BioSciences

Undergraduate Advising Information (2018-2019)

Packet Contents:

BioSciences Advisors .................................................................................................................. 2
Getting Started in BioSciences ................................................................................................. 3
BioSciences Courses Accessible to Freshmen ........................................................................... 4
Introduction to the Degree Programs in BioSciences ............................................................... 6
Undergraduate Research in BioSciences ..................................................................................... 11
Finding and Securing Research Opportunities .......................................................................... 12
Frequently Asked Questions and Tips for Planning Your Major ............................................... 13

Follow BioSciences!

Website: http://biosciences.rice.edu (advising/courses/majors/research information can be found here)
OwlSpace: https://owlspace-cem.rice.edu/portal (log on and join “BioSciences Opportunities”)
Facebook: https://www.facebook.com/BioSciencesatRice

The BioSciences department unites faculty engaged in research and teaching in a wide range of disciplines within the life sciences, creating a vibrant and diverse community of scholars. The department offers undergraduate degrees in Biochemistry & Cell Biology (BA, BS), Biological Sciences (BA), and Ecology & Evolutionary Biology (BA, BS), along with Neuroscience (BA) and Environmental Science (BA, BS) in concert with other departments as well as minors in each of these areas. The BA degrees offer a rigorous biological curriculum suitable for a large number of career paths yet allow the flexibility for academic exploration outside of biology. The BS degrees offer greater depth in upper-level coursework and/or more intense independent research experiences and are often chosen by students planning to pursue an advanced degree in the life sciences. BioSciences undergraduate students of all majors are welcome and encouraged to participate in research, availing themselves of the numerous independent research opportunities at Rice and at partner institutions in the Houston community.
BioSciences Advisors
(Photos are in order of their first contact listing below)

Advisors for Prospective Students, Freshmen, and Undeclared Sophomores:
These advisors communicate with incoming students and advise freshmen and sophomores formally and informally. They are here to assist prospective majors and others, including premedical students who need specific information about our programs, lecture courses, and laboratory courses. (Note: All BioSciences advisors can provide information on Biological Sciences BA degree).

Dr. Beth Beason-Abmayr (BIOC Degrees): 326 Anderson Biological Labs; x2535; bbeason@rice.edu
Dr. Matthew Bennett, (BIOC Degrees): 306 Keck Hall; x4161; matthew.bennett@rice.edu
Dr. Jamie Catanese (BIOC Degrees): 130C Anderson Biological Labs; x2391; djc98@rice.edu
Dr. Scott Egan (EBIO Degrees): 103 Anderson Biological Labs; x2334; Scott.P.Egan@rice.edu
Dr. Kathleen Matthews (BIOC Degrees): 203 Keck Hall; x4871; ksm@rice.edu
Dr. Alma Novotny (BIOC Degrees): W105 George R. Brown; x4015; novotnya@rice.edu
Dr. Dereth Phillips (BIOC Degrees): 340 Anderson Biological Labs; x2343; derethp@rice.edu
Dr. Scott Solomon (EBIO Degrees): 130D Anderson Biological Labs; x2661; scott.solomon@rice.edu

Advisors for Declaring/Declared BIOC or BIOL Majors (advisors assigned by first letter of your last name):
Dr. Kate Beckingham: W130 George Brown Hall; x4016; kate@rice.edu (names beginning with A-H)
Dr. Dave Caprette: 327 Anderson Biological Labs; x3498; caprette@rice.edu (names beginning with I-P)
Dr. Charles Stewart: W104 George Brown Hall; x4926; crs@rice.edu (names beginning with Q-Z)

Advisors for Declaring/Declared EBIO or BIOL Majors:
Dr. Adrienne M. S. Correa: 201D Anderson Biological Labs; x3054; ac53@rice.edu
Dr. Scott Solomon: 130D Anderson Biological Labs; x2661; scott.solomon@rice.edu

Advisor for Declaring/Declared ENSC Majors and ENST Minors (including transfer credit):
Dr. Amy Dunham: 103B Anderson Biological Labs; x2792; aed4@rice.edu

Advisors for Declaring/Declared Neuroscience Majors (including transfer credit):
Dr. Dave Caprette: 327 Anderson Biological Labs; x3498; caprette@rice.edu
Dr. Jon Flynn: W102 George R. Brown; x4860; flynn@rice.edu

Advisors for Transfer Credit:
For specific BIOC course credit or generic BIOC transfer credit, contact Dr. Dave Caprette (see contact info above)
For specific EBIO course credit or generic EBIO transfer credit, contact Dr. Scott Solomon (see contact info above)
For Study Abroad transfer credit for BIOC, contact Dr. George Bennett: 813 BRC; x4920; gbennett@rice.edu.
For Study Abroad transfer credit for EBIO, contact Dr. Scott Solomon (see contact info above)

BIOS Undergraduate Program Coordinator:
Pedro Muniz: GRB W132; x4207; pedro.muniz@rice.edu
Getting Started in BioSciences

Courses To Take First
The following fundamental courses are required for BioSciences upper level offerings and must be taken as prerequisites for most advanced courses. For this reason, it is important for all BioSciences majors to take the following courses during their first year (or transfer in AP credit for them):

- **BIOC 201**: Introductory Biology lecture
- **BIOC 112 or NSCI 120**: Introductory Labs (recommended; prerequisite for undergraduate research for credit)
- **CHEM 121/123**: General Chemistry and lab (and for BIOC and BIOS majors or minors **CHEM 122/124**)

First year Biological Sciences, Ecology & Evolutionary Biology, or Environmental Sciences majors, also need to take:

- **EBIO 202**: Introductory Biology II lecture
- **EBIO 213**: Introductory Lab in EBIO (can be concurrent with BIOC 211 if class/laboratory times are not in conflict)

**AP Credit….to take or not to take**: If you have AP credit, think about whether you feel confident and wish to take next steps or would benefit from taking the introductory courses (BIOC 201 and/or EBIO 202). See the information on “BioSciences Courses Accessible to Freshmen” (p. 4) to view courses you can take your freshman year if you have AP for required courses. BIOC 300 is designed as a next step for students with AP credit to prepare them for upper-level BIOC courses (see details on p. 5).

Consult an advisor if you feel uncertain!!!

Undergraduate Research Opportunities

*Start planning now!* Undergraduate research opportunities are available and highly encouraged as an important part of a thorough education in the biological sciences. Undergraduates may begin their research experience as early as their freshman year by finding and securing a research position on a volunteer basis, for pay, or for credit through the courses BIOC 310 or EBIO 306. Be aware that prospective research advisors often prefer students who can demonstrate competence either through prior experience or completion of a teaching laboratory course. BIOC 112, NSCI 120, or either BIOC 211 or BIOC 212 can serve as a prerequisite for BIOC 310 research, whereas BIOC 112 or 211 and EBIO 213 are preferred for EBIO 306 (see Finding Research Opportunities).

BioSciences Opportunities OwlSpace List

*Join now for departmental information and research opportunities!* On this “joinable” site are posted BioSciences departmental information and various biology-related opportunities that we encounter. Examples include: Information sessions, research opportunities, summer internship programs, fellowships, jobs, study abroad, etc. This site and mailing list is a great way to join the BioSciences team and to hear about biological and biomedical research opportunities on and off the Rice campus. To join the list and view previous posts, log on to [http://owlspace-ccm.rice.edu](http://owlspace-ccm.rice.edu) using your net ID and password. Go to “My Workspace”/“Membership”/“Joinable Sites”, search the list and select “BioSciences Opportunities.”
BioSciences Courses Accessible to Freshmen

LABORATORY COURSES:

Laboratories for Freshmen: BIOC 112 or NSCI 120 (Optional)
These optional labs focus on fundamental research skills and prepare students for research experiences before completing BIOC 211 or BIOC 212; these courses are highly recommended for students with limited laboratory experience but are not required. A student may receive credit for BIOC 112 (1 credit hour) or NSCI 120 (3 credit hours), but not for both courses. NSCI 120 (3 credit hours) fulfills the biology laboratory requirement for medical school applications. AP credit is not accepted for biology laboratory courses.

BIOC 112 Introductory Biological Research Challenges (offered Fall and Spring, 1 credit hour)
Teams of students work on investigative, client-based projects with opportunities to design experiments, analyze data, and communicate their findings. This course is recommended for students who are interested in a BioSciences major but have very limited practical laboratory experience. Only first year students may enroll.

NSCI 120 Introduction to Scientific Research Challenges (offered Fall and Spring, 3 credit hours)
Students in NSCI 120 will solve client-based problems that require the discovery or application of scientific knowledge, specifically in the fields of biology and chemistry. Students will work in interdisciplinary teams and be involved in shaping their project and implementing the scientific method to find solutions. This course is limited to first year students only.

FRESHMAN SEMINARS (offered Fall and Spring, 1 credit hour):

BIOC 115/FSEM 115 Freshman Seminar in Local BioSciences Research
EBIO 116/FSEM 116 Freshman Biology Seminar
ENST 117 Freshman Seminar in Local Environmental Science Research
These half-semester seminar courses introduce freshmen interested in biology to the excitement of research at Rice and across Houston. Small groups will meet weekly with a graduate student or postdoctoral researcher to explore a research article published by a local lab, gaining background information about the subject and exposure to the research techniques. Students will meet researchers and tour labs at Rice and elsewhere in the Houston research community. All first-year, non-transfer students are eligible to enroll. EBIO 116 meets in the first half of each semester, and BIOC 115 and ENST 117 meet in the second half of each semester (www.bioc.rice.edu/bioc115/).

LECTURE COURSES FOR FRESHMEN:

BIOC 201 Introductory Biology (offered Fall and Spring, 3 credit hours)
An introductory course featuring topics that include chemistry and energetics, cell physiology, cell biology, Mendelian genetics, molecular genetics, developmental biology, and plant physiology.

EBIO 202 Introductory Biology II (offered Spring only, 3 credit hours)
The second in a series of two introductory biology courses (BIOC 201, EBIO 202). This course examines the diversity of life, comparative animal physiology, evolution, ecology, and conservation. An emphasis is placed on evolution as a central framework necessary for a complete understanding of modern biology. Group discussions allow students to explore topics in more detail and discover how they are relevant to our everyday lives. Prerequisite: BIOC 201.

BIOC 300 Paradigms in Biochemistry and Cell Biology (offered Fall only, 3 credit hours)
Designed for BIOC majors and minors and recommended strongly for students with Advanced Placement in Biology who do not take BIOC 201 and for students wanting additional foundation before transitioning to the other 300-level BIOC courses. BIOC 201 examines a broader range of biological sciences, whereas BIOC 300 examines paradigms in biochemistry and cell biology with a specific focus on the “central dogma” of molecular biology and utilizes both historic and contemporary research papers. Using a newly designed “flipped” format, lectures will be available on-line, and in-class activities will address confusions/questions, examine research articles, explore cases and problems, and engage students in short writing assignments. Note that BIOC 300 may be offered in a summer session.
OTHER LECTURE COURSES ACCESSIBLE TO FRESHMEN:

**EBIO 270 Ecosystem Management** *(offered Spring only, 1 credit hour)*
This course focuses on applied ecosystem topics, including relations with state and federal agencies, field studies, wetland delineations, permitting compliance, and environmental regulations.

**BIOC 335 Cellular and Molecular Animal Physiology** *(offered Spring only, 3 credit hours)*
This course takes a functional approach to investigate animal physiology from a cellular and molecular perspective. Using an integrated and comparative approach, students learn how animals maintain homeostasis, including how they meet their energy needs, take up and transport oxygen, and maintain hydration and salt balance. Students will read primary literature to explore physiological adaptations for survival in extreme environments. Prerequisite: BIOC 201.

Upper Level Required Courses
Two upper level courses — BIOC 341 Cell Biology and BIOC 344 Molecular Biology & Genetics — can be considered by students with a strong background in biology. A conversation with the instructor prior to enrolling is strongly advised.

INTERMEDIATE LEVEL LABORATORIES (REQUIRE PERMISSION TO ENROLL):

**BIOC 211 Intermediate Experimental Biosciences** *(offered Fall and Spring, 2 credit hours)*. This course is an intermediate level laboratory experience required for BioSciences majors. Freshmen students wishing to take a laboratory should take BIOC 112 or NSCI 120. BIOC 211 is not available to first year students until the spring semester and requires instructor permission for registration. Note that prospective Neuroscience majors must take BIOC 212 rather than BIOC 211. Note also that BIOC 211 may be offered in a summer session.

**BIOC 212 Intermediate Experimental Cellular and Molecular Neuroscience** *(offered Fall and Spring, 2 credit hours)*. This course is similar to BIOC 211, but designed for and required for Neuroscience majors. Freshmen students wishing to take this course should take BIOC 112 or NSCI 120. BIOC 212 is not available to first year students until the spring semester and requires instructor permission for registration. BIOC 211 and BIOC 212 cannot both be taken for credit.

**EBIO 213 Intro Experimental Ecology and Evolutionary Biology** *(offered Fall & Spring, 2 credit hours)*. This course, required for EBIO and Biological Sciences majors, features experimental, laboratory, and field studies of natural history, ecology, evolution, and animal behavior. EBIO 213 meets during the second half of the semester only. (BIOC 211 and EBIO 213 can be taken concurrently if class times do not conflict).

NOTE: Be sure to check the course offerings on the Registrar’s web page to confirm availability of courses.
Introduction to the Degree Programs in BioSciences

The Department of BioSciences offers a broad range of courses across the biological sciences, and students may choose from a variety of degree programs:

The Biochemistry & Cell Biology BS and BA degree paths are designed for students pursuing a wide range of careers in the life sciences, typically leading to graduate, medical, or other professional schools. Both paths are designed to emphasize a broad understanding of cell biology and biochemistry, provide room for exploration anywhere in the Natural Sciences or Engineering, and culminate in one (BA) or two (BS) required 400-level capstone courses incorporating primary scientific literature, presentations, and writing. The BA offers greater flexibility with two fewer courses (including a choice of 300-level core courses). The BS offers greater coverage and depth, with a complete 300-level core and an additional 400-level capstone course.

The Ecology & Evolutionary Biology BS and BA degree paths are designed to educate the next generation of scientists and environmental citizens through coursework that involves hands-on, local, and applied learning opportunities as well as experiences in overseas settings. These programs provide students with the flexibility to specialize in particular sub-disciplines through interactions within our department and with our colleagues in other departments and institutions. The BA is appropriate for students planning to pursue either graduate or professional degrees and allows students to explore a second major. The BS requires independent research under supervision of a faculty member and is designed to facilitate advanced studies.

The Biological Sciences BA degree incorporates elements of the Ecology and Evolutionary Biology (EBIO) and the Biochemistry & Cell Biology (BIOC) degree programs to give students a broad understanding of the full range of biological disciplines. Although Biological Sciences majors must distribute their upper-level electives between the two programs, they have few restrictions on which upper-level BioSciences courses they select, providing flexibility to design a path suiting their biological interests. This major may not be combined with any other BioSciences degree (i.e., BS, BA or Minor in Ecology & Evolutionary Biology or BS, BA or Minor in Biochemistry & Cell Biology; this major may be combined with the Neuroscience BA or minor).

The interdisciplinary Environmental Science BS and BA degree paths (with concentration in Ecology & Evolutionary Biology) explore interconnections between humans and the natural environment, drawing courses from BioSciences, Earth Sciences, Civil Engineering, and across Humanities and Social Sciences. This program is designed to foster the critical thinking required to address the increasing complexities facing our planet and develop solutions to enhance the environment.

The Neuroscience BA degree is an interdisciplinary program that is designed to provide multiple paths for students interested in the brain and neuron function. This degree path will explore the biological basis for these functions and explore our current understanding of brain and neuron function. This program will equip students to explore key issues, analyze and interpret neuro-scientific data, and both understand and apply experimental methods that expand our understanding of brain and neuron function. Research experiences are highly encouraged with a wide range of investigators at Rice and across the Texas Medical Center.

The Minors in Biochemistry & Cell Biology, Ecology & Evolutionary Biology, Environmental Studies, and Neuroscience are intended for those with an interest in the life sciences but who may be majoring in other areas. The minor in Biochemistry & Cell Biology incorporates many of the life science core courses required for the health professions.
### REQUIREMENTS FOR MAJORS AND MINORS IN BIOSCIENCES: Biochemistry & Cell Biology, Ecology & Evolutionary Biology, Biological Sciences*

<table>
<thead>
<tr>
<th>Category</th>
<th>BA BIOC</th>
<th>BS BIOC</th>
<th>BA Biol</th>
<th>BA EBIO</th>
<th>BS EBIO</th>
<th>BIOC-Minor</th>
<th>EBIO-Minor</th>
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<tbody>
<tr>
<td>Math/Stat</td>
<td>MATH 101/102 or listed substitutions (see lists next page) MATH 211</td>
<td>MATH 101/102 or listed substitutions (see lists next page) MATH 211</td>
<td>MATH 101/102 EBIO 338 or MATH 211 or STAT 305</td>
<td>MATH 101/102 or listed substitutions EBIO 338 or STAT (≥ 3 credits)</td>
<td>MATH 101/102 or listed substitutions EBIO 338 or STAT (≥ 3 credits)</td>
<td>MATH 101/102 or listed substitutions</td>
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<tr>
<td>Physics</td>
<td>PHYS 125/126 or listed substitutions</td>
<td>PHYS 125/126 or listed substitutions</td>
<td>PHYS 125 or listed substitutions</td>
<td>PHYS 125</td>
<td>PHYS 125/126 or listed substitutions</td>
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<tr>
<td>Intro Chem</td>
<td>CHEM 121/123 CHEM 122/124 or listed substitutions</td>
<td>CHEM 121/123 CHEM 122/124 or listed substitutions</td>
<td>CHEM 121/123 CHEM 122/124 or listed substitutions</td>
<td>CHEM 121/123</td>
<td>CHEM 121/123 CHEM 122/124 or listed substitutions</td>
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<td>Orgo Chem</td>
<td>CHEM 211/213 CHEM 212/214, 215 or listed substitutions</td>
<td>CHEM 211/213 CHEM 212/214, 215 or listed substitutions</td>
<td>CHEM 211/213 CHEM 212/214, 215 or listed substitutions</td>
<td>CHEM 211/213</td>
<td>CHEM 211/213 CHEM 212/214, 215 or listed substitutions</td>
<td>CHEM 211/213 CHEM 212/214, 215 or listed substitutions</td>
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<tr>
<td>Intro Bio</td>
<td>BIOC 201</td>
<td>BIOC 201</td>
<td>BIOC 201/EBIO 202</td>
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<td>BIOC 201/EBIO 202</td>
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<tr>
<td>Labs</td>
<td>BIOC 112 or NSCI 120 (recommended, not req) BIOC 211</td>
<td>BIOC 112 or NSCI 120 (recommended, not req) BIOC 211</td>
<td>BIOC 112 or NSCI 120 (recommended, not req) BIOC 211</td>
<td>BIOC 112 or NSCI 120 (recommended, not req) BIOC 211</td>
<td>BIOC 112 or NSCI 120 (recommended, not req) BIOC 211</td>
<td>BIOC 112 or NSCI 120 (recommended, not req) BIOC 211</td>
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<tr>
<td>Adv Labs</td>
<td>BIOC 311 2 BIOC labs ≥ 300 level</td>
<td>BIOC 311 2 BIOC labs ≥ 300 level</td>
<td>BIOC 311 2 BIOC labs ≥ 300 level</td>
<td>3 EBIO/BIOC 300/400 Labs</td>
<td>1 EBIO 300 lab 1 BIOC/EBIO 300/400 Lab</td>
<td>1 EBIO 300 lab 1 BIOC/EBIO 300/400 Lab</td>
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<tr>
<td>Upper Level Lecture Courses in Major Area (≥3 credit hours)</td>
<td>BIOC 301 BIOC 341 2 of these 3: BIOC 302 BIOC 344 BIOC 352</td>
<td>BIOC 301 BIOC 302 BIOC 341 BIOC 344 BIOC 352</td>
<td>BIOC 301 1 of these 4: BIOC 302, 341, 344, or 352 3 EBIO ≥ 300 level 1 BIOC ≥ 300 level 1 BIOC or EBIO ≥300 level</td>
<td>EBIO 325 EBIO 334 2 EBIO 300/400 level 1 BIOC 300/400 level</td>
<td>EBIO 325 EBIO 334 2 EBIO 300/400 level 1 BIOC 300/400 level</td>
<td>EBIO 325 EBIO 334 2 EBIO 300/400 level 1 BIOC 300/400 level</td>
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<tr>
<td>Broadening Upper Level Lecture Courses</td>
<td>2 NSCI/ENGI ≥ 300 (≥ 3 credit hours)</td>
<td>2 NSCI/ENGI ≥ 300 (≥ 3 credit hours)</td>
<td>1 NSCI/ENGI &gt;300 (≥ 3 credit hours)</td>
<td>1 NSCI/ENGI ≥300 (≥ 3 credit hours)</td>
<td>1 NSCI/ENGI ≥300 (≥ 3 credit hours)</td>
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<td>Senior Capstone</td>
<td>1 BIOC 400 level (≥ 3 credit hours)</td>
<td>2 BIOC 400 level (≥ 3 credit hours)</td>
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*NOTE: This document was created to simplify, but not supersede, information found in the General Announcements. In the event of discrepancies, the General Announcements are to be considered the final authority on the requirements of the various majors/minors offered in BioSciences (e.g., for listed substitutions).
BIOC Majors (BA or BS) and BIOC Minors additional notes

**Permissible substitutions:** MATH 111 and 112 or MATH 105 may be substituted for MATH 101; MATH 106 may be substituted for MATH 102. CHEM 151/153 and CHEM 152/154 may be substituted for CHEM 121/123 and CHEM 122/124; CHEM 320 may be substituted for CHEM 212; CHEM 365 may be substituted for CHEM 215; PHYS 101/103 and PHYS 102/104 or PHYS 111 and PHYS 112 may be substituted for PHYS 125 and 126; CHEM 301 and 302 may substitute for BIOC 352. BIOC 212 may substitute for BIOC 211. A maximum of 3 credit hours from BIOC 390 (transfer credit in Biochemistry and Cell Biology) may be applied to elective NSCI/ENG I lecture requirements.

**Research courses and laboratory requirements:** BIOC majors (BA and BS) must take BIOC 311 and at least one of the additional advanced laboratory courses other than a research for credit course. If desired, the third advanced laboratory requirement may be satisfied by completing: (i) BIOC 310 if taken for at least 3 credits; or (ii) honors research (BIOC 401/402/412). This substitution may be used only once regardless of the number of semesters of independent research taken.

EBIO majors (BA or BS) additional notes

**Acceptable substitutions:** Permissible substitutions: MATH 111 and MATH 112 or MATH 105 may be substituted for MATH 101; CHEM 151/153 may be substituted for CHEM 121/123; PHYS 101/103 or PHYS 111 may be substituted for PHYS 125.

**Research courses and laboratory requirements:** All EBIO majors (BA and BS) must take at least two advanced labs (300/400-level). EBIO BA degree students may substitute EBIO 306 (taken for at least two credit hours) for one of their advanced laboratory requirements. This substitution may not be used by students completing the BS in EBIO because the independent research courses, EBIO 306, 403, and 404, are requirements of the EBIO BS degree in addition to the two advanced labs.

Biological Sciences (BA) additional notes

**Acceptable substitutions:** MATH 111 and MATH 112 or MATH 105 may be substituted for MATH 101; MATH 106 may be substituted for MATH 102. CHEM 151/153 and CHEM 152/154 may be substituted for CHEM 121/123 and CHEM 122/124; CHEM 320 may be substituted for CHEM 212; CHEM 365 may be substituted for CHEM 215; PHYS 101/103 and PHYS 102/104 or PHYS 111 and PHYS 112 may be substituted for PHYS 125 and 126. BIOC 212 may be substituted for BIOC 211. CHEM 311 and 312 may substitute for BIOC 352. A maximum of 3 credits of transfer credit (BIOC 390 or EBIO 391) can apply to this major.

**Research courses and laboratory requirements:** Only one of the three advanced laboratory requirements may be satisfied by taking any of the following: (i) BIOC 310 for at least 3 credits or EBIO 306 if taken for at least 2 credits; (ii) BIOC 401/402/412 or EBIO 403/404, or (iii) BIOC/EBIO 393 (laboratory transfer credit). This substitution may be used only once regardless of the number of semesters of independent research or transfer credit.

*This document was created to simplify, but not supersede, the more complete information found in the General Announcements. In the event of discrepancies, the General Announcements are to be considered the final authority on the requirements of the various majors offered in BioSciences.*
## REQUIREMENTS FOR ENVIRONMENTAL SCIENCE B.S. AND B.A. AND ENVIRONMENTAL STUDIES MINOR*

<table>
<thead>
<tr>
<th>Category</th>
<th>B. A. in Environmental Science</th>
<th>B.S. in Environmental Science</th>
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<td>EBIO Concentration</td>
<td>EBIO Concentration</td>
<td>Required course: ENST 100</td>
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<td><strong>General Prerequisites</strong></td>
<td>BIOC 201, EBIO 202</td>
<td>BIOC 201, EBIO 202</td>
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<td>CHEM 121/122/123/124 or substitution</td>
<td>CHEM 121/122/123/124 or substitution</td>
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<td>MATH 101/102 or substitution</td>
<td>MATH 101/102 or substitution</td>
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<td>STAT 280 or STAT 305</td>
<td>PHYS 101/103 or PHYS 111 (with lab)</td>
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<td>PHYS 125 (with lab)</td>
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<td>PHYS 102/104 or PHYS 112 (with lab)</td>
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<td>PHYS 126 (with lab)</td>
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<td>STAT 280 or STAT 305</td>
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<tr>
<td><strong>Core Required Courses</strong></td>
<td>ENST 100/ARCH 105, ESCI 115, ESCI 107 (or 109 or 201), EBIO 213, EBIO 325</td>
<td>ENST 100/ARCH 105, ESCI 115, ESCI 107 (or 109 or 201), EBIO 213, EBIO 325</td>
<td>Introductory courses (one): EBIO 124, ESCI 101, ESCI 107, ESCI 109, ESCI 201</td>
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<td><strong>Field Experience</strong></td>
<td>2-3 credit hours of field experience: see GA for list of approved courses</td>
<td>2-3 credit hours of field experience: see GA for list of approved courses</td>
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<tr>
<td><strong>Major Concentration in Ecology &amp; Evolutionary Biology</strong></td>
<td>Two courses from: EBIO 270, EBIO/ENST 323, EBIO 372</td>
<td>Two courses from: EBIO 270, EBIO/ENST 323, EBIO 372</td>
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<tr>
<td><strong>Advanced Electives</strong></td>
<td>One course from each of the following categories: Social Sciences: See GA for list of approved courses</td>
<td>One course from each of the following categories: Social Sciences: See GA for list of approved courses</td>
<td>Two courses from each of the following categories: ARCH, HUMA, SOCI: See GA for list of approved courses</td>
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<td>Natural Sciences/Engineering: See GA for list of approved courses</td>
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<td>Humanities/Architecture: See GA for list of approved courses</td>
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<td><strong>Capstone Requirement</strong></td>
<td>EBIO 495 Independent Research encouraged</td>
<td>One course from the following: ESCI 390, ESCI 391, EBIO 403 or 404, ESCI 481</td>
<td>EBIO 495</td>
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# REQUIREMENTS FOR NEUROSCIENCE B.A. AND MINOR*

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<thead>
<tr>
<th>Category</th>
<th>Neuroscience Major</th>
<th>Neuroscience Minor</th>
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<tr>
<td><strong>Foundation Requirements</strong>**</td>
<td>BIOC 201 Introductory Biology</td>
<td>NEUR 380/PSYC 380/BIOC 380 Fundamental Neuroscience Systems</td>
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<td>CAAM 210 Introduction to Engineering Computation</td>
<td>Science and Engineering Track Core Requirement: NEUR 385/BIOC 385 Fundamentals of Cellular and Molecular Neuroscience</td>
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<td>CHEM 121/123 General Chem I/Laboratory I</td>
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<td>CHEM 122/124 General Chem II/Laboratory II</td>
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<td></td>
<td>MATH 101 Single Variable Calculus I or MATH 105</td>
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<td>MATH 102 Single Variable Calculus II or MATH 106</td>
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<td></td>
<td>PHYS 125 General Physics (with Lab)</td>
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<td>PHYS 126 General Physics (with Lab)</td>
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<td></td>
<td>PSYC 203 Introduction to Cognitive Psychology</td>
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<td><strong>Foundation Courses should consist of 12 credits from the following:</strong></td>
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<td></td>
<td>STAT 305 Introduction to Statistics for Biosciences</td>
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<td></td>
<td>STAT 310 Probability &amp; Statistics</td>
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<tr>
<td></td>
<td>STAT 312 Probability &amp; Statistics for Engineers</td>
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<td><strong>Introductory courses in CHEM, MATH, PHYS have alternates that are listed in the General Announcements.</strong></td>
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<tr>
<td><strong>Core Requirements</strong></td>
<td>NEUR 362/PSYC 362 Cognitive Neuroscience</td>
<td>Select three courses from the following list: BIOC 415, BIOE/ELEC/NEUR 481, BIOE 492, COMP 440, EBI 321/NEUR 382, ELEC 382, ELEC 475, NEUR 310, NEUR 383, NEUR 401 and NEUR 402 and NEUR 412, NEUR/CAAM 415/ELEC 488, NEUR/CAAM 416/ELEC 489</td>
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<tr>
<td></td>
<td>NEUR 380/BIOC 380/PSYC 380 Fundamental Neuroscience Systems</td>
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<td></td>
<td>NEUR 383/BIOE 380/ELEC 380 Introduction to Neuroengineering</td>
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<td></td>
<td>NEUR 385/BIOC 385 Fundamentals of Cellular and Molecular Neuroscience</td>
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<td><strong>Project-Based Laboratory Courses</strong></td>
<td>BIOC 112 or NSCI 120 (recommended, not req.)</td>
<td>Select one course from the following list: LING/ANTH 411, NEUR 301, NEUR 302, NEUR 306, PHIL 103, PHIL 303, PHIL 312, PHIL 358, PHIL 359, PSYC 375, PSYC 432</td>
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<td>BIOC 212 Intermediate Exptl Cell/Mol Neuroscience (required)</td>
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<td><strong>Must take one course from the following list:</strong></td>
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<td></td>
<td>BIOC 417 Experimental Cell &amp; Molecular Neuroscience</td>
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<td>NEUR 310 Independent Research for Neuroscience</td>
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<td></td>
<td>NEUR 364 Cognitive Neuroscience Lab</td>
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<tr>
<td><strong>Electives</strong></td>
<td>Select four courses from the following list: BIOC 129 (3 semesters), BIOC 442,</td>
<td>Select one course from the following list: LING/ANTH 411, NEUR 301, NEUR 302, NEUR 306, PHIL 103, PHIL 303, PHIL 312, PHIL 358, PHIL 359, PSYC 375, PSYC 432</td>
</tr>
<tr>
<td></td>
<td>BIOC 449, BIOE 492, COMP/ELEC 440, EBI 321, ELEC 475, LING 411, NEUR 301, NEUR 302, NEUR 310, NEUR/ELEC 382, NEUR/CAAM 415/ELEC 488, NEUR/CAAM 416/ELEC 489, PHIL 103, PHIL 303, PHIL 312, PHIL 358, PHIL 359, PSYC 375, PSYC 432</td>
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*This document was created to simplify, but not supersede, information found in the General Announcements. In the event of discrepancies, the General Announcements are to be considered the final authority on the requirements of the various majors offered in BioSciences.

**Introductory courses in CHEM, MATH, PHYS have alternates that are listed in the General Announcements.
Undergraduate Research in BioSciences

Undergraduate research is an important component of the BioSciences programs, can enhance the undergraduate experience, and provide opportunities for career development. Research experience is becoming a critical element for admission to professional schools or biological graduate programs or for those intending to go directly into industry research labs. The undergraduate research programs in BioSciences have been designed to flow from observation through participation. Students are encouraged to seek undergraduate research opportunities whenever they are ready. Freshmen seminars (BIOC 115, EBIO 116, & ENST 117) and laboratory fundamentals courses (BIOC 112, NSCI 120 & EBIO 213) are designed to provide students in each major with the exposure and basic skills to navigate early entry into labs.

OPPORTUNITIES are available to experience and participate in active research programs at Rice and beyond: Texas Medical Center, Houston Zoo, Houston Museum of Natural Science, Houston Arboretum and Nature Center, Flower Garden Banks National Marine Sanctuary NOAA Office (Galveston), and other off-campus research sites.

- **BIOC 115/FSEM 115: Freshman Seminar in Local Biology Research**
- **EBIO 116/FSEM 116: Freshman Biology Seminar**
- **ENST 117 Freshman: Seminar in Local Environmental Science Research**

These half-semester seminar courses introduce freshmen interested in biology to the excitement of research at Rice and across Houston. Small groups meet weekly with a graduate student or postdoctoral researcher to explore a research article published by a local lab, gaining background information about the subject and exposure to the research techniques. At the end of the course, students will meet researchers and tour labs at Rice and elsewhere in the Houston research community. All first-year non-transfer students are eligible to enroll. EBIO 116 meets in the 1st half of each semester and BIOC 115 and ENST 117 meet in the 2nd half of each semester (http://www.bioc.rice.edu/bioc115/)

- **EBIO 306: Independent Research in Ecology & Evolutionary Biology**

This course provides a program of independent research for students with previous training in the biosciences. Students are generally expected to spend an average of 3 hours per week in the laboratory for each semester hour of credit and to write a research paper. Students taking ≥2 hours of credit for this course are encouraged to present their research at the university annual undergraduate symposium in the spring semester. Venues for research are both inside Rice and in the larger Houston community. Permission of the instructor is required. Suggested prerequisite is EBIO 213.

- **BIOC and NEUR 310: Independent Research in Biochemistry & Cell Biology/Neuroscience**

These courses are research-for-credit; students perform research for an average of 3 hours per week per credit hour in faculty laboratories in BioSciences at Rice and elsewhere in the Texas Medical Center, prepare a research proposal, weekly reports and a research paper (Fall) or poster (Spring), and receive course credit for their effort. Those intending to participate in BIOC 310 or NEUR 310 undergraduate research should take BIOC 112 or NSCI 120 or BIOC 211 or BIOC 212 (with permission). Please read the Independent Research website for complete information and requirements: [biosciences.rice.edu/UG_Research.aspx](http://biosciences.rice.edu/UG_Research.aspx)

If intending to pursue BIOC 310 research off-campus, please submit an application to the BIOC 310 or NEUR 310 instructor at the indicated link above at least 3 weeks before the start of the semester for permission to enroll. The BIOC 310/NEUR 310 off-campus regulations may be obtained from the website above. Students working off campus may not take BIOC 310/NEUR 310 for fewer than 3 credit hours (9 hours of research/week).

- **BIOC 401/402/412: Honors Research in Biochemistry & Cell Biology**

The Biochemistry & Cell Biology Honors Research Program is a suite of courses offering our seniors and advanced juniors the opportunity to perform a two-semester, individual research project in a research laboratory in biochemistry & cell biology at Rice or elsewhere in the TMC and requires substantial time devoted to the research project (minimum 3 hours per week per credit hour). This immersive program is intended to give a first-hand experience of what a career in research would entail. Students interested in graduate school are strongly encouraged to apply for consideration for honors research. Information and application can be found at the following site: [https://biosciences.rice.edu/Content.aspx?id=2147483811#3](https://biosciences.rice.edu/Content.aspx?id=2147483811#3)

- **EBIO 403/404: Senior Research in Ecology & Evolutionary Biology**

This course for research in EBIO is open only to undergraduate majors during their senior year and requires permission of the research supervisor and chair. Applications are due in April of the previous academic year. Registration for EBIO 403/404 implies a commitment to participate in research for at least 2 semesters.

BioSciences Opportunities OwlSpace List

On this “joinable” site, we post various biology-related opportunities. Examples include: Research opportunities, summer internship programs, information sessions, fellowships, jobs, study abroad, et al. This site mailing list is a great way to hear about biological and biomedical research opportunities on/off the Rice campus. To join, log on to OwlSpace using your netID and password and go to “My Workspace” —> “Membership” —> “Joinable Sites” and select “BioSciences Opportunities.”
Finding and Securing Research Opportunities

Biochemistry & Cell Biology undergraduate research contact information:
Dr. Dereth Phillips: BIOC 115 and BIOC 310. Office: 340 Anderson Biological Labs; email: derethp@rice.edu

Ecology & Evolutionary Biology undergraduate research contact information:
Dr. Adrienne M. S. Correa. Office: 201D Anderson Biological Labs; email: ac53@rice.edu
Dr. Scott Solomon. Office: 130D Anderson Biological Labs; email: scott.solomon@rice.edu

Neuroscience undergraduate research contact information:
Dr. Jon Flynn. Office: W102 George R. Brown Hall; email: flynn@rice.edu

Think about the sorts of research that may be of interest to you and talk to students and advisors in that area of research. Explore on your own by searching through different research departments at Rice, at the Texas Medical Center, or in the greater Houston area. You can learn about the research in a particular department by going to the “Faculty” or “People” tab and clicking through the various faculty names and research statements. At the same time, join the “BioSciences Opportunities” OwlSpace site to receive information about research opportunities at Rice and elsewhere. When you have found a lab(s) of interest, scan through recent research articles from that lab and contact the professor to express your interest. [If you are a BIOC major, before contacting the professor, it may be helpful to read the BIOC 310 course manual to get a feel for the expectations of an undergraduate researcher (www.bioc.rice.edu/bioc310)]. Determine the nature of your engagement (volunteer, for pay, for credit, for one semester/summer, for multiple years). If you are interested in receiving credit for your research, contact the instructor of the research-for-credit/independent study course in the appropriate department. Links to the BioSciences Department and to various off-campus departments may be found on the department website in the section “Research and Internships” under “Undergraduate Studies.”

Independent Research in BioSciences and Beyond

Once you have found a research position, you may be eligible to receive course credit in an appropriate department. All of the following courses may be taken by permission only. Please contact the course instructors for additional details and requirements.

- BIOC 310/401/402—BioSciences: Program in Biochemistry & Cell Biology
- EBIO 306/403/404—BioSciences: Program in Ecology & Evolutionary Biology
- BIOE 400/401—Bioengineering
- CHEM 391/491/492/493—Chemistry
- CHBE 499—Chemical & Biomolecular Engineering
- ESCI 481—Earth Science
- KINE/HEAL 495/496—Kinesiology
- NEUR 310/401/402—Neuroscience Program
- UNIV 301—University-wide, zero-credit, for all majors, all types of projects qualify
- HONS 470/471 (RUSP)—University-wide companion course for research in all majors

Find the course number/department that best matches your research interests. Most departments, including those not listed here, have an independent study/research course.

Note for those interested in the health professions: There are many types of research that can improve human health outside of the biological sciences (health disparities, healthcare economics, medical sociology, psychology of addiction, et al.). For the most fulfilling research experience, make sure to pursue the research that most interests you rather than that which you perceive is desired by medical schools.
Frequently Asked Questions and Tips for Planning Your Major

"Is it better to get a BS rather than a BA?" Neither degree is "better" than the other. Graduate schools, medical schools, and employers will look at your overall academic record including performance, research experience, extracurricular activities, etc. You might choose the BA degree because you want to add a double major, for example, or because you want to spend more time on undergraduate research rather than on the extra course work required for the BS.

"I want to earn a BS in BIOC or EBIO and double major in history. Can I do it?" Yes, but because a history major earns a BA degree you would have to meet the requirements for what we call a dual degree. A dual degree is not the same as a double major. You can major in two or more different fields simply by meeting the requirements for both majors provided that the degree earned is either a BA or BS but not both. To earn a dual degree (BA/BS), you must complete the requirements for both majors and complete at least 30 additional semester hours at Rice during the hours required for the first degree.

"I will complete all of the requirements for my major, but how can I be sure I have my 60 hours outside the major?" All courses not specifically used to satisfy major requirements count as "outside" the major, even courses taken in the same discipline. For example, if you complete all of the course requirements listed for a BA in BIOC or EBIO and take a couple of extra BIOC or EBIO courses, those courses count toward the additional 60 hours needed.

I have AP Biology credit. Which BIOC/EBIO class should I take next? What class(es) can I take to get a better feel for the major? Even if you receive AP credit for introductory biology (BIOC 201), you should not wait to begin your introductory laboratory sequence (BIOC 112 or NSCI 120 freshmen year and BIOC 211, BIOC 212 or EBIO 213 sophomore year). BIOC 300 (Paradigms in Biochemistry and Cell Biology) is a 3-credit course designed for first year students with AP biology credit (or who have taken BIOC 201). BIOC 335 (Molecular and Cellular Animal Physiology), EBIO 319 (Tropical Field Biology), and EBIO 320 (Ecology and Conservation of Brazilian Wetlands) are also accessible to freshmen who have credit for BIOC 201 (note that EBIO 319 and 320 are only offered in summer). BIOC 115 and EBIO 116 are 1-credit seminars that introduce students to research and researchers at Rice. With AP credit, some students go straight into upper level courses, although some have reported that these courses are challenging for the first year of college. For more information see “Courses Accessible to Freshmen.”

What's the difference between BIOC 112, NSCI 120, and BIOC 211 or 212? We offer two entry-level laboratory course options — BIOC 112 (1 credit hour) or NSCI 120 (3 credit hours) — to introduce fundamental methods and standard laboratory practices in biosciences. Major objectives are to prepare students who have limited laboratory experience to move on to courses that require more independent learning (including BIOC 211 for BIOC/BIOL majors or BIOC 212 for NEUR majors) and to provide students with fundamental skills that are needed to conduct independent study in a research laboratory in BioSciences. BIOC 112 or NSCI 120 should be taken in the first year. Completion of NSCI 120 fulfills the biology laboratory requirement for medical school applications. A student may receive credit for BIOC 112 or NSCI 120, but not for both courses. BIOC 211/212 (2 credit hours) are intermediate level required laboratory courses designed for BioSciences/NEUR majors in their second year.

Should I take Physics 125/126 or Physics 101/102? Both sequences will fulfill the BIOC, BIOL, EBIO, and NEUR physics requirements. PHYS 125/126 is intended for biosciences and premedical students; however, if you are also considering a major in engineering or the physical sciences, then you should take the PHYS 101/102 or PHYS 111/112 series, which is required for most engineering and physical sciences majors.

Which 300-level course is best to take first? BIOC 201 provides a broad overview, and BIOC 300 is a great “first” 300-level for BIOC majors. Although not part of the 300-level core, this course counts toward your 300-level BIOC electives (if taken before any other 300-level BIOC course) or toward 300-level NSCI/ENG1 electives and provides a strong foundation for other 300-level courses. EBIO majors should consider taking BIOC 201 before EBIO 325 or EBIO 334 as their first 300-level EBIO courses.
Which core 300-level BIOC required course is best to take first — BIOC 341: Cell Biology, BIOC 301: Biochemistry I or BIOC 344: Molecular Biology and Genetics? Of the two required core courses for the BIOC BA degree (BIOC 301 and BIOC 341), the order in which you take them depends on your preparation and path through the major. BIOC 301 is best taken soon after your organic chemistry experience as it builds on this knowledge. BIOC 344 is accessible to first-year students with a strong biology background.

How do I get involved in research, and can I get BIOC/EBIO credit for this research? If you perform research in a BioSciences faculty lab or perform research off-campus related to cell or molecular biology, biochemistry, structural biology, genetics, ecology, evolution, conservation biology, or other lab or field-based biology you may be able to receive credit for your research (≥3 hours of work in the laboratory are required for 1 hour credit). Tips for finding research positions and opportunities for receiving credit are found on the BioSciences website.

I want to improve my scientific writing skills. Which courses in the BioSciences department have a stronger emphasis on scientific writing? All of our introductory and advanced teaching labs have a focus on improving scientific writing through practice. Many upper-level classes are also designed to hone writing skills. BIOC 300 (Paradigms in Biochemistry & Cell Biology) will give you practice in writing about science. EBIO 412 (Advanced Communication in Biological Sciences), a required capstone course for EBIO majors, focuses on refining communication skills for students that already have a solid foundation of biological knowledge. Most upper level courses have writing requirements.

I’m a premedical student: Should I plan on getting the BIOC minor since I’ll need to fulfill most of the requirements anyway? Premedical students aren’t required to complete the BIOC minor, but the minor is a good way for non-majors to build a strong science foundation and is one path to completing the Natural Sciences requirements for most medical schools.

What’s the difference between EBIO, Biological Sciences, and BIOC majors? Please examine the respective degree plans for each! In general, BIOC courses feature an exploration of life from the level of the molecule to the level of the organism, whereas EBIO courses tend to start at the level of the organism and explore life through its diversity, environmental interactions, and evolutionary history. The Biological Sciences major combines the approaches of both the BIOC and EBIO majors.

What is the best course schedule (which classes to take when) for someone deciding between Biochemistry & Cell Biology and Bioengineering? The suggested courses for freshmen in BIOE and BIOC are overlapping, but there are additional critical courses to take in your freshman year to keep on track with each major. Both majors suggest strongly that you take General Chemistry and Calculus in your first year, but BIOE freshmen should also take Physics and CAAM 210. BIOC freshmen should take BIOC 201 (Introductory Biology) and may want to take an introductory biology lab (BIO 112 or NSCI 120). Those deciding between the two majors may need to take “all of the above” during the freshman year.

What are some post-graduation options for me if I graduate with a degree in BIOC or EBIO (aside from medical school or graduate school)? You have many options, especially if you are not geographically limited. These include jobs in education, conservation, environmental resource management, biotechnology, science writing, science policy, scientific/medical illustration, forensic science, and many more. For additional ideas, see the following articles:

“Career counseling: 101+ things you can do with a degree in biology”
http://advan.physiology.org/content/31/4/323.full-text.pdf

“Positions Available: No Ph.D. Required?”
https://www.sciencemag.org/careers/features/2008/08/positions-available-no-phd-required

“Careers in the Biological Sciences”
http://www.aibs.org/careers/