MICROBIOLOGY AND CELL SCIENCE | CALS

The study of small living organisms, Microbiology and Cell Science includes emphasis on molecular biology and genetics; immunology; virology; host-pathogen interactions; cellular ultrastructure; environmental microbiology; and microbial physiology, metabolism and regulation. Microbiology and Cell Science students study chemistry, physics, bacterial pathogens, and genetics.

About this Program

- **College:** Agricultural and Life Sciences (http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/)
- **Degree:** Bachelor of Science
- **Credits for Degree:** 120

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

Department Information

The Department of Microbiology & Cell Science is committed to excellence in education, research and service to the community. The curriculum provides an excellent preparation for students who wish to enter the workforce or continue their education in professional programs such as medical, dental, pharmacy, veterinary programs, graduate school, or public health degrees. BS degrees are offered through both the College of Agricultural and Life Sciences and the College of Liberal Arts and Sciences and the MS and PhD degrees are offered through the College of Agricultural and Life Sciences. Combination degrees are available.

_Website (http://microcell.ufl.edu/)_

CONTACT

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MICROBIOLOGY AND CELL SCIENCE BUILDING (MCSB)
GAINESVILLE FL 32611-0700
Map (http://campusmap.ufl.edu/#/index/0981)

Curriculum

- Bioinformatics Minor
- Bioinformatics Minor UF Online
- Combination Degrees
- Microbiology and Cell Science UF Online
- Microbiology and Cell Science | CALS
- Microbiology and Cell Science | CLAS
- Pathogenesis Minor
- Pathogenesis Minor UF Online

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 credits: 18 credits are core requirements, 7 credits are department electives and 3 credits are the quantitative requirement. A minimum of one credit in an advanced laboratory is required as part of the 7 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>
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### Core Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSC 2891</td>
<td>Python Programming for Biology</td>
<td>3</td>
</tr>
<tr>
<td>or MCB 4325C</td>
<td>R for Functional Genomics</td>
<td></td>
</tr>
<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 and 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 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>
<tr>
<td>MCB 4403</td>
<td>Prokaryotic Cell Structure and Function</td>
<td>3</td>
</tr>
<tr>
<td>or PCB 3134</td>
<td>Eukaryotic Cell Structure and Function</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits: 21

If students take both "or" courses, one will count as a core course and the other will roll over into the 7-credit department elective requirement.

### Department Elective Requirements

A total of 7 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 may be taken in other departments. The remaining six credits must be chosen from approved department electives.

### Programming or Biostatistics with Programming Requirement

A total of 3 credits of approved courses meets this requirement. Select from BSC 2891, MCB 4325C, or any equivalent programming class. 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. STA 2023 will not fulfill this requirement.

### 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 positions as Supervised Teaching. TA positions may be repeated for two semesters with one lab assignment per semester.

Enrollment in MCB 4911, MCB 4905, and MCB 4934 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 BS degree.

**Relevant Minors and Certificates**
The Department of Microbiology and Cell Science also offers a minor in bioinformatics to students majoring in any biology-related subject, including and not limited to microbiology, biology, or biochemistry.

More Info (http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/BIF_UMN/)

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.

Enrollment in MCB 4911 will not fulfill any credits toward the microbiology major requirements; they will count only as general elective credit toward the 120 credits for the BS degree.

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**Critical Tracking**
Critical Tracking records each student’s progress in courses that are required for progress toward 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 (https://cpm.flvc.org/advance-search/) 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 or CHM 2200 or CHM 3217
- 2.5 GPA required for all critical-tracking courses
- 2.0 upper division GPA required
- 2.0 UF GPA required

Semester 6
- Complete MCB 3023
- 2.0 upper division GPA required
- 2.0 UF GPA required

Semester 7
- Complete MCB 4203 (Fall) or PCB 4233 (Spring) or PCB 3134 (Fall/Spring) or MCB 4403 (Fall)
- 2.0 upper division GPA required
- 2.0 UF GPA required

Semester 8
- Complete MCB 4034L
- 2.0 upper division GPA required
- 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).

Degree Comparison between the Colleges

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester One</td>
<td>Quest 1 (Gen Ed Humanities)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CHM 2045 &amp; 2045L</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>MAC 2311</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>State Core Gen Ed Composition</td>
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</table>

Credits: 14

Semester Two

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<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>BSC 2891</td>
<td>Python Programming for Biology (Or similar quantitative elective)</td>
<td>3</td>
</tr>
<tr>
<td>CHM 2046 &amp; 2046L</td>
<td>General Chemistry 2 and General Chemistry 2 Laboratory (Critical Tracking; Gen Ed Physical Sciences)</td>
<td>4</td>
</tr>
</tbody>
</table>

Credits: 14

Semester Three

Select one:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>
AEB 2014 Economic Issues, Food and You
AEB 3103 Principles of Food and Resource Economics
ECO 2103 Principles of Macroeconomics
ECO 2023 Principles of Microeconomics (Gen Ed Social and Behavioral Sciences)
BSC 2011 Integrated Principles of Biology 2
& 2011L and Integrated Principles of Biology Laboratory 2 (Critical Tracking; Gen Ed Biological and Physical Sciences)
CHM 2210 Organic Chemistry 1 (Critical Tracking) 5
State Core Gen Ed Social and Behavioral Sciences; potentially with Gen Ed International or Gen Ed Diversity 3

Credits 13-14

Semester Four
Quest 2 (Gen Ed Biological or Physical Sciences) 3
AEC 3030C Research and Business Writing in Agricultural and Life Sciences (Writing Requirement)
or ENC 2210 or Technical Writing
CHM 2211 Organic Chemistry 2
& 2211L and Organic Chemistry Laboratory
MCB 3023 Principles of Microbiology
& 3023L and Principles of Microbiology Laboratory (Critical Tracking)

Credits 16

Semester Five
AEC 3030C Effective Oral Communication
or SPC 2608 or Introduction to Public Speaking
MCB 4203 Bacterial Pathogens (Critical Tracking) 2
or PCB 4233 or Immunology
MCB 4403 Prokaryotic Cell Structure and Function (Critical Tracking)
or PCB 3134 or Eukaryotic Cell Structure and Function
Gen Ed Diversity or Gen Ed International 3
Electives 3

Credits 17

Semester Six
BCH 4024 Introduction to Biochemistry and Molecular Biology
or CHM 3218 or Organic Chemistry/Biochemistry 2
MCB 4304 Genetics of Microorganisms (Critical Tracking) 4
or PCB 4522 or Molecular Genetics
MCB 4034L Advanced Microbiology Laboratory (Critical Tracking)
Gen Ed Mathematics 3
Department elective 3

Credits 14

Semester Seven
Select one: 4-5
PHY 2048 Physics with Calculus 1
& 2048L and Laboratory for Physics with Calculus 1
PHY 2053 Physics 1
& 2053L and Laboratory for Physics 1
State Core Gen Ed Humanities (http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext) 3
Writing Requirement 3
Department elective 3
Elective 3

Credits 16-17

Semester Eight
Select one: 4-5
PHY 2049 Physics with Calculus 2
& 2049L and Laboratory for Physics with Calculus 2
PHY 2054 Physics 2
& 2054L and Laboratory for Physics 2
State Core Gen Ed Humanities (http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext) 3
Gen Ed International 3
Department elective 3
Elective 3

Credits 16-17

Total Credits 120
ENC 1101 recommended.

MCB 4203 is taught in the Fall and Spring. PCB 4233 is taught only in the Spring.

Choice depends on courses taken in Semesters 3 and 4.

MCB 4304 is taught only in the Fall. PCB 4522 is taught only in the Spring.

Students should begin the organic chemistry/biochemistry series of courses at this point. This model semester plan highlights the most common pathway through these courses, but there are alternative routes to satisfy this requirement.

- Traditional route: CHM 2210, CHM 2211, CHM 2211L, BCH 4024
- Alternative route 1, for students who have a strong chemistry background: CHM 3217, CHM 2211L, CHM 3218
- Alternative route 2, for students who were not as successful or are less confident in previous chemistry courses: CHM 2200 (without the lab course), and then complete either Alternative route 1 (recommended) or the Traditional route.

Students should meet with their major advisor to determine their best path.

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

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>
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<tbody>
<tr>
<td>AEC 3030C</td>
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<td>I, R, A</td>
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<tr>
<td>AEC 3033C</td>
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<tr>
<td>MCB 3023</td>
<td>I, A</td>
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<td></td>
<td></td>
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<tr>
<td>MCB 3023L</td>
<td>I, R</td>
<td>I, R</td>
<td></td>
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<td>I, R, A</td>
<td></td>
</tr>
<tr>
<td>MCB 4203 or PCB 4233</td>
<td>I, R, A</td>
<td>I, R</td>
<td>I, R</td>
<td>I, R</td>
<td>I, R</td>
<td>I, R</td>
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<tr>
<td>MCB 4304 or PCB 4522</td>
<td>I, R, A</td>
<td>I, R</td>
<td>R, A</td>
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</tbody>
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Assessment Types

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