MICROBIOLOGY AND CELL SCIENCES | CALS

The Bachelor of Science in microbiology and cell science offers a flexible curriculum that develops an excellent knowledge base and an understanding of concepts in microbiology, cell biology and the biomolecular sciences. Emphasis will be placed on application of the scientific method to gain an understanding of the biological world at the cellular and molecular levels. Students will learn to evaluate hypotheses, interpret experimental data and communicate results effectively.

About this Program

- **College**: Agricultural and Life Sciences
- **Degree**: Bachelor of Science
- **Credits for Degree**: 120
- **Additional Information**
- **Related Microbiology and Cell Science Programs**

To graduate with this major, students must complete all university, college, and major requirements.

This major prepares students for entry into professional programs in medicine, dentistry and veterinary medicine and provides a strong foundation for graduate studies in microbiology, cell biology and related cellular and biomedical sciences. The major also provides a background for entry into government, industrial research and diagnostic laboratories.

The curriculum develops fundamental knowledge of prokaryotic and eukaryotic cells and viruses. Courses include the physiology and genetics of microorganisms, mechanisms of pathogenesis and innate immunity systems, astrobiology, bacterial and genome sequencing and bioinformatics.

Coursework for the Major

All majors must take 28-29 credits: 15 credits are core requirements, 10 credits are upper-division department electives and 3-4 credits are the quantitative requirement. A minimum of one credit in an advanced laboratory is required as part of the 10 department-elective credits.

Minimum grades of C, attained within two attempts (including withdrawals), are required in all critical-tracking courses, major courses, department core requirements, department electives and the quantitative requirement. Second attempts must be completed the next semester of enrollment. A 2.0 cumulative GPA of also is required.

Required Coursework

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSC 2010</td>
<td>Integrated Principles of Biology 1</td>
<td>4</td>
</tr>
<tr>
<td>&amp; 2010L</td>
<td>and Integrated Principles of Biology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Laboratory 1</td>
<td></td>
</tr>
<tr>
<td>BSC 2011</td>
<td>Integrated Principles of Biology 2</td>
<td>4</td>
</tr>
<tr>
<td>&amp; 2011L</td>
<td>and Integrated Principles of Biology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Laboratory 2</td>
<td></td>
</tr>
<tr>
<td>CHM 2045</td>
<td>General Chemistry 1</td>
<td>4</td>
</tr>
<tr>
<td>&amp; 2045L</td>
<td>and General Chemistry 1 Laboratory</td>
<td></td>
</tr>
<tr>
<td>CHM 2046</td>
<td>General Chemistry 2</td>
<td>4</td>
</tr>
<tr>
<td>&amp; 2046L</td>
<td>and General Chemistry 2 Laboratory</td>
<td></td>
</tr>
<tr>
<td>MAC 2311</td>
<td>Analytic Geometry and Calculus 1</td>
<td>4</td>
</tr>
</tbody>
</table>

Select one of the following: 8-10

Option One

- **PHY 2053**: Physics 1 and Laboratory for Physics 1
- **PHY 2054**: Physics 2 and Laboratory for Physics 2

Option Two

- **PHY 2048**: Physics with Calculus 1 and Laboratory for Physics with Calculus 1
- **PHY 2049**: Physics with Calculus 2 and Laboratory for Physics with Calculus 2
- **CHM 2210**: Organic Chemistry 1
- **CHM 2211**: Organic Chemistry 2 and Organic Chemistry Laboratory

Total Credits: 36-38

All majors must complete the biology and general chemistry sequences and calculus by the end of the sophomore year. CHM 2210 must be completed by the end of tracking term five. To continue in the major, students must attain a minimum 2.5 cumulative GPA in these graded courses with no grade lower than a C.

Core Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BCH 4024</td>
<td>Introduction to Biochemistry and Molecular</td>
<td>4</td>
</tr>
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<td>or CHM 3218</td>
<td>Organic Chemistry/Biochemistry</td>
<td></td>
</tr>
<tr>
<td>MCB 3023</td>
<td>Principles of Microbiology</td>
<td>5</td>
</tr>
<tr>
<td>&amp; 3023L</td>
<td>and Principles of Microbiology Laboratory</td>
<td></td>
</tr>
<tr>
<td>MCB 4203</td>
<td>Bacterial and Viral Pathogens</td>
<td>3</td>
</tr>
<tr>
<td>or PCB 4233</td>
<td>Immunology</td>
<td></td>
</tr>
<tr>
<td>MCB 4304</td>
<td>Genetics of Microorganisms</td>
<td>3</td>
</tr>
<tr>
<td>or PCB 4522</td>
<td>Molecular Genetics</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits: 15

Students must take MCB 4203 or PCB 4233 as a core course. If they take both, one will count as a core course and the other will roll over into the 10-credit department elective requirement.

Department Elective Requirements

A total of 10 credits of approved department electives, including one credit in an advanced lab, are required. The list of approved department electives is available on the department website. A maximum of four credits of approved department electives with course prefixes of CHM, FOS, HOS, SWS and ZOO (excluding ZOO 4232) may be taken in other departments. The remaining six credits must be chosen from approved department electives and may include these BSC and ZOO courses: BSC 2891, BSC 4434C and ZOO 4232.

Quantitative Requirement

A total of 3-4 credits of approved courses meets this requirement. Courses include:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHM 3120</td>
<td>Introduction to Analytical Chemistry</td>
<td>3-4</td>
</tr>
<tr>
<td>&amp; 3120L</td>
<td>and Analytical Chemistry Laboratory</td>
<td></td>
</tr>
<tr>
<td>STA 2023</td>
<td>Introduction to Statistics 1</td>
<td></td>
</tr>
<tr>
<td>COP 3275</td>
<td>Computer Programming Using C</td>
<td></td>
</tr>
<tr>
<td>PCB 3063</td>
<td>Genetics</td>
<td></td>
</tr>
<tr>
<td>MCB 4320C</td>
<td>The Microbiome</td>
<td></td>
</tr>
<tr>
<td>BSC 4434C</td>
<td>Introduction to Bioinformatics</td>
<td>3</td>
</tr>
</tbody>
</table>
Course Details

MCB 4911 may be taken for a maximum of three credits per semester and six credits total. This policy applies to all microbiology and cell science majors registered for undergraduate research in other out-of-department undergraduate research courses such as BCH 4905, BMS 4905, ZOO 4905, etc.

MCB 4934 is often used for TA lab positions. TA positions may be repeated for two semesters with one lab assignment per semester.

Enrollment in MCB 4911, MCB 4905 and MCB 4934 (Teaching Assistantship) will not fulfill any credits toward the microbiology department elective requirements; they will count only as general elective credit toward the 120 credits for the B.S. degree.

Undergraduate Research

A majority of MCS students are actively involved in undergraduate research for credit with mentors throughout the university. The department encourages preprofessional and graduate school bound students to complete a minimum of two semesters of undergraduate research. The department maintains a list of mentors across campus who allow undergraduate students to participate in valuable research under their guidance. More information is available about undergraduate research and faculty mentors who have worked with microbiology and cell science students.

Combined-Degree Program

A Bachelor of Science and Master of Science (non-thesis) program is offered by the College of Agricultural and Life Sciences. Microbiology majors in both the College of Agricultural and Life Sciences and the College of Liberal Arts and Sciences are eligible for admission to the combined degree program. Students should email for an appointment to determine their eligibility for this program.

Preparation for Graduate Study

This major prepares students for entry into graduate studies in microbiology, cell biology, biochemistry and other areas.

All students interested in graduate education should develop a strong background in chemistry. Suggested schedules for students who plan to attend graduate school are available on the website. Students planning graduate study in microbiology, biochemistry or molecular biological sciences should consider taking these courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM 3218</td>
<td>Organic Chemistry/Biochemistry 2 (for the biochemistry requirement)</td>
<td>4</td>
</tr>
<tr>
<td>MAC 2312</td>
<td>Analytic Geometry and Calculus 2</td>
<td>4</td>
</tr>
<tr>
<td>STA 2023</td>
<td>Introduction to Statistics 1</td>
<td>3</td>
</tr>
</tbody>
</table>

Select the following to fulfill nine credits of required department electives:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>MCB 4403</td>
<td>Prokaryotic Cell Structure and Function</td>
</tr>
<tr>
<td>PCB 3134</td>
<td>Eukaryotic Cell Structure and Function</td>
</tr>
<tr>
<td>CHM 3400</td>
<td>Physical Chemistry for the Biosciences</td>
</tr>
</tbody>
</table>

Select one of the following to fulfill the microbiology advanced laboratory requirement:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>MCB 5305L</td>
<td>Microbial Genetics Lab</td>
</tr>
<tr>
<td>MCB 5136L</td>
<td></td>
</tr>
<tr>
<td>PCB 4233</td>
<td>Immunology (to fulfill the pathogens or immunology requirement)</td>
</tr>
<tr>
<td>MCB 4905</td>
<td>Independent Study (will provide valuable laboratory research experience)</td>
</tr>
</tbody>
</table>

Total Credits: 29-30

Relevant Minors and/or Certificates

The Department of Microbiology and Cell Science also offers a minor in bioinformatics to students majoring in any life sciences subject, including and not limited to microbiology, biology or biochemistry.

So integrated is bioinformatics with the life sciences that it is difficult to find an active research program that does not rely on bioinformatic analysis to achieve results. By integrating bioinformatic and traditional methods, the minor in bioinformatics provides critical training to future professionals in the life science disciplines.

Related Microbiology and Cell Science Programs

- Combined Degree
- Bachelor of Science in Microbiology and Cell Science, CLAS
- Bachelor of Science in Microbiology and Cell Science, UF Online
- Bioinformatics minor

Critical Tracking

Critical Tracking records each student's progress in courses that are required for entry to each major. Please note the critical-tracking requirements below on a per-semester basis.

Equivalent critical-tracking courses as determined by the State of Florida Common Course Prerequisites may be used for transfer students.

Semester 1

- Complete CHM 1025 or CHM 2045/CHM 2045L
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 2

- Complete CHM 2045/CHM 2045L and BSC 2010/BSC 2010L
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 3

- Complete CHM 2046/CHM 2046L and MAC 2311
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 4

- Complete BSC 2011/BSC 2011L
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required
Semester 5

- Complete CHM 2210
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Model Semester Plan

To remain on track, students must complete the appropriate critical-tracking courses, which appear in bold. These courses must be completed by the terms as listed above in the Critical Tracking criteria.

This semester plan represents an example progression through the major. Actual courses and course order may be different depending on the student’s academic record and scheduling availability of courses. Prerequisites still apply.

<table>
<thead>
<tr>
<th>Course Semester One</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BSC 2010 &amp; 2010L</td>
<td>Integrated Principles of Biology 1 and Integrated Principles of Biology Laboratory 1 (Critical Tracking; Gen Ed Biological Sciences)</td>
<td>4</td>
</tr>
<tr>
<td>CHM 2045 &amp; 2045L</td>
<td>General Chemistry 1 and General Chemistry 1 Laboratory (Critical Tracking; State Core Gen Ed Biological and Physical Sciences)</td>
<td>4</td>
</tr>
<tr>
<td>IUF 1000</td>
<td>What is the Good Life (Gen Ed Humanities)</td>
<td>3</td>
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</tbody>
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State Core Gen Ed Composition; Writing Requirement | 3 |

Credits | 14 |

Semester Two

Select one: 3-4

- AEB 2104 Economic Issues, Food and You
- AEB 3103 Principles of Food and Resource Economics
- ECO 2013 Principles of Macroeconomics
- ECO 2023 Principles of Microeconomics (Gen Ed Social and Behavioral Sciences)
- BSC 2011 & 2011L Integrated Principles of Biology 2 and Integrated Principles of Biology Laboratory 2 (Critical Tracking; Gen Ed Biological Sciences)
- CHM 246 & 246L General Chemistry 2 and General Chemistry 2 Laboratory (Critical Tracking; Gen Ed Physical Sciences)

State Core Gen Ed Humanities | 3 |

Credits | 14-15 |

Semester Three

CHM 2210 | Organic Chemistry 1 (Critical Tracking) | 3 |
MAC 2311 | Analytic Geometry and Calculus 1 (Critical Tracking; State Core Gen Ed Mathematics) | 4 |

Select one: 4-5

- PHY 2053 Physics 1 & 2053L and Laboratory for Physics 1
- PHY 2048 Physics with Calculus 1 & 2048L and Laboratory for Physics with Calculus 1

State Core Gen Ed Social and Behavioral Sciences | 3 |

Credits | 14-15 |

Semester Four

Select one: 3

- AEC 3033C Research and Business Writing in Agricultural and Life Sciences (Writing Requirement)
- ENC 2210 Technical Writing (Writing Requirement)
- CHM 2211 Organic Chemistry 2 & 2211L and Organic Chemistry Laboratory
- MCB 3023 and Principles of Microbiology & 3023L
- Gen Ed Composition; Writing Requirement 3 |

Credits | 16 |

Semester Five

AEC 3030C or SPC 2608 Effective Oral Communication or Introduction to Public Speaking
BCH 4024 Introduction to Biochemistry and Molecular Biology or CHM 3218 Organic Chemistry/Biochemistry 2 |

Select one: 4-5

- PHY 2054 Physics 2 & 2054L and Laboratory for Physics 2
- PHY 2049 Physics with Calculus 2 & 2049L and Laboratory for Physics with Calculus 2

Gen Ed Diversity | 3 |

Credits | 14-15 |

Semester Six

PCB 4522 Molecular Genetics
STA 2023 Introduction to Statistics 1 (Gen Ed Mathematics) |

Department elective | 3 |

International elective | 3 |

Electives | 4 |

Credits | 16 |

Semester Seven

MCB 4203 Bacterial and Viral Pathogens
Writing Requirement | 3 |

Department electives | 6 |

Electives | 4 |

Credits | 16 |

Total Credits | 120 |

1 ENC 1101 recommended.

A 2.5 GPA with minimum grades of C in the bolded science and math courses listed above is required to continue in the major after Semester 4.

Academic Learning Compact

The Bachelor of Science in microbiology and cell science, offered by both the College of Agricultural and Life Sciences and the College of Liberal Arts and Sciences, offers students flexibility in a curriculum that develops an excellent knowledge base and an understanding of concepts in microbiology, cell biology and the biomolecular sciences. Emphasis will be placed on application of the scientific method to gain an understanding of the biological world at the cellular and molecular levels. Students will learn to evaluate hypotheses, to interpret experimental data and to communicate results effectively.

Before Graduating Students Must

- Pass a microbiology and cell sciences competency test consisting of four parts, one part from each of these required courses:
Students in the Major Will Learn to

Student Learning Outcomes (SLOs)

Content
1. Describe fundamental concepts, skills and processes in microbiology, molecular biology and in host/pathogen interactions.
2. Apply fundamental concepts, skills and protocols used to conduct research in fields of microbiology, molecular biology and in host/pathogen.

Critical Thinking
3. Evaluate information and data in the general areas of microbiology and the cellular and molecular biological sciences.
4. Solve typical problems that are encountered in general areas of microbiology and cellular and molecular biological sciences.

Communication
5. Communicate effectively in written form in a manner appropriate in microbiology and the cellular and molecular biological sciences.
6. Communicate orally (including visual aids) in an effective manner appropriate in microbiology and the cellular and molecular biological sciences.

Curriculum Map

<table>
<thead>
<tr>
<th>Courses</th>
<th>SLO 1</th>
<th>SLO 2</th>
<th>SLO 3</th>
<th>SLO 4</th>
<th>SLO 5</th>
<th>SLO 6</th>
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</thead>
<tbody>
<tr>
<td>AEC 3030C</td>
<td>I, R, A</td>
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<td>I, R, A</td>
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</tr>
<tr>
<td>MCB 3023L, A</td>
<td>I</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>MCB 3023L, R</td>
<td>I, R</td>
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<td>I, R, A</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>MCB 4034L, R, A or PCB 4233</td>
<td>I, R</td>
<td>I, R</td>
<td>I, R</td>
<td>I, R</td>
<td>I, R</td>
<td></td>
</tr>
<tr>
<td>MCB 4304L, R, A or PCB 4522</td>
<td>I, R</td>
<td>R, A</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
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Assessment Types
- Genome and lab projects
- Presentations
- Exams
- Final grades