### Microbiology and Cell Sciences | CLAS

The Bachelor of Science in Microbiology and Cell Science 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. Emphasizes application of the scientific method to gain an understanding of the biological world at the cellular and molecular levels. Students learn to evaluate hypotheses, to interpret experimental data, and to communicate results effectively.

### About this Program
- **College:** Liberal Arts and 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.

More Info

### Coursework for the Major

All majors must complete 28-29 credits: 15 credits of core requirements, at least 10 credits of upper-division department electives and 3-4 credits for the quantitative requirement. A minimum of one credit in an advanced laboratory is required as part of the 10 department-elective credits. In addition, students must complete 35-38 hours of required foundation coursework.

Minimum grades of C 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 cumulative 2.0 GPA is also required.

### Required Foundation 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 and Laboratory 1</td>
<td>4</td>
</tr>
<tr>
<td>&amp; 2010L</td>
<td>and Integrated Principles of Biology Laboratory 1</td>
<td></td>
</tr>
<tr>
<td>BSC 2111</td>
<td>Integrated Principles of Biology 2 and Laboratory 2</td>
<td>4</td>
</tr>
<tr>
<td>&amp; 2011L</td>
<td>and Integrated Principles of Biology Laboratory 2</td>
<td></td>
</tr>
<tr>
<td>CHM 2045</td>
<td>General Chemistry 1 and Laboratory 1</td>
<td>4</td>
</tr>
<tr>
<td>&amp; 2045L</td>
<td>and General Chemistry 1 Laboratory</td>
<td></td>
</tr>
</tbody>
</table>

Select one of the following: 8-10

Option One
- **PHY 2053** Physics 1
  - & 2053L and Laboratory for Physics 1
- **PHY 2054** Physics 2
  - & 2054L and Laboratory for Physics 2

Option Two
- **PHY 2048** Physics with Calculus 1
  - & 2048L and Laboratory for Physics with Calculus 1
- **PHY 2049** Physics with Calculus 2
  - & 2049L and Laboratory for Physics with Calculus 2
- **CHM 2210** Organic Chemistry 1
  - 3
- **CHM 2211** Organic Chemistry 2
  - 5
- & 2211L 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. Organic Chemistry, CHM 2210, must be completed by the end of tracking term five. To continue in the major, students must attain a cumulative GPA in these graded courses of no less than 2.5 and with no grade lower than a C.

### Core Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCH 4024</td>
<td>Introduction to Biochemistry and Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>or CHM 3218</td>
<td>Organic Chemistry/Biochemistry 2</td>
<td></td>
</tr>
<tr>
<td>MCB 3023</td>
<td>Principles of Microbiology and Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>&amp; 3023L</td>
<td>Principles of Microbiology Laboratory</td>
<td></td>
</tr>
<tr>
<td>MCB 4203</td>
<td>Bacterial 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 Requirement

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

### 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>
</tr>
</thead>
<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</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>Code</td>
<td>Title</td>
<td>Credits</td>
</tr>
<tr>
<td>----------</td>
<td>-------------------------------------------------</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>
<tr>
<td>BSC 2891</td>
<td>Python Programming for Biology</td>
<td></td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td><strong>6-7</strong></td>
</tr>
</tbody>
</table>

Several of these courses are also department electives and cannot be used to fulfill both the quantitative and the department elective requirements. No overlap is allowed.

**Course Details**

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

MCB 4934 is often used for TA lab positions. TA positions may be repeated for a total of 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 major requirements; they will count only as general elective credit toward the 120 credits for the B.S. degree.

**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.

**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 as soon as possible. Suggested schedules for students who plan to attend graduate school are available on the website. Students planning graduate study in microbiology, cell biology, biochemistry, and other areas should consider taking the following 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>
<tr>
<td>Select the following to fulfill nine credits of required department electives:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCB 4403</td>
<td>Prokaryotic Cell Structure and Function</td>
<td></td>
</tr>
<tr>
<td>PCB 3134</td>
<td>Eukaryotic Cell Structure and Function</td>
<td></td>
</tr>
<tr>
<td>CHM 3400</td>
<td>Physical Chemistry for the Biosciences</td>
<td></td>
</tr>
<tr>
<td>MCB 5305L</td>
<td>Microbial Genetics Lab (fulfills the microbiology advanced laboratory requirement)</td>
<td>2</td>
</tr>
<tr>
<td>PCB 4233</td>
<td>Immunology (fulfills the pathogens or immunology requirement)</td>
<td>3</td>
</tr>
<tr>
<td>MCB 4905</td>
<td>Independent Study (will provide valuable laboratory research experience)</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td><strong>29</strong></td>
</tr>
</tbody>
</table>

**Relevant Minors and/or Certificates**

The Microbiology and Cell Science Department also offers an undergraduate minor in bioinformatics to students majoring in any biology-related subject, including and not limited to microbiology, biology, or biochemistry.

So integrated is bioinformatics with biology that it is difficult to find an active research program that does not rely on bioinformatic analysis to achieve results. Unfortunately, the integration of bioinformatic and traditional methods is not stressed in many undergraduate programs, leaving the next generation of biologists without the skills they need to succeed in tomorrow’s research environment. The undergraduate minor in bioinformatics provides this critical training to future professionals in the biological disciplines.

**Research**

A majority of majors are actively involved in undergraduate research for credit with mentors throughout the university. Preprofessional and graduate school-bound majors are encouraged to do a minimum of two semesters of undergraduate research. The department has a comprehensive list of mentors across campus who allow undergraduate students to do valuable research under their guidance. Please refer to the department website for more information on undergraduate research, finding a mentor and a contact list of UF faculty who have worked with microbiology and cell science majors.

**Related Microbiology and Cell Science Programs**

- Combined Degree
- Bachelor of Science in Microbiology and Cell Science, CALS
- Bachelor of Science in Microbiology and Cell Science, UF Online

**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 MAC 2311
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required
Semester 3
• Complete CHM 2046/CHM 2046L and BSC 2010/BSC 2010L
• 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
Students are expected to complete the writing requirement while in the process of taking the courses below. Students are also expected to complete the general education international (GE-N) and diversity (GE-D) requirements concurrently with another general education requirement (typically, GE-C, H, or S).

For degree requirements outside of the major, refer to CLAS Degree Requirements: Structure of a CLAS Degree.

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.

Course Title Credits

Semester One
CHM 2045 & 2045L General Chemistry 1 and General Chemistry 1 Laboratory (Critical Tracking: State Core Gen Ed Physical Sciences) 4
IUF 1000 What is the Good Life (Gen Ed Humanities) 3
MAC 1147 Precalculus Algebra and Trigonometry (Gen Ed Mathematics) 4
State Core Gen Ed Composition Credits 3
14

Semester Two
CHM 2046 & 2046L General Chemistry 2 and General Chemistry 2 Laboratory (Critical Tracking: Gen Ed Physical Sciences) 4
MAC 2311 Analytic Geometry and Calculus 1 (Critical Tracking: State Core Gen Ed Mathematics) 4
Gen Ed Composition Credits 3
State Core Gen Ed Social and Behavioral Sciences Credits 3
14

Semester Three
BSC 2010 & 2010L Integrated Principles of Biology 1 and Integrated Principles of Biology Laboratory 1 (Critical Tracking: Gen Ed Biological Sciences) 4
CHM 2210 Organic Chemistry 1 (Critical Tracking) 3

Foreign language 5
Gen Ed Social and Behavioral Sciences 3
Credits 15

Semester Four
BSC 2011 & 2011L Integrated Principles of Biology 2 and Integrated Principles of Biology Laboratory 2 (Critical Tracking: Gen Ed Biological Sciences) 4
CHM 2211 Organic Chemistry 2 & 2211L and Organic Chemistry Laboratory 5
Foreign language 5
State Core Gen Ed Humanities Credits 3
17

Semester Five
BCH 4024 or CHM 3218 Introduction to Biochemistry and Molecular Biology or Organic Chemistry/Biochemistry 2 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
Gen Ed Social and Behavioral Sciences 3
Elective 3
Credits 14-15

Semester Six
MCB 3023 Principles of Microbiology & 3023L and Principles of Microbiology Laboratory 5
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 Humanities 3
Credits 15-16

Semester Seven
MCB 4203 Bacterial Pathogens 3
Select one: 3-4
MCB 4320C The Microbiome
COP 3275 Computer Programming Using C
CHM 3120 Introduction to Analytical Chemistry & 3120L and Analytical Chemistry Laboratory
BSC 2891 Python Programming for Biology
BSC 4434C Introduction to Bioinformatics
PCB 3063 Genetics
STA 2023 Introduction to Statistics 1
Department elective 3
Elective 3
Elective credits (3000 level or higher; not in major) 4
Credits 16-17

Semester Eight
MCB 4034L Advanced Microbiology Laboratory 1
PCB 4522 Molecular Genetics 3
Department electives 6
Electives 5
Credits 15
Total Credits 120

1 If needed for MAC 2311 in the spring.
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:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCB 3023</td>
<td>Principles of Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>MCB 3023L &amp; MCB 4034L</td>
<td>Principles of Microbiology Laboratory and Advanced Microbiology Laboratory (or equivalent)</td>
<td>3</td>
</tr>
<tr>
<td>MCB 4203 or PCB 4233</td>
<td>Bacterial Pathogens</td>
<td>3</td>
</tr>
<tr>
<td>MCB 4304 or PCB 4522</td>
<td>Genetics of Microorganisms</td>
<td>3</td>
</tr>
</tbody>
</table>

- Complete requirements for the baccalaureate degree, as determined by faculty.

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

I = Introduced; R = Reinforced; A = Assessed

<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>
</tr>
</thead>
<tbody>
<tr>
<td>AEC 3030C</td>
<td>I, R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AEC 3033I</td>
<td></td>
<td>I, R</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCB 3023I, A</td>
<td></td>
<td></td>
<td>I</td>
<td>I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCB 3023I, R</td>
<td>I, R</td>
<td>R</td>
<td>I, R</td>
<td>A</td>
<td></td>
<td>R</td>
</tr>
<tr>
<td>MCB 4034I, R</td>
<td>I, R</td>
<td>I, R</td>
<td>I, R</td>
<td>A</td>
<td>R</td>
<td>I, R</td>
</tr>
</tbody>
</table>

Assessment Types
- Genome and lab projects
- Presentations
- Exams
- Final grades