

## **BIOLOGY MAJOR**

*Dr. Aida Jimenez, Program Director*

- Strong emphasis on undergraduate research and experiential learning
- Formal admissions test reviews (e.g. MCAT, PCAT) lead by Professors in their specialties
- Laboratory sections taught by Professors
- Four areas of emphasis to meet students' educational goals

### **Biology Program Mission Statement**

The mission of the Biology Program is to educate each student in understanding the living world and fundamental life processes and to help them acquire the skills and knowledge base needed work as a biologist, pursue graduate work, professional school or to teach biology. Each student is encouraged to think critically using their acquired knowledge base to make informed decisions in their future career and life enabling the student to use their skills to productively contribute to their community.

### **Biology Program Philosophy**

The Biology program at UC provides a rigorous curriculum grounded on a variety of biological disciplines (organismal biology, molecular biology, environmental science and biomedical science), along with intensive laboratory courses, field work, experiential learning, and research opportunities. By the time our students graduate, they will be equipped with the theoretical and practical skills necessary to be competitive and successful applicants for employment or admission to professional or graduate school in the biological, medical or environmental sciences. Our most recent 3-year aggregate data (2017-2019) shows that 84% of our graduates are successfully admitted to professional and graduate schools or have employment in a related area.

We foster a student-centered atmosphere where student learning, discovery, and self-reflection are embedded throughout the curriculum. Innovation, analytics and critical thinking are cultivated by providing opportunities for independent research projects both inside and outside of the curriculum. Most of our upper division courses are inquiry-based courses which help in bridging the gap between understanding foundational biological concepts to practicing scientific inquiry. Our strong biology curricular core is complemented by foundational chemistry, physics and mathematics courses which ensure our graduates are not only well rounded in the natural sciences but have acquired the necessary requirements for any professional and graduate program.

Our diverse faculty is dedicated to excellent teaching, service in all areas and to research. Our departmental teaching philosophy is based on the belief that using a combination of passive and active learning activities in small class sizes will help

develop self-regulated independent students who will be life-long learners. In addition, our facilities, laboratories and equipment support this teaching philosophy.

### **Admission Requirements**

Students must gain general admission to the University of Charleston. A visit to campus to meet with Admissions personnel and program faculty is strongly encouraged. Biology is offered on the Charleston campus.

### **Program Outcomes**

The graduate will:

1. The graduate effectively communicates ideas and presents results using proper English grammar, vocabulary, and conventional scientific format in both written and oral formats.
2. The graduate demonstrates comprehension of biological content knowledge from atoms to ecosystems through coursework.
3. The graduate demonstrates the use of scientific methodology to summarize data in tabular or graphical form.
4. The graduate demonstrates the ethical use of resources, data, and behavior.
5. The graduate demonstrates the ability to integrate content from math, chemistry, physics and technology to answer biological questions.

### **Assessment**

Biology majors are required to attain a minimum level of “C” in all courses or learning experiences and an overall grade point average (GPA) in all required major courses taken of 2.0 for graduation as per university policy. Competencies for all students will be assessed each semester. Demonstration of competencies is viewed as a continuous process. Once achieved, competencies must be maintained and further refined as each student progresses toward graduation.

### **Courses with Labs**

All courses with labs will have separate grades for the in-class lecture portion and the lab. However, to get full credit, students must pass both the lecture and the related lab with a grade of “C” or better in the same semester. Students failing either the lecture or lab by receiving a “D” or “F” will have to repeat both in the same semester. A student who fails the lecture or the lab or who transfers in credit for lecture without a lab may get approval from the instructor *and* the department chair to retake one without the other. Approval will be based on available lab seats and lecture seats and may not be granted until the start of the semester.

### **Core Program of study**

The Bachelor of Science in Biology requires a total of 120 credit hours of coursework. The student must fulfill 27 credit hours in General education requirements

for the University. Through thoughtful and intentional advising, we make sure the general education choices count toward the student’s graduate or professional school requirements. Biology majors must take 48 credits which are a foundational set of courses listed below.

<b>CORE Science and Math courses – 48 CREDIT HOURS</b>		
BIOL 130	Introductory Biology for Majors (with lab)	4 credits
BIOL 2xx	Introduction to Cell Physiology and Biochemistry (with lab)	4 credits
BIOL 331	Microbiology (with lab)	4 credits
BIOL 332	Genetics (with lab)	4 credits
BIOL 496	Biology Capstone	1 credit
NSCI 220	Statistics for Science and Research	3 credits
CHEM 101	General Chemistry I (with lab)	4 credits
CHEM 102	General Chemistry II (with lab)	4 credits
CHEM 201	Organic Chemistry I (with lab)	4 credits
CHEM 202	Organic Chemistry II (with lab)	4 credits
MATH 201	Calculus I	4 credits
PHSC 201	Physics I (with lab)	4 credits
PHSC 202	Physics II (with lab)	4 credits

In addition, students take 24 credits in four keystone areas of biology: organismal biology, molecular biology, ecology, and biomedical sciences. All biology courses are classified into each of these categories. Every student in the major will be required to take a number of courses (experiences) in each of these areas, but they can choose from this pre-approved list. Some courses may be listed in more than one area but shall only count once. This flexible approach ensures that everyone who graduates with a Biology major from UC has taken courses in these keystone areas. This coursework better prepares graduates in current areas of biology and it allows students to explore the areas of emphasis before they commit to one.

<b>Major Requirements– 24 CREDIT HOURS</b>		
<b>Organismal Biology</b>	<b>Select 3 from the following:</b>	
BIOL 215	Botany (with lab)	4 credits
BIOL 224	Zoology (with lab)	4 credits
BIOL 301	Anatomy and Physiology I (with lab)	4 credits
BIOL 302	Anatomy and Physiology II (with lab)	4 credits
<b>Molecular Biology</b>	<b>Select 1 from the following:</b>	
BIOL 3xx	Introduction to Bioinformatics	4 credits
BIOL 419	Micro Eco Health/Disease (with lab)	4 credits
BIOL 451	Cell and Molecular Biology (with lab)	4 credits
BIOL 453	Virology (with lab)	4 credits
CHEM 410	Biochemistry	4 credits
<b>Ecology</b>	<b>Select 1 from the following:</b>	
BIOL 128	Biology and Chemistry of Nat Eco in WV (with lab)	4 credits
BIOL 3xx	GIS for Biologists	4 credits
BIOL 3xx	Soil Biology (with lab)	4 credits
BIOL 400	Ecology (with lab)	4 credits
BIOL 413	Appalachian Flora (with lab)	4 credits
BIOL 419	Micro Eco Health/Disease (with lab)	
BIOL 430	Limnology (with lab)	4 credits
<b>Biomedical Science</b>	<b>Select 1 from the following:</b>	
BIOL 303	Medical Terminology	3 credits
BIOL 321	Animal Parasitology	4 credits
BIOL 333	Immunology (with lab)	4 credits
BIOL 370	Physiology of Exercise	3 credits
BIOL 420	Pathophysiology I	3 credits
BIOL 421	Pathophysiology II	3 credits
BIOL 422	Embryology (with lab)	4 credits
BIOL 419	Micro Eco Health/Disease (with lab)	4 credits
BIOL 453	Virology (with lab)	4 credits

## **Concentrations**

The biology program offers 4 concentrations listed below. Each area requires at least 16 credits hours. These credits are in addition to the core requirements, the major requirements and the General education requirements and count towards the 120 credit hours needed to complete the bachelor's degree. These concentrations help students to provide structure to electives, develop in their fields of interest and provide expertise in a field within biology for students seeking admission to post-baccalaureate programs or employment.

The concentrations are:

- General Biology
- Biomedical Sciences
- Environmental Biology
- Data analytics

### **General Biology**

The General Biology concentration is the most general of the tracks, offering a flexible yet robust curriculum for students interested in a broader understanding of biology. The additional 16 credit hours required are chosen from the list of upper division courses shown above, one from each major category (organismal biology, molecular biology, ecology and biomedical sciences). Even though this concentration prioritizes breadth over focus, it is still appropriate for all professions that require a major in biology and will prepare students for graduate school, professional school or employment. If a student is unsure about what to do with their biology major and/or wants to take a wider variety of the courses which are part of the Biology curriculum, then the General Biology concentration may be the best choice for them.

Students in this concentration take one additional course in each major area. Courses in the concentration must be different than those taken as part of the major requirements.

- One additional Organismal biology course
- One additional Molecular biology course
- One additional Ecology course
- One additional Biomedical sciences course

### **Biomedical Sciences**

This concentration is designed for the undergraduate student with an aptitude for the biological sciences and who plans to attend a professional school in the health sciences including but not limited to Medical school, Pharmacy school, Physician Assistant program, Dental school, Chiropractic school, and Physical Therapy school.

While many of the courses in our biology curriculum core ensure our graduates have acquired the necessary requirements for any professional and graduate program, this concentration allows students to take more specialized courses in areas of human health that will make them stand out as candidates. Students can explore topics such as pathophysiology, embryology, virology and more. Students may also consider taking approved classes from other departments to expand the breadth of their degree. For example, some courses in Health Sciences and Psychology may be used to fulfill the requirements of this concentration (e.g. nutrition or health psychology). This concentration also works well with the 3+1 pathway from UC Pharmacy school allowing students to graduate with a B.S. in Biology by completing year one of the professional program and using those courses as the biomedical science concentration courses.

Students in this concentration take four additional courses in the biomedical sciences area. Courses in the concentration must be different than those taken as part of the major requirements.

- BIOL 303 Medical Terminology
- BIOL 321 Animal Parasitology
- BIOL 333 Immunology (with lab)
- BIOL 370 Physiology of Exercise
- BIOL 420 Pathophysiology I
- BIOL 421 Pathophysiology II
- BIOL 422 Embryology (with lab)
- BIOL 419 Micro Eco Health/Disease (with lab)
- BIOL 453 Virology (with lab)
- PHAR 520 Pathophysiology\*
- PHAR 511 Drug Literature Evaluation\*
- PHAR 512 Immunology\*
- PHAR 513 Biochemistry\*
- PHAR 524 Clinical Research Methods\*

\*PHAR courses are only available to UC Pharmacy students in the 3 +1 pathway. Students in the Pharmacy 3+1 pathway at UC cannot take BIOL 333 and BIOL 420 as part of their concentration electives because these courses will be part of the first year of pharmacy school.

Students who intend to apply to Pharmacy school, Physician Assistant school, Medical School or any other professional school after completing a the Bachelor of Science in Biology degree or after completing the admissions requirements are encouraged to discuss with their advisors which courses fit best with the requirements for

admissions to these programs and take these courses among the electives for the concentration.

### **Environmental Biology**

The Environmental Biology concentration is designed to provide students with a foundation in environmental sciences and population, organismal, and evolutionary biology. Students will explore regional organismal processes and the environments in which they thrive. Ecology, conservation and restoration of biodiversity are also a focus. Conservation and restoration field work and internships with local environmental agencies are some of the opportunities provided to students on this track. Course requirements for professional certification by several societies (e.g. Ecological Society of America) can be met within this concentration. Students with expertise in Environmental biology can work for local environmental agencies, Department of Environmental Protection, Department of Natural Resources, The National Park Service, US Forestry Service, Department of Commerce, the Environmental Protection Agency, and many others. Students in this track will also be prepared for graduate school in biological and environmental sciences.

Students in this concentration take four additional courses in the organismal or ecology areas. Courses in the concentration must be different than those taken as part of the major requirements.

- BIOL 128 Biology and Chemistry of Nat Eco in WV (with lab)
- BIOL 215 Botany
- BIOL 224 Zoology
- BIOL 3xx GIS for Biologists
- BIOL 3xx Soil Biology (with lab)
- BIOL 400 Ecology (with lab)
- BIOL 413 Appalachian Flora (with lab)
- BIOL 419 Micro Eco Health/Disease (with lab)
- BIOL 430 Limnology (with lab)

### **Data analytics**

With a strong emphasis of biology at the molecular, cellular, organismal, and ecosystem levels, this concentration applies the traditional techniques of computer science, mathematics, and statistics to the solution of problems in biology. Students will acquire the programming, data analysis and modeling skills required to study complex natural systems which will prepare them to deal with the large, complex, imperfect data sets typical of the biological sciences and to convert data into useful and practical information. The preparation in computer science and programming required in this track is quite advantageous to students interested in pursuing a M.S. or Ph.D. in Computational

biology, and other fields like Biomedical Informatics, Microbiology or Ecology, which rely more and more every day on bioinformatic tools. For students interested in healthcare professions, this degree offers a foundational focus in genomics and proteomics both areas which are at the foundation of precision medicine.

Students in this concentration must take BIOL 3xx and BIOL 3xx as their major requirements in addition to the courses below.

- DASC 100 Introduction to Scientific Programming
- DASC 101 Introduction to Data Science
- DASC 310 Machine Learning
- DASC 330 Data Modeling and Simulation
- MATH 240 Probability and Statistics

Other electives are offered and may be taken with the permission of the Program Director or Department Chair. Online or Web courses will require approval of the department chair.

**Pre-requisites:** Please note there are pre-requisites for many Science courses. You must take the prescribed pre-requisites before taking a Science course.

### Typical Schedule for 4-year completion of BS BIOL with Concentration

FRESHMAN YEAR 35 credits			
FALL SEMESTER		SPRING SEMESTER	
UNIV 104X College Motivation and Success	3	UNIV 105 Foundations of Character and Leadership	3
COMM 101 Freshman Writing I	3	COMM 102 Freshman Writing II	3
BIOL 130 Biology for Majors & Lab (STEM Flex)	4	BIOL 2xx Cell Phys and Biochem	4
MATH 201 Calculus I or other based on placement (STEM Flex)	4	SPCH 103 Fundamental of Speech	3
CHEM 101 General Chemistry I & Lab (Flex Elective)	4	CHEM 102 General Chemistry II & Lab (Flex Elective)	4
<b>TOTAL CREDITS</b>	<b>18</b>	<b>TOTAL CREDITS</b>	<b>17</b>



**SOPHOMORE YEAR 36 credits**

<b>FALL SEMESTER</b>		<b>SPRING SEMESTER</b>	
Organismal course	4	Organismal course	4
CHEM 201 Organic Chemistry I & Lab	4	CHEM 202 Organic Chemistry II & Lab	4
NSCI 220 Statistics for Science & Research (or another math based on placement)	3	SSCI Flex elective 2	3
Organismal course	4	Ecology course	4
SSCI Flex elective 1	3	HUMN Flex elective 1	3
<b>TOTAL CREDITS</b>	<b>18</b>	<b>TOTAL CREDITS</b>	<b>18</b>

**JUNIOR YEAR 30 credits**

<b>FALL SEMESTER</b>		<b>SPRING SEMESTER</b>	
BIOL 331 Microbiology for majors & Lab	4	BIOL 332 Genetics & Lab	4
HUMN Flex elective 2	3	Molecular Biology course	4
PHYS 201 Introductory Physics I & Lab (Flex Elective)	4	PHYS 202 I Introductory Physics II & Lab (Flex elective)	4
Biomedical science course	4	Elective*	3
<b>TOTAL CREDITS</b>	<b>15</b>	<b>TOTAL CREDITS</b>	<b>15</b>

**SENIOR YEAR 26- 27 credits**

<b>FALL SEMESTER</b>		<b>SPRING SEMESTER</b>	
Concentration courses	8	Concentration course	7-8
BIOL 496 Senior Capstone	1	Elective*	3
Elective*	3	Elective*	3
<b>TOTAL CREDITS</b>	<b>12</b>	<b>TOTAL CREDITS</b>	<b>13-14</b>

\*Electives to stay as full-time student may be other coursework of interest or of requirement for professional/graduate school. It may also be fulfilled by math coursework assuming student does not place in MATH 201 upon entrance. Students may also consider a minor.

Courses in the concentration are chosen by the student in consultation with their advisor to meet total credit hour requirement for degree.

### **Additional Requirements**

The University of Charleston comprehensive examination requirement for Biology majors is met through completion of the senior capstone. Biology Majors must also complete the Biology Assessment test in their freshman year. Biology majors must take the Biology Assessment test in their senior year in order to graduate.

### **BIOLOGY MINOR**

The Biology Minor consists of at least 19 credit hours. Required classes include:

- BIOL 130 and BIOL 130L Introductory Biology for Majors and lab (4 credits)
- NSCI 220 Statistics in Science and Research (3 credits)
- BIOL 224 and BIOL 224L General Zoology

OR

- BIOL 215 and BIOL 251L General Botany (4 credits)

The students must also take 8 additional credits from among the following courses:

Course	Title	Credits
BIOL 301/301L	A&P I and lab	4 credits
BIOL 302/302L	A&P II and lab	4 credits
BIOL 331/331L	Microbiology for Majors and lab	4 credits
BIOL 332/332L	Genetics and lab	4 credits
BIOL 333/333L	Immunology and lab	4 credits
BIOL 400/400L	Ecology and lab	4 credits
BIOL 419/419L	Microbial Ecology of Health and Disease	4 credits
BIOL 422/422L	Embryology and lab	4 credits
BIOL 451/451L	Cell and Molecular Biology and Lab	4 credits
BIOL 453/453L	Virology and lab	4 credits

## Chemistry-Biology Dual-Major (BIOCHEM)

This specially designed BS degree plan allows interested students to obtain two majors: chemistry and biology, within a four-year timeframe. Students interested in pursuing this option should consult the section of this *Academic Catalog* describing the **Chemistry Program** for a full description of the coursework needed to complete the Dual Major.

### Pathways for Admission to UC Physician Assistant Program (UCPAP)

Two admission pathways have been developed for the UC PAP. For more information, students should refer to the Biology student handbook and make an appointment with their advisor as soon as possible during their freshman year to discuss their choices

#### Fast Track

The PA Fast Track is only available to full time students who are currently enrolled at UC. Students can apply as early as their freshman year and can apply during any spring semester until they graduate. Students accepted into the PA fast track program matriculate in the master's degree of Physician Assistant Studies (PA School) after completion of their pre-requisites.

#### Direct Admission

Students also have the option of earning their Bachelor's Degree and applying to the UC Physician Assistant Program, or other PA Programs across the nation, through the Direct Admissions Pathway.

### Pathways for Admission to UC School of Pharmacy (SOP)

Two admission pathways have been developed for the UC SOP. For more information, students should refer to the Biology student handbook and make an appointment with their advisor as soon as possible during their freshman year to discuss their choices

#### Fast Track Pathway

Students may choose to apply to pharmacy school after completing only those courses that are required for admission to the pharmacy school. Students can often finish these prerequisite courses in 2 or 3 years.

#### Traditional Admission Pathway

Students wishing to earn their undergraduate degree prior to applying to pharmacy school will be enrolled as a Biology, Chemistry, or Chemistry-Biology dual major. The student can then complete 4 years of pharmacy school to earn the Doctor of Pharmacy degree. Another option, the 3+1 degree pathway\*, allows a student to combine 3 years of undergraduate coursework with an additional 1 year of pharmacy school coursework to earn a BS in Biology with an emphasis in Biomedical Sciences.

*\*Only available to students who complete their undergraduate and graduate work at UC.*