

# MICROBIOLOGY AND CELL SCIENCES | 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
- **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 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

Code	Title	Credits
BSC 2010 & 2010L	Integrated Principles of Biology 1 and Integrated Principles of Biology Laboratory 1	4
BSC 2011 & 2011L	Integrated Principles of Biology 2 and Integrated Principles of Biology Laboratory 2	4
CHM 2045 & 2045L	General Chemistry 1 and General Chemistry 1 Laboratory	4
CHM 2046 & 2046L	General Chemistry 2 and General Chemistry 2 Laboratory	4
MAC 2311	Analytic Geometry and Calculus 1	4
Select one:		8-10

Option One		
PHY 2053 & 2053L	Physics 1 and Laboratory for Physics 1	
PHY 2054 & 2054L	Physics 2 and Laboratory for Physics 2	
Option Two		
PHY 2048 & 2048L	Physics with Calculus 1 and Laboratory for Physics with Calculus 1	
PHY 2049 & 2049L	Physics with Calculus 2 and Laboratory for Physics with Calculus 2	
CHM 2210	Organic Chemistry 1	3
CHM 2211 & 2211L	Organic Chemistry 2 and Organic Chemistry Laboratory	5
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

Code	Title	Credits
BSC 2891 or MCB 4325C	Python Programming for Biology or R for Functional Genomics	3
BCH 4024 or CHM 3218	Introduction to Biochemistry and Molecular Biology or Organic Chemistry/Biochemistry 2	4
MCB 3023 & 3023L	Principles of Microbiology and Principles of Microbiology Laboratory	5
MCB 4203 or PCB 4233	Bacterial Pathogens or Immunology	3
MCB 4304 or PCB 4522	Genetics of Microorganisms or Molecular Genetics	3
MCB 4403 or PCB 3134	Prokaryotic Cell Structure and Function or Eukaryotic Cell Structure and Function	3
Total Credits		21

If students take both "or" classes, 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.

More Info (<http://microcell.ufl.edu/undergraduate-programs>)

## 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 B.S. degree.

## Relevant Minors and/or 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](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.

More Info (<http://microcell.ufl.edu/programs>)

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 B.S. degree.

## Related Microbiology and Cell Science Programs

- Combined Degree (<http://catalog.ufl.edu/UGRD/academic-programs/combined-degrees>)
- Bachelor of Science in Microbiology and Cell Science, CLAS ([http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/MCY\\_BS](http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/MCY_BS))
- Bachelor of Science in Microbiology and Cell Science, UF Online ([http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/MCB\\_BS\\_UFO](http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/MCB_BS_UFO))

- Bioinformatics minor ([http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/BIF\\_UMN](http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/BIF_UMN))

## 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 (<http://www.flvc.org/cpp/displayRecord.jsp?cip=260503&track=01>) 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).

## Degree Comparison between the Colleges

CALS   MCB	CLAS   MCY
Effective Oral Communication (AEC 3030C, SPC 2608)	College-level Foreign Language Sequence (8-10 credits)
Technical Writing (ENC 2210, ENC 3254, AEC 3033C)	1 additional Humanity course
Economics (ECO 2013, ECO 2023, AEB 2014)	1 additional Social Science course

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
<b>Semester One</b>		
MAC 2311	Analytic Geometry and Calculus 1 ( <b>Critical Tracking</b> )	4
CHM 2045 & 2045L	General Chemistry 1 and General Chemistry 1 Laboratory ( <b>Critical Tracking</b> )	4
IDS 1161	What is the Good Life (Gen Ed Humanities)	3
State Core Gen Ed Composition ( <a href="http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext">http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext</a> ); Writing Requirement <sup>1</sup>		3
Credits		14
<b>Semester Two</b>		
BSC 2010 & 2010L	Integrated Principles of Biology 1 and Integrated Principles of Biology Laboratory 1 ( <b>Critical Tracking</b> ; Gen Ed Biological Sciences)	4
BSC 2891	Python Programming for Biology	3
CHM 2046 & 2046L	General Chemistry 2 and General Chemistry 2 Laboratory ( <b>Critical Tracking</b> ; Gen Ed Physical Sciences)	4
State Core Gen Ed Composition ( <a href="http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext">http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext</a> ); Writing Requirement		3
Credits		14
<b>Semester Three</b>		
Select one:		3-4
AEB 2014	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 ( <b>Critical Tracking</b> ; Gen Ed Biological and Physical Sciences)	4
CHM 2210	Organic Chemistry 1 ( <b>Critical Tracking</b> )	3
State Core Gen Ed Social and Behavioral Sciences ( <a href="http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext">http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext</a> )		3
Credits		13-14
<b>Semester Four</b>		
AEC 3033C or ENC 2210	Research and Business Writing in Agricultural and Life Sciences (Writing Requirement) or Technical Writing	3
CHM 2211 & 2211L	Organic Chemistry 2 and Organic Chemistry Laboratory	5
MCB 3023 & 3023L	Principles of Microbiology and Principles of Microbiology Laboratory ( <b>Critical Tracking</b> )	5
Science Elective		3
Credits		16

<b>Semester Five</b>		
AEC 3030C or SPC 2608	Effective Oral Communication or Introduction to Public Speaking	3
MCB 4203 or PCB 4233	Bacterial Pathogens ( <b>Critical Tracking</b> ) <sup>2</sup> or Immunology	3
MCB 4403 or PCB 3134	Prokaryotic Cell Structure and Function ( <b>Critical Tracking</b> ) or Eukaryotic Cell Structure and Function	3
Gen Ed Diversity		3
Electives		5
Credits		17
<b>Semester Six</b>		
BCH 4024 or CHM 3218	Introduction to Biochemistry and Molecular Biology or Organic Chemistry/Biochemistry 2	4
MCB 4304 or PCB 4522	Genetics of Microorganisms <sup>3</sup> or Molecular Genetics	3
MCB 4034L	Advanced Microbiology Laboratory	1
Gen Ed Mathematics		3
Department elective		3
Credits		14
<b>Semester Seven</b>		
Select one:		4-5
PHY 2048 & 2048L	Physics with Calculus 1 and Laboratory for Physics with Calculus 1	
PHY 2053 & 2053L	Physics 1 and Laboratory for Physics 1	
State Core Gen Ed Humanities ( <a href="http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext">http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext</a> )		3
Writing Requirement		3
Department elective		3
Elective		3
Credits		16-17
<b>Semester Eight</b>		
Select one:		4-5
PHY 2049 & 2049L	Physics with Calculus 2 and Laboratory for Physics with Calculus 2	
PHY 2054 & 2054L	Physics 2 and Laboratory for Physics 2	
State Core Gen Ed Humanities ( <a href="http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext">http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext</a> )		3
Gen Ed International		3
Department elective		3
Elective		3
Credits		16-17
Total Credits		120

<sup>1</sup> ENC 1101 recommended.

<sup>2</sup> MCB 4203 is taught only in the fall; PCB 4233 is taught only in the spring.

<sup>3</sup> MCB 4304 is taught only in the fall; PCB 4522 is taught only in the spring.

*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:

Code	Title	Credits
MCB 3023	Principles of Microbiology	3
MCB 3023L & MCB 4034L	Principles of Microbiology Laboratory and Advanced Microbiology Laboratory (or equivalent)	3
MCB 4203 or PCB 4233	Bacterial Pathogens Immunology	3
MCB 4304 or PCB 4522	Genetics of Microorganisms Molecular Genetics	3

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

## Assessment Types

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

## 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*

Courses	SLO 1	SLO 2	SLO 3	SLO 4	SLO 5	SLO 6
AEC 3030C						I, R, A
AEC 3033C					I, R, A	
MCB 3023I, A			I	I		
MCB 3023I, R	I, R		R	I, R, A		R
MCB 4034I, R	I, R, A		I, R, A	I, R	R	I, R
MCB 4203I, R, A or PCB 4233	I, R		I, R	I, R	I, R	I, R
MCB 4304I, R, A or PCB 4522	I, R		R, A	R	R	R