FERMENTATION SCIENCE MAJOR

Program Director: Sara Kao, sarakao@umd.edu

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 of 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

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BSCI170</td>
<td>Principles of Molecular &amp; Cellular Biology</td>
<td>3</td>
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<tr>
<td>BSCI171</td>
<td>Principles of Molecular &amp; Cellular Biology Laboratory</td>
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<tr>
<td>BSCI223</td>
<td>General Microbiology</td>
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<tr>
<td>CHEM131</td>
<td>Chemistry I - Fundamentals of General Chemistry</td>
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<tr>
<td>CHEM132</td>
<td>General Chemistry I Laboratory</td>
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<tr>
<td>CHEM231</td>
<td>Organic Chemistry I</td>
<td>3</td>
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<td>CHEM232</td>
<td>Organic Chemistry Laboratory I</td>
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<td>CHEM241</td>
<td>Organic Chemistry II</td>
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<tr>
<td>CHEM242</td>
<td>Organic Chemistry Laboratory II</td>
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<td>CHEM271</td>
<td>General Chemistry and Energetics</td>
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<td>CHEM272</td>
<td>General Bioanalytical Chemistry Laboratory</td>
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<tr>
<td>ENGL101</td>
<td>Academic Writing</td>
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<tr>
<td>ENGL393</td>
<td>Technical Writing</td>
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<tr>
<td>MATH120</td>
<td>Elementary Calculus I</td>
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<tr>
<td>NFSC112</td>
<td>Food: Science and Technology</td>
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<tr>
<td>BCHM463</td>
<td>Biochemistry of Physiology</td>
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<tr>
<td>NFSC398</td>
<td>Seminar</td>
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<td>NFSC421</td>
<td>Food Chemistry</td>
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<tr>
<td>NFSC423</td>
<td>Food Chemistry Laboratory</td>
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<tr>
<td>NFSC430</td>
<td>Food Microbiology</td>
<td>3</td>
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<tr>
<td>NFSC431</td>
<td>Food Quality Control</td>
<td>4</td>
</tr>
<tr>
<td>PLSC110</td>
<td>Introduction to Horticulture</td>
<td>3</td>
</tr>
<tr>
<td>or PLSC112</td>
<td>Introductory Crop Science</td>
<td>3</td>
</tr>
<tr>
<td>PLSC130</td>
<td>Did Yeast Create Civilization?</td>
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</tr>
<tr>
<td>AGST3XX</td>
<td>(Viticulture and Enology)</td>
<td>4</td>
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<tr>
<td>AGST3XX</td>
<td>(Brewing and Distilling)</td>
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<td>NFSC412</td>
<td>Food Processing Technology</td>
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<td>NFSC2XX</td>
<td>(Fermented Food, Feed, and Pharmaceuticals)</td>
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<tr>
<td>NFSC4XX</td>
<td>(Fermentation Science Laboratory)</td>
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<tr>
<td>NFSC4XX</td>
<td>(Cheese and Fermented Dairy Products)</td>
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<td>NFSC386</td>
<td>Experiential Learning</td>
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<tr>
<td>NFSC4XX</td>
<td>(Sensory Analysis Lab)</td>
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Total Credits for Degree: 120

Course Title Credits

The following courses are suggested electives:

<table>
<thead>
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<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>AREC250</td>
<td>Elements of Agricultural and Resource Economics</td>
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<tr>
<td>BMGT110</td>
<td>Introduction to the Business Value Chain</td>
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<tr>
<td>BMGT220</td>
<td>Principles of Accounting I</td>
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<tr>
<td>BMGT360</td>
<td>Strategic Management of Human Capital</td>
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<tr>
<td>BMGT364</td>
<td>Managing People and Organizations</td>
<td></td>
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<tr>
<td>COMM200</td>
<td>Critical Thinking and Speaking</td>
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</tr>
<tr>
<td>INAG103</td>
<td>Agricultural Marketing</td>
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</table>
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.

FOUR-YEAR PLAN

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

Additional information on developing a four-year academic plan can be found on the following pages:

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