**BIOLOGY MAJOR**

**Program Overview**

The undergraduate Biology curriculum begins with a core of courses that presents the fundamentals of the life sciences, both in concept and methodology. After completing the core, students take a distribution of upper division courses with at least one course in each of the three major areas of biology. This distribution strategy insures that all students have broad exposure to an extensive range of topics including cell and molecular biology, microbiology, genetics, plant biology, evolution, physiology, ecology, environmental biology, and animal behavior. The curriculum provides appropriate training for students seeking admission to professional and graduate schools and those who wish to enter the job market directly following graduation.

The faculty of the Department of Biology view teaching as the primary mission of both the Department and the University. In addition, Biology faculty are involved in high caliber scientific research. The interplay between teaching and research, and the involvement of students in faculty research strengthens the Biology curriculum. One of the most important qualities of the Department is the opportunity for undergraduates to participate in faculty research. This mentor-student relationship involves the design and execution of experiments, and is a very enriching learning experience. Students can work with faculty as volunteers, for academic credit, or for pay during the summer months. The research done by students often leads to publications and presentations at national and regional conferences. Whatever the career plans, students are encouraged to seriously consider participating in undergraduate research. Up to two semesters of research may be counted as biology electives.

The Department of Biology also has a small but strong graduate program that leads to either a MS or a MA degree in biology. The MA degree is primarily designed for post-graduates who are working or wishing to improve their credentials for professional school. The MS degree requires the development and presentation of a thesis based on original research. This degree is more appropriate for full-time students wishing to engage in research as part of a career or as a prelude to graduate training at the doctoral level. Students in the MS program may be eligible for a teaching assistantship that provides a tuition scholarship and stipend. The presence of diverse and engaged graduate students enhances both faculty research and the academic experience for undergraduate students.

**Advisory Option - Biology Pre-Professional**

Biology majors may satisfy entrance requirements for medical, dental, osteopathic medical, and other schools of the health professions. Students are advised to take elective courses in liberal arts and behavioral sciences.

**Biology B.A.**

The Bachelor of Arts degree in Biology is for students who wish to pursue a dual major with Secondary Education (B.S.). The B.A. degree is only available for students who pursue the dual major.

Requirements for the B.A. in Biology to become certified to teach at the secondary education level (grades 7-12), students must complete a total of five Education and three Special Education courses, and student teaching. For further details, see the Teacher Education section of the catalog. Students interested in the five-year program should speak to their academic advisors and to Chair of the Department of Biology as early in their academic careers as possible.

**Biology Five-year BS/MS or BS/MA**

Students who are completing undergraduate degrees leading to the BS in Biology have the option to complete a combined BS/MS or BS/MA degree in five years (including the summer term after the fifth year). Students electing this option must apply to the graduate program in their senior year and be provisionally accepted before they complete the BS. (Students applying for the BS/MS program must have been accepted by a faculty mentor for the thesis portion of their work at the time of application.) They will be required to complete all the requirements for the normal MS or MA degree, with the following additions/exceptions:

- Students in the five year programs will have the option of taking up to two graduate courses that count toward the graduate degree while they are still enrolled as undergraduates. The graduate courses will only count toward the graduate degree if they are not needed for the BS. For example, a senior exercising the 38 course option for Biology majors can take two graduate level Biology courses, thus complete 40 courses, and use the two graduate courses toward the credits required for the graduate degree. For students in the BS/MS program, it would be possible for the graduate credits to be research credits, if they have begun their graduate research in their senior year.

Students exercising these options may be able to graduate in the spring of the fifth year.

- Students in the five year programs will be expected to take at least three credits during the summer between their senior year and the fifth year. These credits may be for research or coursework.

- Students in the five year BS/MA will not take the lab portion of research techniques but should be accepted into a research lab in their senior year. BS/MS students are expected to take three graduate courses: Research Techniques plus two other 3 or 4 credit graduate courses. The balance of the required credits can be graduate research credits.

- Students in the five year programs will be expected to take graduate seminar for both semesters in their fifth year.

- Students considering the five year programs should speak with their advisors and the graduate director as early as possible.

**Learning Goals and Objectives**

**Goal 1:** Students will gain an appreciation and understanding of cell structure and function, the organization of biological systems, and the evolution of biological diversity.

**Objective 1.1:** Students will be able to describe evolution and the basic mechanisms of evolutionary change.

**Objective 1.2:** Students will demonstrate knowledge of the major domains of life on earth and the distinctive characteristics of major groups.

**Objective 1.3:** Students will demonstrate knowledge of anabolic and catabolic pathways used by living organisms to provide energy and macromolecules for synthesis.

**Objective 1.4:** Students will be able to describe the components of the major trophic levels and diagram the flow of nutrients through food webs in the environment.
Objective 1.5: Students will be able to describe how organisms respond to physiological, environmental and physical challenges.

Objective 1.6: Students will be able to describe the role of genetics at both cellular and organismal levels.

Objective 1.7: Students will demonstrate an understanding of the importance of protein structure and function.

Goal 2: Students will develop skills in experimental design, surveying of scientific literature, data collection, and the interpretation of results, including statistical analysis.

Objective 2.1: Students will demonstrate competency in operating basic laboratory equipment.

Objective 2.2: Students will demonstrate competency in data reduction and presentation, including choosing and interpreting the appropriate statistical tests.

Goal 3: Students will develop skills in presenting scientific information both orally and in writing.

Objective 3.1: Students will be able to develop cogent, well structured, and researched written and oral presentations of scientific content.

The traditional undergraduate programs include 40 courses distributed across three components: A General Education component divided into Signature Courses, Variable Courses, and an Integrative Learning requirement; a Major and Divisional component; and Free Electives. In addition to course requirements as specified in each area, students must complete one certified course in each of the following overlay areas:

1. Diversity, Globalization or Non-western Area Studies,
2. Ethics Intensive, and
3. Writing Intensive. Overlay requirements are part of the forty-course requirement.

General Education Signature Courses
See this page about Signature courses (https://academiccatalog.sju.edu/curricula/#signature). Six courses

General Education Variable Courses
See this page about Variable courses (https://academiccatalog.sju.edu/curricula/#variable). Six to Nine courses

General Education Overlays
See this page about Overlays (https://academiccatalog.sju.edu/curricula/#overlay).

General Education Integrative Learning Component
See this page about Integrative Learning Component (https://academiccatalog.sju.edu/curricula/#integrative-learning). Three courses:

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<th>Title</th>
<th>Hours</th>
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<tr>
<td>CHM 120</td>
<td>General Chemistry I</td>
<td>5</td>
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<tr>
<td>&amp; 120L</td>
<td>and General Chemistry Lab I</td>
<td></td>
</tr>
<tr>
<td>CHM 210</td>
<td>Organic Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>&amp; 210L</td>
<td>and Organic Chemistry Lab I</td>
<td></td>
</tr>
<tr>
<td>PHY 101</td>
<td>General Physics I</td>
<td>4</td>
</tr>
<tr>
<td>&amp; 101L</td>
<td>and General Physics Laboratory I</td>
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GEP Electives
At least six courses

Biology majors may graduate with 38 or 39 courses instead of the usual 40 course requirement. The student retains the option to take 40 courses.

Major Concentration
Thirteen courses

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<thead>
<tr>
<th>Code</th>
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<th>Hours</th>
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<tbody>
<tr>
<td>BIO 102</td>
<td>Bio II: Genetics (second semester, freshman year)</td>
<td>4</td>
</tr>
<tr>
<td>BIO 201</td>
<td>Bio III: Organismic Biology (first semester, sophomore year)</td>
<td>4</td>
</tr>
<tr>
<td>BIO 390</td>
<td>Biology Seminar (required each semester for sophomores, juniors and seniors)</td>
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Select one from each of the following groups: 1

Group A: Cell Structure and Function
- BIO 402 Advanced Cell Biology
- BIO 404 Biochemistry
- BIO 408 Histology
- BIO 410 Light and Electron Microscopy
- BIO 411 Molecular Genetics
- BIO 412 Neurobiology
- BIO 416 Microbiology
- BIO 421 Molecular&Cellular Biophysics
- BIO 424 Biotechnology
- BIO 428 Histopathology

Group B: Systemic Organization
- BIO 403 Biometrics and Modeling
- BIO 405 Biomechanics
- BIO 407 Developmental Biology
- BIO 413 Plant Physiological Ecology
- BIO 415 Immunology
- BIO 417 Systemic Physiology
- BIO 425 Bacterial Pathogenesis

Group C: Evolution and Diversity of Life
- BIO 401 Animal Behavior
- BIO 409 Ecology
**Biology Major**

- **BIO 406**  Comparative Anatomy
- **BIO 414**  Plant Systematics
- **BIO 419**  Invertebrate Zoology
- **BIO 420**  Bioinformatics
- **BIO 422**  Applied & Environ Microbio
- **BIO 423**  Evolution
- Four additional 400-level biology courses

**Chemistry**

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<th>Code</th>
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<th>Description</th>
<th>Credits</th>
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<tr>
<td>CHM 125</td>
<td>General Chemistry II (second semester, freshman year)</td>
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<td></td>
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<tr>
<td>CHM 125L</td>
<td>General Chemistry Lab II (second semester, freshman year)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CHM 215</td>
<td>Organic Chemistry II (second semester, sophomore year)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CHM 215L</td>
<td>Organic Chemistry Lab II (second semester, sophomore year)</td>
<td>1</td>
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**Mathematics**

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<th>Description</th>
<th>Credits</th>
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<tr>
<td>MAT 128</td>
<td>Applied Statistics (first semester, sophomore year)</td>
<td>3</td>
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**Physics**

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<th>Course</th>
<th>Description</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PHY 102</td>
<td>General Physics II (second semester, junior year)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>PHY 102L</td>
<td>General Physics Laboratory II (second semester, junior year)</td>
<td>1</td>
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1. **BIO 101, BIO 102, BIO 201 and CHM 120, CHM 125 are prerequisite for all 400 level BIO courses.**

**Note:** Directed readings, special topics Biology Graduate courses and other Biology courses without a lab component can only be counted as a Biology elective and in most cases no more than one such non-lab course may be applied to this requirement. Students with the appropriate Mathematics background and interests can substitute University Physics for General Physics.