Social and Behavioral Sciences (SB) **RES EC 121 (SBG, SUGGESTED)**
- \_\_\_\_\_ Additional Social World (AL, ST, or SB) or Interdisciplinary (I, SI) **RES EC 102 (SB, SUGGESTED)**

SOCIAL AND CULTURAL DIVERSITY: 2 COURSES, MIN 3 CR EACH. It may be combined with Social World designation (e.g., ALU, HSG, I.G., etc.)

- \_\_\_\_\_ United States (U)
- \_\_\_\_\_ Global (G) **RES EC 107 (SBG, SUGGESTED)**

## INTEGRATED EXPERIENCE (IE)

- \_\_\_\_\_ **FD SCI 561 and FD SCI 563**

\*Students Transferring to UMass must take two additional GenEd courses (BS, PS, AL, AT, HS, SB, or I). Most often, these additional requirements can be fulfilled by the large number of Physical Science courses required by the major.

## *Departmental Honors*

**Food Science Departmental Honors.** Food Science Departmental Honors are open to Commonwealth Honor College (CHC) members who complete the program requirements. Departmental Honors (DH) can be done alone or as a part of the full Commonwealth Honors College Curriculum.

### **Application:**

Students, who are already members of the CHC, should arrange to meet with Dr. Hang Xiao, the Food Science Honors Program Director, to apply to the Departmental Honors Program.

Food Science majors, who are not already members of CHC but have a GPA of greater than 3.40 and wish to pursue Departmental Honors (DH), should complete the online CHC online application:

<https://www.honors.umass.edu/admissions/apply-current-students>.

### **Eligibility:**

- An overall GPA of 3.400 or higher
- The ability to complete the DH-Track requirements
- The ability to complete the CHC residency requirement of 45-graded (not pass/fail) credits earned at UMass Amherst (not transferred)

### **Program Requirements**

- 2 FD SCI honors courses selected from FD SCI 544, 561, 567, or 581 with affiliated honors colloquium or Honors Independent Study attached\*
- Honors Thesis or Project. Independent Capstone Experience: choose from two options:
  - (I) FD SCI 499Y Honors Research & FD SCI 499T Honors Thesis.
  - (II) FD SCI 499Y Honors Research & FD SCI 499P Honors Project.

\*One of these requirements may be substituted by a FD SCI 600-level course with the approval of the Honors Program Director via an Honors College "Petition for Exception" form.

## ***5-year BS/MS Program***

Students with a *Food Science and Technology* concentration and a strong interest in research may pursue a 5-year BS/MS combined degree. For this accelerated program, students must begin graduate laboratory research in their Junior year and complete the thesis MS program.

### **To prepare for the 5-year BS/MS Program, students must:**

- Identify a Research Adviser\* no later than their junior year.
- Begin conducting laboratory research no later than their junior year.
- Take the GRE late in Junior or early in their senior year.
- Apply to the Food Science MS program in their senior year and have their Research Adviser write one of the letters of recommendation.
- Take up to 6 credits of graduate courses (500 level or above) which can be transferred into their graduate requirements (Optional)\*\*

\*Research Advisors are different from your departmentally assigned *Academic Advisor*

\*\*Students can only transfer credits into the Graduate program if taking credits are not required by the Food Science Department for BS Degree and the student has completed 120 credits required by the University for graduation.

### **Completion of MS with Thesis Requirements**

- Complete the MS requirements that can be found at <http://www.umass.edu/foodsci/graduate/msphd-requirements/ms-thesis>
- Plan on spending two summers (after your Senior and Graduate year) at UMass to conduct research.

### ***Food Science Club***

The Department of Food Science has a Food Science Club. The Food Science Club is a local section of The Student Association of the Institute of Food Technologists.

Undergraduates, Graduates, and Faculty can become Food Science Club members. It is a great way to build your resume, make friends and learn more about the exciting profession of Food Science. Activities vary year-to-year but often include Monthly Meetings, Pizza Lunches, Invited Industrial speakers, Plant Tours, Hosting "International Night Dinner" (the annual Departmental celebration), Fund Raising activities, and IFT Student Association competitions.

Fall is the time when students organize into Product Development teams, so interested students should watch for club meetings in the Fall semester.



## *Notes*



## *Notes*

## *Departmental Contacts*

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Learn more at:  
[www.umass.edu/foodsci](http://www.umass.edu/foodsci)

