B.S.M.A.S. IN MARINE SCIENCE / MICROBIOLOGY AND IMMUNOLOGY

Marine Science/Microbiology and Immunology

The Marine Science/Microbiology and Immunology degree is a Bachelor of Science degree (BSMAS) that is designed to give students a strong background in molecular and cellular aspects of microbial pathogenesis and immune defenses. The ocean, which is teeming with microbes, is explored to highlight the complex biological interactions between microbes and their hosts and the environmental factors that influence these relationships. This program is ideal for students interested in the relationship between the ocean and human health and medicine as well as those interested in pursuing a pre-medical or pre-veterinary track.

Undergraduate students are encouraged to work with the faculty and are able to earn course credit by conducting independent research under the supervision of leading scientists in their field. Research encompasses ocean and human health, medicine, and molecular and cellular aspects of microbial pathogenesis and immune defenses.

The Bachelor of Science double major in Marine Science/Microbiology and Immunology prepares students for admission to graduate programs and for careers in teaching and research as well as for technical careers in government and private industries concerned with the oceans.

Curriculum Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSC 111</td>
<td>Introduction to Marine Science</td>
<td>3</td>
</tr>
<tr>
<td>MSC 112</td>
<td>Introduction to Marine Science Lab</td>
<td>1</td>
</tr>
<tr>
<td>MSC 215</td>
<td>Chemical Oceanography</td>
<td>3</td>
</tr>
<tr>
<td>MBE 230</td>
<td>Introduction to Marine Biology</td>
<td>3</td>
</tr>
<tr>
<td>MBE 232</td>
<td>Introduction to Marine Biology Laboratory</td>
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</tr>
<tr>
<td>MSC 301</td>
<td>Introduction to Physical Oceanography</td>
<td>3</td>
</tr>
<tr>
<td>MSC 216</td>
<td>Chemical Oceanography Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>or MSC 302</td>
<td>Introduction to Physical Oceanography Lab</td>
<td>1</td>
</tr>
<tr>
<td>Select 12 credit hours of approved RSMAS electives within MBE, MSC, OCE or RSM courses</td>
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</table>

Required Microbiology and Immunology Courses 11

Take the following:

MIC 301  Introduction to Microbes and the Immune System
MIC 304  Introduction to Microbes and the Immune System (Lab)

Select one of the following:

MIC 319  Innate Immunity
MIC 321  Immunobiology

Select one of the following:

MIC 201  Modern Plagues and Society
MIC 322  Medical Parasitology
MIC 323  Microbial Pathogenesis and Physiology
MIC 436  Fundamental and Medical Virology

Microbiology and Immunology Approved Electives 13

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIC 201</td>
<td>Modern Plagues and Society</td>
</tr>
<tr>
<td>MIC 319</td>
<td>Innate Immunity</td>
</tr>
<tr>
<td>MIC 321</td>
<td>Immunobiology</td>
</tr>
<tr>
<td>MIC 322</td>
<td>Medical Parasitology</td>
</tr>
<tr>
<td>MIC 323</td>
<td>Microbial Pathogenesis and Physiology</td>
</tr>
<tr>
<td>MIC 436</td>
<td>Fundamental and Medical Virology</td>
</tr>
<tr>
<td>MIC 441</td>
<td>Microbiology and Immunology Colloquium</td>
</tr>
<tr>
<td>MIC 460</td>
<td>Advanced Topics in Microbiology and Immunology</td>
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</table>

Only 6 credit hours of Research in MIC may be applied toward the 16 MIC elective hours, any credits over 6 count as elective credits toward the 120 credits required for graduation or 150 credits for dual degree seeking students.

MIC 451  Special Projects in Immunobiology
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>MIC 452</td>
<td>Special Projects in Parasitology</td>
</tr>
<tr>
<td>MIC 453</td>
<td>Special Projects in Pathogenic Bacteriology</td>
</tr>
<tr>
<td>MIC 454</td>
<td>Special Projects in Microbial Genetics</td>
</tr>
<tr>
<td>MIC 455</td>
<td>Special Projects in Immunogenetics</td>
</tr>
<tr>
<td>MIC 456</td>
<td>Special Projects in Virology</td>
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</tbody>
</table>

Maximum of 2 course from outside electives can count towards the 13 MIC elective hours

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>BIL 255</td>
<td>Cellular and Molecular Biology</td>
</tr>
<tr>
<td>or BIL 250</td>
<td>Genetics</td>
</tr>
<tr>
<td>MBE 465</td>
<td>Marine Comparative Immunology</td>
</tr>
<tr>
<td>or GSC 309</td>
<td>Microbes and the Environment</td>
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### Additional Required Courses

<table>
<thead>
<tr>
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<tr>
<td>BIL 150</td>
<td>General Biology</td>
</tr>
<tr>
<td>BIL 151</td>
<td>General Biology Laboratory</td>
</tr>
<tr>
<td>BIL 160</td>
<td>Evolution and Biodiversity</td>
</tr>
<tr>
<td>BIL 161</td>
<td>Evolution and Biodiversity Laboratory</td>
</tr>
<tr>
<td>BMB 401</td>
<td>Biochemistry for the Biomedical Sciences</td>
</tr>
<tr>
<td>CHM 121</td>
<td>Principles of Chemistry</td>
</tr>
<tr>
<td>CHM 113</td>
<td>Chemistry Laboratory I</td>
</tr>
<tr>
<td>CHM 221</td>
<td>Introduction to Structure and Dynamics</td>
</tr>
<tr>
<td>CHM 205</td>
<td>Chemical Dynamics Laboratory</td>
</tr>
<tr>
<td>CHM 222</td>
<td>Organic Reactions and Synthesis</td>
</tr>
<tr>
<td>CHM 206</td>
<td>Organic Reactions and Synthesis Laboratory</td>
</tr>
<tr>
<td>MTH 161</td>
<td>Calculus I</td>
</tr>
<tr>
<td>or MTH 171</td>
<td>Calculus I</td>
</tr>
<tr>
<td>MTH 162</td>
<td>Calculus II</td>
</tr>
<tr>
<td>or MTH 172</td>
<td>Calculus II</td>
</tr>
<tr>
<td>ENG 105</td>
<td>English Composition I</td>
</tr>
<tr>
<td>ENG 107</td>
<td>English Composition II: Science and Technology</td>
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<tr>
<td>or ENG 106</td>
<td>English Composition II</td>
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Select one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>GSC 110</td>
<td>The Earth System</td>
</tr>
<tr>
<td>GSC 111</td>
<td>Earth System History</td>
</tr>
<tr>
<td>MSC 424</td>
<td>Origin and Geology of the Galapagos Islands</td>
</tr>
</tbody>
</table>

Select one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>MSC 204</td>
<td>Environmental Statistics</td>
</tr>
<tr>
<td>MTH 224</td>
<td>Introduction to Probability and Statistics</td>
</tr>
<tr>
<td>MSC 203</td>
<td>Foundations of Computational Marine Science</td>
</tr>
<tr>
<td>CSC 120</td>
<td>Computer Programming I</td>
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Select one of the following options:

<table>
<thead>
<tr>
<th>Option 1:</th>
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</thead>
<tbody>
<tr>
<td>PHY 201</td>
</tr>
<tr>
<td>PHY 106</td>
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<tr>
<td>PHY 202</td>
</tr>
<tr>
<td>PHY 108</td>
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</table>

<table>
<thead>
<tr>
<th>Option 2:</th>
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<td>PHY 221</td>
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<tr>
<td>PHY 222</td>
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<tr>
<td>PHY 223</td>
</tr>
<tr>
<td>PHY 224</td>
</tr>
<tr>
<td>or PHY 225</td>
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</tbody>
</table>

| Option 3: |
B.S.M.A.S. in Marine Science / Microbiology and Immunology

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>PHY 101 &amp; PHY 106</td>
<td>College Physics I and College Physics Laboratory I</td>
<td></td>
</tr>
<tr>
<td>PHY 102 &amp; PHY 108</td>
<td>College Physics II and College Physics Laboratory II</td>
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**Electives**

<table>
<thead>
<tr>
<th>Category</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Arts and Humanities Cognate Courses</td>
<td>9</td>
</tr>
<tr>
<td>People and Society Cognate Courses</td>
<td>9</td>
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</tbody>
</table>

**Total Credit Hours**

129-131

1. At least 6 of which must be at the 300-level or higher. MSC 204, MSC 425 and RSM 567 do not satisfy the MSC elective requirement. GSC courses and courses from other Schools are allowed only if taken from an approved list (https://undergraduate.rsmas.miami.edu/academics/majors/marine-science-dual-major-programs/).

2. MBE 465 or GSC 309 may double count as both Marine Science and Microbiology and Immunology upper level electives.

3. Principles of Chemistry must be passed with a grade of “C-” or higher.

4. Calculus I must be passed with a grade of “C-” or higher.

5. Option 1 is recommended for Physics.

**Suggested Plan of Study**

**Freshman Year**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Fall</td>
<td>MSC 111</td>
<td>Introduction to Marine Science</td>
<td>3</td>
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<td></td>
<td>MSC 112</td>
<td>Introduction to Marine Science Lab</td>
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</tr>
<tr>
<td></td>
<td>BIL 150</td>
<td>General Biology</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>BIL 151</td>
<td>General Biology Laboratory</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>ENG 105</td>
<td>English Composition I</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MTH 161</td>
<td>Calculus I</td>
<td>4</td>
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<tr>
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<td><strong>Credit Hours</strong></td>
<td><strong>16</strong></td>
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<tr>
<td>Spring</td>
<td>MIC 301</td>
<td>Introduction to Microbes and the Immune System</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CHM 121</td>
<td>Principles of Chemistry</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>CHM 113</td>
<td>Chemistry Laboratory I</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>ENG 107</td>
<td>English Composition II: Science and Technology</td>
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</tr>
<tr>
<td></td>
<td>MTH 162</td>
<td>Calculus II</td>
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**Sophomore Year**

<table>
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<tr>
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<tbody>
<tr>
<td>Fall</td>
<td>MBE 230</td>
<td>Introduction to Marine Biology</td>
<td>3</td>
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<td></td>
<td>MBE 232</td>
<td>Introduction to Marine Biology Laboratory</td>
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<tr>
<td></td>
<td>MIC 304</td>
<td>Introduction to Microbes and the Immune System (Lab)</td>
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<tr>
<td></td>
<td>GSC 111</td>
<td>Earth System History</td>
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<tr>
<td></td>
<td>MSC 204</td>
<td>Environmental Statistics</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Elective #1</td>
<td></td>
<td>3</td>
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<tr>
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<td><strong>Credit Hours</strong></td>
<td><strong>16</strong></td>
</tr>
<tr>
<td>Spring</td>
<td>MIC 321</td>
<td>Immunobiology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MIC 323</td>
<td>Microbial Pathogenesis and Physiology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>BIL 160</td>
<td>Evolution and Biodiversity</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>BIL 161</td>
<td>Evolution and Biodiversity Laboratory</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>CHM 221</td>
<td>Introduction to Structure and Dynamics</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>CHM 205</td>
<td>Chemical Dynamics Laboratory</td>
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<tr>
<td></td>
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<td><strong>Credit Hours</strong></td>
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### Junior Year

#### Fall

<table>
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<th>Course Code</th>
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<th>Credit Hours</th>
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<td>MSC Course</td>
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<tr>
<td>MIC Approved Elective</td>
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</tr>
<tr>
<td>CHM 222</td>
<td>Organic Reactions and Synthesis</td>
<td>4</td>
</tr>
<tr>
<td>CHM 206</td>
<td>Organic Reactions and Synthesis Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>PHY 201</td>
<td>University Physics I for the Sciences</td>
<td>4</td>
</tr>
<tr>
<td>PHY 106</td>
<td>College Physics Laboratory I</td>
<td>1</td>
</tr>
<tr>
<td><strong>Credit Hours</strong></td>
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#### Spring

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSC 215</td>
<td>Chemical Oceanography</td>
<td>3</td>
</tr>
<tr>
<td>MSC 301</td>
<td>Introduction to Physical Oceanography</td>
<td>3</td>
</tr>
<tr>
<td>MIC Approved Elective</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>PHY 202</td>
<td>University Physics II for the Sciences</td>
<td>4</td>
</tr>
<tr>
<td>PHY 108</td>
<td>College Physics Laboratory II</td>
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<td>Elective #2</td>
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### Senior Year

#### Fall

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>MSC 216</td>
<td>Chemical Oceanography Laboratory ¹</td>
<td>1</td>
</tr>
<tr>
<td>MBE 465</td>
<td>Marine Comparative Immunology</td>
<td>3</td>
</tr>
<tr>
<td>BMB 401</td>
<td>Biochemistry for the Biomedical Sciences</td>
<td>4</td>
</tr>
<tr>
<td>MSC Course</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Elective #3</td>
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#### Spring

<table>
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<th>Course Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>MSC Course</td>
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<tr>
<td>MIC Approved Elective</td>
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<tr>
<td>Elective #4</td>
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<td>3</td>
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<td>Elective #5</td>
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</tr>
<tr>
<td><strong>Credit Hours</strong></td>
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<td><strong>16</strong></td>
</tr>
</tbody>
</table>

### Total Credit Hours

|                | 127 |

* 6 elective courses must include:
  - 3 Arts and Humanities Cognate courses
  - 3 People and Society Cognate Courses

¹ Students must take one laboratory from MSC 216 or MSC 302.

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**Mission**

The mission of the Rosenstiel School of Marine and Atmospheric Science is to deepen our collective knowledge of our planet through cutting-edge scientific research on the oceans, atmosphere, geology, biota, and the human dimension, while training the next generation of scientists. We transfer the knowledge gained to our students, the national and international scientific community, and to policymakers and the public.

The educational mission of the BS degree in Marine Science at the University of Miami is to graduate students with the ability and desire to integrate knowledge of marine science into their future careers.

**Goals**

Students completing this double major will be able to master a broad set of fundamental scientific knowledge in Marine Science and Microbiology and Immunology, acquire valuable technical skills and learn how to apply this knowledge to real-world problems, in light of increasing stress on environment and human health. The program will provide the rigor, flexibility, depth and integration to enable students to:

- Design and pursue their course of study that meets requirements of a double major in Marine Science and Microbiology and Immunology.
- Learn from the diverse and outstanding group of professors and researchers who are experts in their fields and have active research programs.
• Undertake active research experiences, which will allow them to gain a strong understanding of the scientific process and provide them with a set of valuable experimental and computational skills.
• Prepare themselves for graduate school and for successful careers in public and private industries.

**Student Learning Outcomes**

• Students will demonstrate an ability to communicate effectively.
• Students will develop analytical and quantitative skills to allow critical data analysis.
• Students will be able to do carry out supervised research in the field of marine science.