# 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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P.O. Box 110700 1355 Museum Drive 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**

CodeTitleCreditsBSC 2010Integrated Principles of Biology 14& 2010Land Integrated Principles of Biology Laboratory 1

Option One	Disciss 1	
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	

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

### **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
- · 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**

Select one:

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**

<i>y</i> .	
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.

Semester Three		
	Credits	14
Gen Ed Composition		3
& 2046L	and General Chemistry 2 Laboratory (Critical Tracking; Gen Ed Physical Sciences)	
CHM 2046	General Chemistry 2	4
BSC 2891	Python Programming for Biology (Or similar quantitative elective)	3
	Sciences)	
& 2010L	and Integrated Principles of Biology Laboratory 1 ( <b>Critical Tracking</b> ; Gen Ed Biological	
BSC 2010	Integrated Principles of Biology 1	4
Semester Two		• • • • • • • • • • • • • • • • • • • •
	Credits	14
Requirement <sup>1</sup>		
State Core Gen Ed Composition (http://	catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext); Writing	3
MAC 2311	Analytic Geometry and Calculus 1 (Critical Tracking; State Core Gen Ed Mathematics)	4
& 2045L	and General Chemistry 1 Laboratory (Critical Tracking; State Core Gen Ed Physical Sciences)	
CHM 2045	General Chemistry 1	4
Quest 1 (Gen Ed Humanities)		3
Semester One		
Course	Title	Credits

3-4

AER 3103 Principles of Flood and Resource Economics ECO 2013 Principles of Macroeconomics (Sen Ed Social and Behavioral Sciences) ECO 2023 Principles of Microeconomics (Gen Ed Social and Behavioral Sciences) ECO 2023 Principles of Microeconomics (Gen Ed Social and Behavioral Sciences)  8 2011 Integrated Principles of Biology Laboratory 2 (Gritical Tracking, Gen Ed Biological and Physical Sciences) CHM 2210 Organic Chemistry 1 (Gritical Tracking) Satte Gore Gen Ed Social and Behavioral Sciences, potentially with Gen Ed International or Gen Ed Diversity  3 3 3 3 3 3 3 3 4 3 4 4 4 4 4 4 4 4 4			
ECO 2015   Principles of Macroeconomics   Cen Ed Social and Behavioral Sciences)   SEC 2011   Integrated Principles of Biology 2   A 2 2011   Integrated Principles of Biology 2   A 2 2011   Integrated Principles of Biology 2   A 2 2011   A 2 2011   Integrated Principles of Biology 2   A 2 2011	AEB 2014	Economic Issues, Food and You	
ECO 2023			
Sec 2011   Integrated Principles of Biology 2   A 2011   and Integrated Principles of Biology 2   Critical Tracking, Gen Ed Biological and Physical Sciences) Organic Chemistry (Critical Tracking)   3   3   3   3   3   3   3   3   3		·	
### State			
Physical Sciences   Organic Chemistry (Critical Tracking)   3   3   3   3   3   3   3   3   3			4
CHM 2210	& 2011L		
State Core Cem Ed Social and Behavioral Sciences; potentially with Gen Ed International or Gen Ed Diversity 3-14  Semester Four  Outset 2 (Gen Ed Biological or Physical Sciences)  AEC 303302 Research and Business Writing in Agricultural and Life Sciences (Writing Requirement)  or FENC 2210 Or FENC 2210 Or Fenchistry 2  AEC 303302 Research and Business Writing in Agricultural and Life Sciences (Writing Requirement)  or FENC 2210 OR	01114 0070	·	
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Credits         14           Semester Seven           Select one:         4-5           PHY 2048         Physics with Calculus 1         4-5           PHY 2053         Physics 1         4-5           & 2053L         and Laboratory for Physics 1         5-2           State Core Gen Ed Humanities (http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext)         3           Writing Requirement         3           Department elective         3           Elective         5-2           Credits         16-17           Semester Eight         5-2           Select one:         6-2         6-17           Select one:         4-5           PHY 2049         Physics with Calculus 2           & 2049L         and Laboratory for Physics with Calculus 2           & 2054L         and Laboratory for Physics 2           & 2054L         and Laboratory for Physics 2           State Core Gen Ed Humanities (http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext)         3			
Select one: Select	Department elective		3
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	14
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Gen Ed International         3           Department elective         3           Elective         3           Credits         16-17	State Core Gen Ed Humanitie	s (http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext)	3
Elective 3 Credits 16-17	Gen Ed International		3
Credits 16-17	Department elective		3
	Elective		3
Total Credits 120		Credits	16-17
		Total Credits	120

- ENC 1101 recommended.
- MCB 4203 is taught only in the Fall. PCB 4233 is taught only in the Spring.
- <sup>3</sup> 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.

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

Courses	SL0 1	SL0 2	SL0 3	SL0 4	SLO 5	SLO 6
AEC 3030C						I, R, A
AEC 3033C					I, R, A	
MCB 3023	I, A		1	1		
MCB 3023L	I, R	I, R	R	I, R, A		R
MCB 4034L	I, R	I, R, A	I, R, A	I, R	R	I, R
MCB 4203 or PCB 4233	I, R, A	I, R				
MCB 4304 or PCB 4522	I, R, A	I, R	R, A	R	R	R

# **Assessment Types**

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