BACHELOR OF SCIENCE (BS) DEGREE WITH A MAJOR IN BIOCHEMISTRY AND CELL BIOLOGY

Program Learning Outcomes for the BS Degree with a Major in Biochemistry and Cell Biology

Upon completing the BS degree with a major in Biochemistry and Cell Biology, students will be able to:

1. Demonstrate a comprehensive knowledge of biology with particular emphasis on biochemistry, genetics, and cell biology.
2. Demonstrate the ability to apply the modern scientific method, including designing experiments and/or building mathematical models, and collecting, analyzing, and interpreting data using common statistical methods and software programs.
3. Demonstrate effective oral and written communication skills, including an ability to communicate effectively and work with diverse groups and the ability to interpret and communicate the results of original research.
4. Locate primary scientific literature and demonstrate the ability to use critical thinking and problem-solving skills to evaluate published and proposed research in the biological sciences and to apply these skills.
5. Demonstrate understanding of the practice and culture of science, scientific ethics, and the relationship between science and society.
6. Develop quantitative reasoning via the construction of models and/or the analysis of data.

Requirements for the BS Degree with a Major in Biochemistry and Cell Biology

For general university requirements, see Graduation Requirements (https://ga.rice.edu/undergraduate-students/academic-policies-procedures/graduation-requirements). Students pursuing the BS degree with a major in Biochemistry and Cell Biology must complete:

- A minimum of 28 courses (minimum of 69 credit hours) to satisfy major requirements. Additional credit hours may be required depending on course selection.
- A minimum of 129 credit hours to satisfy degree requirements. Additional credit hours may be required depending on course selection.
- A minimum of 60 credit hours outside of major requirements.
- A minimum of 12 courses (minimum of 31 credit hours) taken at the 300-level or above.

The BS degree path emphasizes a broad understanding of biochemistry and cell biology, provides room for exploration anywhere in the Natural Sciences or Engineering, and culminates in two required 400-level capstone courses from an approved list of courses. Students in Biochemistry and Cell Biology are strongly encouraged to pursue their research interests through independent research experiences. The BS degree program offers greater coverage and depth as compared to the BA.

The courses listed below satisfy the requirements for this major. In certain instances, courses not on this official list may be substituted upon approval of the major's academic advisor, or where applicable, the department's Director of Undergraduate Studies. (Course substitutions must be formally applied and entered into Degree Works by the major's Official Certifier (https://registrar.rice.edu/facstaff/degreeworks/officialcertifier/). Students and their academic advisors should identify and clearly document the courses to be taken.

### Summary

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td></td>
<td>Total Credit Hours Required for the Major in Biochemistry and Cell Biology</td>
<td>Minimum of 69</td>
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<tr>
<td></td>
<td>Total Credit Hours Required for the BS Degree with a Major in Biochemistry and Cell Biology</td>
<td>Minimum of 129</td>
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### Degree Requirements

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<thead>
<tr>
<th>Code</th>
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<th>Credit Hours</th>
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<tbody>
<tr>
<td></td>
<td>Core Requirements</td>
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<td></td>
<td>Non-Biology Courses 1</td>
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<tr>
<td>MATH 101</td>
<td>SINGLE VARIABLE CALCULUS I</td>
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<tr>
<td>or MATH 105</td>
<td>AP/OTH CREDIT IN CALCULUS I</td>
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<td>MATH 102</td>
<td>SINGLE VARIABLE CALCULUS II</td>
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<td>or MATH 106</td>
<td>AP/OTH CREDIT IN CALCULUS II</td>
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<tr>
<td>MATH 211</td>
<td>ORDINARY DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA</td>
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</tr>
<tr>
<td>PHYS 125</td>
<td>GENERAL PHYSICS (WITH LAB)</td>
<td>4</td>
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<tr>
<td>PHYS 126</td>
<td>GENERAL PHYSICS II (WITH LAB)</td>
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</tr>
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<td>CHEM 121</td>
<td>GENERAL CHEMISTRY I</td>
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<td>or CHEM 111</td>
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<td>or CHEM 113</td>
<td>AP/OTH CREDIT IN GENERAL CHEMISTRY LAB</td>
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<td>GENERAL CHEMISTRY II</td>
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<td>or CHEM 112</td>
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<td>CHEM 124</td>
<td>GENERAL CHEMISTRY LABORATORY II</td>
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<td>or CHEM 114</td>
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<td>CHEM 211</td>
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<tr>
<td>&amp; CHEM 213</td>
<td>and ORGANIC CHEMISTRY DISCUSSION</td>
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<td>CHEM 212</td>
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<td>&amp; CHEM 214</td>
<td>and ORGANIC CHEM DISCUSSION II</td>
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<td>CHEM 215</td>
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<td>or CHEM 365</td>
<td>ORGANIC CHEMISTRY LAB</td>
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<td>Core Lecture Courses</td>
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<tr>
<td>BIOC 201</td>
<td>INTRODUCTORY BIOLOGY I</td>
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<td>BIOC 301</td>
<td>BIOCHEMISTRY I</td>
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<tr>
<td>BIOC 302</td>
<td>BIOCHEMISTRY II</td>
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<tr>
<td>BIOC 341</td>
<td>CELL BIOLOGY</td>
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<td>BIOC 344</td>
<td>MOLECULAR BIOLOGY AND GENETICS</td>
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<td>BIOC 352</td>
<td>PHYSICAL CHEMISTRY FOR THE BIO SCIENCES</td>
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<td>Core Laboratory Courses</td>
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1. Additional credit hours may be required depending on course selection.
2. Additional credit hours may be required depending on course selection.
### University Graduation Requirements

- **Total Credit Hours Required for the Major in Biochemistry and Cell Biology**
  - Minimum of 69

- **University Graduation Requirements**
  - [Link](https://qa.rice.edu/undergraduate-students/academic-policies-procedures/graduation-requirements/)
  - 60

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#### BIOC 211: INTERMEDIATE EXPERIMENTAL BIOSCIENCES
- Credit Hours: 2

#### BIOC 311: ADVANCED EXPERIMENTAL BIOSCIENCES
- Credit Hours: 2

#### Advanced Laboratory Courses

Select 2 courses from advanced labs at the 300-level or above:

- **BIOC 313**: EXPERIMENTAL SYNTHETIC BIOLOGY
- **BIOC 318**: MICROBIOLOGY LABORATORY
- **BIOC 320** / **BIOE 342**: LABORATORY IN TISSUE CULTURE
- **BIOC 333**: BIOINNOVATION STUDIO: FROM BASIC RESEARCH AND IDEATION TO TECHNOLOGY DEVELOPMENT
- **BIOC 415**: EXPERIMENTAL PHYSIOLOGY
- **BIOC 417**: EXPERIMENTAL CELL AND MOLECULAR NEUROSCIENCE
- **BIOC 530**: LAB MODULE IN NMR SPECTROSCOPY AND MOLECULAR MODELING
- **BIOC 535**: PRACTICAL X-RAY CRYSTALLOGRAPHY

1 independent research experience.

#### Elective Lecture Courses

Select 2 courses offered by the School of Natural Sciences and/or the School of Engineering

Minimum of 6

- **BIOC 401**: UNDERGRADUATE HONORS RESEARCH
- **BIOC 402**: UNDERGRADUATE HONORS RESEARCH
- **BIOC 412**: UNDERGRADUATE RESEARCH SEMINAR
- **BIOC 424**: MICROBIOLOGY AND BIOTECHNOLOGY
- **BIOC 425**: PLANT MOLECULAR GENETICS AND DEVELOPMENT
- **BIOC 442**: MOLECULES, MEMORY AND MODEL ANIMALS: METHODS IN BEHAVIORAL NEUROSCIENCE
- **BIOC 443**: DEVELOPMENTAL NEUROBIOLOGY
- **BIOC 445**: ADVANCED MOLECULAR BIOLOGY AND GENETICS
- **BIOC 447**: EXPERIMENTAL BIOLOGY AND THE FUTURE OF MEDICINE
- **BIOC 449**: ADVANCED CELL AND MOLECULAR NEUROSCIENCE
- **BIOC 450**: VIRUSES AND INFECTIOUS DISEASES
- **BIOC 455**: COMPUTATIONAL SYNTHETIC BIOLOGY
- **BIOC 460**: CANCER BIOLOGY
- **BIOC 464** / **BIOE 464**: EXTRACELLULAR MATRIX
- **BIOC 470**: COMPUTATION WITH BIOLOGICAL DATA
- **BIOC 481**: MOLECULAR BIOPHYSICS I
- **BIOC 482**: STRUCTURAL BIOLOGY

#### Total Credit Hours

- Minimum of 129

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### Footnotes and Additional Information

- Includes coursework completed as distribution credit, FWIS, LPAP, upper-level, residency (hours taken at Rice), 60 hours outside of the major (if applicable), and any additional academic program requirements. The “hours outside of the major” requirement may include all of the above university requirements.

- **Footnotes**:
  1. Permissible Substitutions: MATH 105 or MATH 111 and MATH 112 may be substituted for MATH 101; MATH 106 may be substituted for MATH 102; CHEM 151 may be substituted for CHEM 121 or CHEM 111; CHEM 153 may be substituted for CHEM 123 or CHEM 113; CHEM 152 may be substituted for CHEM 122 or CHEM 112, and CHEM 154 may be substituted for CHEM 124 or CHEM 114; CHEM 320 may be substituted for CHEM 212; PHYS 101 and PHYS 103 or PHYS 111 may be substituted for PHYS 125; PHYS 102 and PHYS 104 or and PHYS 112 may be substituted for PHYS 126.
  2. CHEM 301 and CHEM 302 (both courses for 6 credit hours total) may substitute for BIOC 352.
  3. BIOC 212 may be substituted for BIOC 211.
  4. These advanced labs must be taken with or after completion of BIOC 482.
  5. All Biochemistry and Cell Biology majors must take at least one of the listed additional advanced laboratory courses. If desired, the second advanced laboratory requirement may be satisfied by completing:
    1. BIOC 310 if taken for at least 3 credits; or
    2. HONS 470 and HONS 471, if the research supervisor is from one of the biosciences departments or if the research is biological in nature and pre-approved by the student’s major advisor; or
    3. honors research (BIOC 401 and BIOC 402 and BIOC 412).

   *This substitution may be used only once regardless of the number of semesters of independent research taken.*

- The combined courses BIOC 401 and BIOC 402 are considered a single BIOC 400-level course and can be counted as one capstone course together as a series and/or as an independent research experience, provided that this substitution has not been used previously; this 3-course series can count as a single lab at 300-level or higher. **To be applied toward the major all three courses must be completed.**

- Students must complete a total of 2 courses (6 credit hours) from courses offered by the School of Natural Sciences or the School of Engineering. Courses in Natural Sciences/Engineering include any 300-level or greater course of at least 3 credit hours from any department in the Wiess School of Natural Sciences (including BioSciences) or George R. Brown School of Engineering, except independent research courses such as BIOC 310, BIOC 401/BIOC 402, BIOE 400/BIOE 401, or EBIO 306/EBIO 403/EBIO 404, which cannot be used to fulfill this requirement. A maximum of 3 credit hours from BIOC 390 (transfer credit in Biochemistry and Cell Biology) may be applied to this requirement. Courses offered by the School of Natural Sciences and the School of Engineering include the following subject codes: ASTR, BIOC, BIOE, CAAM, CEVE, CHBE, CHEM, COMP, EBIO, ELEC, ENGI, ENST, ESCI, GLHT, HEAL, KINE, MATH, MECH, MSNE, NSCI, PHYS, STAT. BIOC 300 is only allowed to fulfill this elective requirement when it is taken prior to BIOC 301 and BIOC 341, or their equivalent transfer course.
To fulfill the remaining BIOC major requirements, students pursuing the BS degree must complete a total of 2 additional courses (6 credit hours) as capstones. Only BIOC 400-level lecture courses from the list which are explicitly designed for the BIOC major, can be used to satisfy this requirement.

Policies for the BS Degree with a Major in Biochemistry and Cell Biology

Advising
Rice University policies are governed primarily by the General Announcements; students are encouraged to look there first for academic policies. Advising information specific to the Department of BioSciences can be found at the department website by clicking on the tab for Undergraduate Studies: https://biosciences.rice.edu/.

Program Restrictions and Exclusions
Students pursuing the major in Biochemistry and Cell Biology should be aware of the following program restrictions:

- Students pursuing the major in Biochemistry and Cell Biology may not additionally declare the major in Biological Sciences.

Transfer Credit
For Rice University’s policy regarding transfer credit, see Transfer Credit (https://oa.rice.edu/undergraduate-students/academic-policies-procedures/transfer-credit/). Some departments and programs have additional restrictions on transfer credit. The Office of Academic Advising maintains the university’s official list of transfer credit advisors on their website: https://oaa.rice.edu. Students are encouraged to meet with their academic program’s transfer credit advisor when considering transfer credit possibilities.

Departmental Transfer Credit Guidelines
Students pursuing the major in Biochemistry and Cell Biology should be aware of the following departmental transfer credit guidelines:

- Requests for transfer credit will be considered by the program director (and/or the program’s official transfer credit advisor) on an individual case-by-case basis.

Additional Information
For additional information, please see the BioSciences website: https://biosciences.rice.edu/.

Opportunities for the BS Degree with a Major in Biochemistry and Cell Biology

Academic Honors
The university recognizes academic excellence achieved over an undergraduate's academic history at Rice. For information on university honors, please see Latin Honors (https://ga.rice.edu/undergraduate-students/honors-distinctions/university/) (summa cum laude, magna cum laude, and cum laude) and Distinction in Research and Creative Work (https://ga.rice.edu/undergraduate-students/honors-distinctions/university/). Some departments have department-specific Honors awards or designations.

Departmental Honors
Instructions on applying for the Distinction in Research and Creative Work award from the Department of BioSciences can be found at the department website, by clicking on the link for Undergraduate Studies, at: https://biosciences.rice.edu/.

Research in the BioSciences
Research is highly encouraged for all biosciences majors, and there are many opportunities for independent research at Rice. Information about research for credit and research internships specific to the Department of BioSciences can be found at the department website, by clicking on the link for Undergraduate Studies, at: https://biosciences.rice.edu/.

Additional Information
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