

# FERMENTATION SCIENCE MAJOR

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In addition to providing competencies for several areas of work, the fermentation science major is designed specifically for certain professional industrial careers including the fermented food, alcoholic beverage and pharmaceutical products.

The Fermentation Science major is concerned with the application of the fundamental principles of the physical, biological, and behavioral sciences and processing to understand the complex and heterogeneous materials recognized as the raw precursors or/and final food products and beverages of fermentation. The fermentation science major prepares students for careers not only in traditional food and alcoholic beverage industries but also the biotechnology fermentation industry for pharmaceutical and nutraceutical production.

## Program Learning Outcomes

1. Careers and opportunities in fermentation science - Graduates of fermentation science undergraduate program will be well prepared for at least four career options in beverage (beer, wine, distilled spirits and kombucha), vegetable foods (kimchi, tempeh and miso), dairy foods (cheese and yogurt) and biotechnology industries (biofuels, pharmaceuticals and nutraceuticals) based upon their UMD fermentation science training, experience and interests.
2. Fermentation science - Graduates of the undergraduate program will be able to apply fermentation science knowledge and research to enhance fermentation process, propagation and modification of fermentation microbes, fermenter design and downstream processing including effluent treatment. Students will demonstrate mastery of the manufacturing steps involved in various fermented products and gain hands-on experience in making these products at pilot scale and evaluate their quality and safety.
3. Fermented food, feed and pharmaceuticals - Graduates of the fermentation science program will be able to correctly apply their knowledge in the use of prokaryotic and eukaryotic microorganisms in the fermentation of dairy, vegetables and fruits, meat, and grains (food), feed, and pharmaceuticals. Students will be able to describe fermenter design and scale-up, fermentation byproducts and downstream processing, and different types of fermentations.
4. Fermentation science literacy - Graduates of the program will be able to select, understand, and critically evaluate scientific studies in fermentation science disciplines such that they employ research that is applicable, timely, accurate, and useful for their fermentation production and management needs.
5. Knowledge of major issues in fermentation science - Graduates of the program will be well-versed in the issues related to fermentation science such that they contribute to societal debates around the future of farming, the use of microbes and phages in fermentation, sustainability of our fermentation industry, the worker needs, and scaling fermentation enterprises up and down to meet our growing population's fermented product needs.

## REQUIREMENTS

Students enrolled in Fermentation Science Major are required to earn a grade of "C-" or better in courses applied toward satisfaction of the major. This includes all the required and elective courses.

Curriculum for the Fermentation Science Major

Course	Title	Credits
BSCI170	Principles of Molecular & Cellular Biology	3
BSCI171	Principles of Molecular & Cellular Biology Laboratory	1
BSCI223	General Microbiology	4
CHEM131	Chemistry I - Fundamentals of General Chemistry	3
CHEM132	General Chemistry I Laboratory	1
CHEM231	Organic Chemistry I	3
CHEM232	Organic Chemistry Laboratory I	1
CHEM241	Organic Chemistry II	3
CHEM242	Organic Chemistry Laboratory II	1
CHEM271	General Chemistry and Energetics	2
CHEM272	General Bioanalytical Chemistry Laboratory	2
ENGL101	Academic Writing	3
ENGL393	Technical Writing <sup>1</sup>	3
MATH120	Elementary Calculus I	3
NFSC112	Food: Science and Technology	3
BCHM463	Biochemistry of Physiology	3
NFSC398	Seminar	1
NFSC421	Food Chemistry	3
NFSC423	Food Chemistry Laboratory	3
NFSC430	Food Microbiology	3
NFSC431	Food Quality Control	4
PLSC110	Introduction to Horticulture	3
or PLSC112	Introductory Crop Science	
PLSC130	Did Yeast Create Civilization?	3
AGST3XX	(Viticulture and Enology)	4
AGST3XX	(Brewing and Distilling)	4
NFSC412	Food Processing Technology	4
NFSC341	Fermented Food, Feed, and Pharmaceuticals (Fermented Food, Feed, and Pharmaceuticals)	3
NFSC4XX	(Fermentation Science Laboratory)	4
NFSC4XX	(Cheese and Fermented Dairy Products)	3
NFSC386	Experiential Learning	3-6
NFSC4XX	(Sensory Analysis Lab)	3
<b>Total Credits</b>		<b>87-90</b>

Total Credits for Degree: 120

Course	Title	Credits
<b>The following courses are suggested electives:</b>		
AREC250	Elements of Agricultural and Resource Economics	
BMGT110	Introduction to the Business Value Chain	
BMGT220	Principles of Accounting I	
BMGT360	Strategic Management of Human Capital	
BMGT364	Managing People and Organizations <sup>1</sup>	
COMM200	Critical Thinking and Speaking <sup>1</sup>	

INAG103	Agricultural Marketing
INAG204	Agricultural Business Management
INAG206	Agricultural Business Law
NFSC100	Elements of Nutrition
NFSC422	Food Product Research and Development
NFSC434	Food Microbiology Laboratory
ANSC410	The Gut Microbiome and its Roles in Health and Disease
NFSC450	Food and Nutrient Analysis
NFSC498	Selected Topics
AGST333	Crafty Beverage Crops

<sup>1</sup> High-demand course. For non-major students, these seats are assigned as "first-come, first-served". Students are encouraged to register as early as possible for a seat in these courses.

## GRADUATION PLANS

Click here (<https://agmr.umd.edu/academics/advising/four-year-plans/>) for roadmaps for graduation plans in the College of Agricultural and Natural Resources.

Additional information on developing a graduation plan can be found on the following pages:

- <http://4yearplans.umd.edu>
- the Student Academic Success-Degree Completion Policy (<https://academiccatalog.umd.edu/undergraduate/registration-academic-requirements-regulations/academic-advising/#success>) section of this catalog