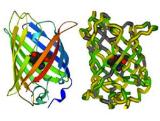


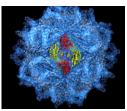
# RICE NATURAL SCIENCES Biosciences











### Undergraduate Advising Information (2019-2020)

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### Follow BioSciences!

Website: http://biosciences.rice.edu (advising/courses/majors/research information can be found here)

Canvas: catalog.rice.edu (log on and enroll in "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 (BCB)** BA and BS, **Biological Sciences (BIOL)** BA, and **Ecology & Evolutionary Biology (EEB)** BA and BS, along with **Neuroscience (NEUR)** BA and **Environmental Science (ENVS)** BA and 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 a graduate degree in the life sciences. BioSciences undergraduate students of <u>all</u> 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 BCB, BIOL, EEB, NEUR, ENVS majors and minors, 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 (BCB & BIOL): 08A Herman Brown Hall; x2535; bbeason@rice.edu
- Dr. Matthew Bennett (BCB & BIOL): 306 Keck Hall; x4161; matthew.bennett@rice.edu
- Dr. Dan Carson (BCB & BIOL): 1023 BioScience Res Collaborative; x3347; daniel.d.carson@rice.edu
- Dr. Jamie Catanese (BCB & BIOL): 05 Herman Brown Hall; x2391; djc98@rice.edu
- Dr. Amy Dunham (ENVS & ENST minor): E300B George R. Brown Hall; x2792; aed4@rice.edu
- Dr. Jon Flynn (NEUR): 04 Herman Brown Hall; x4860; flynn@rice.edu
- Dr. Alma Novotny (BCB & BIOL): 01 Herman Brown Hall; x4015; novotnya@rice.edu
- Dr. Dereth Phillips (BCB & BIOL): 03 Herman Brown Hall; x2343; derethp@rice.edu
- Dr. Evan Siemann (EEB & BIOL): E200D George R. Brown Hall; x5954; siemann@rice.edu
- Dr. Scott Solomon (EEB & BIOL): 07 Herman Brown Hall; x2661; scott.solomon@rice.edu

### Advisors for Declaring/Declared BCB or BIOL Majors/Minors:

(advisors assigned by first letter of last name)

- Dr. Kate Beckingham: W130 George R. Brown Hall; x4016; kate@rice.edu [last names A-H]
- Dr. Dave Caprette: 08B Herman Brown Hall; x3498; caprette@rice.edu [last names I-P]
- Dr. Charles Stewart: W104 George R. Brown Hall; x4926; crs@rice.edu [last names Q-Z]

### Advisor for Declaring/Declared EEB or BIOL Majors/Minors:

Dr. Scott Solomon: 07 Herman Brown Hall; x2661; scott.solomon@rice.edu

### Advisor for Declaring/Declared ENVS Major and ENST Minor:

Dr. Amy Dunham: E300B George R. Brown Hall; x2792; aed4@rice.edu

### Advisors for Declaring/Declared Neuroscience Major/Minor:

Dr. Dave Caprette: 08B Herman Brown Hall; x3498; caprette@rice.edu

Dr. Jon Flynn: 04 Herman Brown Hall; x4860; flynn@rice.edu

Dr. Peter Lwigale: W105 George R. Brown Hall; x6785; lwigale@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 specific ENVS course credit or generic ENVS transfer credit, contact Dr. Evan Siemann (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: W132 George R. Brown Hall; 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 BioSciences majors to take the following courses during their first year (or transfer in AP credit for them):

- BIOC 201: Introductory Biology lecture (required for EEB, BCB, BIOL, NEUR, and ENVS)
- **BIOC 112** or **NSCI 120**: Introductory Labs (recommended; prerequisite for undergraduate research for credit)
- CHEM 121/123: General Chemistry & Lab (required for EEB, BCB, BIOL, NEUR, and ENVS)
- CHEM 122/124: General Chemistry II & Lab (required for BCB, BIOL, NEUR, ENVS)
- **EBIO 202**: Introductory Biology II lecture (required for EEB and ENVS majors, recommended for BCB and BIOL majors)
- EBIO 213: Introductory Ecology & Evolutionary Biology Lab (required for EEB and ENVS majors)

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). Earning AP credit for introductory courses does not necessarily mean that a student is prepared for advanced coursework in BioSciences. 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, EBIO 306, and NEUR 310. 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, 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 Canvas List**

Join now for departmental information and research opportunities!

The BioSciences Opportunities Canvas site offers research, internship, and career information and opportunities related to the biological sciences. It also serves as the portal for advising information for BioSciences majors. To join the site and mailing list go to catalog.rice.edu and then search for "BioSciences Opportunities." Click on the site and click "enroll" (use your standard Rice netID and password, if prompted).

## **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 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 only, 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 118 (formerly BIOC 115) Freshman Seminar in Local Biology Research (BCB) EBIO 119 (formerly EBIO 116) Freshman Seminar in Local Biology Research (EEB)

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 119 meets in the first half of each semester and BIOC 118 meets in the second half of each semester.

### 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 "flipped" format, lectures are available online, and in-class activities 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**

Upper level courses — BIOC 341 Cell Biology, BIOC 344 Molecular Biology & Genetics, EBIO 325 Ecology, and EBIO 334 Evolution — can be considered by students with a strong biology background and AP credit in BIOC 201 and/or EBIO 202. A conversation with the instructor prior to enrolling is strongly advised for these challenging courses.

### **INTERMEDIATE LEVEL LABORATORIES:**

**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 EEB 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 website to confirm availability of courses: https://courses.rice.edu/courses/!SWKSCAT.cat



### BIOSCIENCES AT RICE

### **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 (BCB) 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 (EEB) 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 (BIOL) BA degree incorporates elements of the Ecology and Evolutionary Biology (EEB) and the Biochemistry & Cell Biology (BCB) 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 (ENVS) 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 (NEUR) BA** degree program provides exposure to the breadth of disciplines and diverse methodologies used to investigate the brain and its relationship to the mind. The primary aim of the neuroscience degree program is to provide an understanding of how the cognition and behavior of organisms are encoded in neural processes. 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 Texas Medical Center.

The Minors in Biochemistry & Cell Biology, Ecology & Evolutionary Biology, Environmental Studies (ENST), 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\*

Category	BA BCB	BS BCB	BA BIOL	BA EEB	BS EEB	BCB-Minor	EEB-Minor
Math/Stat	MATH 101/102 or listed substitutions (see lists next page) MATH 211	MATH 101/102 or listed substitutions (see lists next page) MATH 211	MATH 101/102 EBIO 338 or MATH 211 or STAT 305	MATH 101/102 or listed substitutions EBIO 338 or STAT (≥ 3 credits)	MATH 101/102 or listed substitutions EBIO 338 or STAT (≥ 3 credits)	MATH 101/102 or listed substitutions	
Physics	PHYS 125/126 or listed substitutions	PHYS 125/126 or listed substitutions	PHYS 125/126 or listed substitutions	PHYS 125 or listed substitutions	PHYS 125 or listed substitutions	PHYS 125/126 or listed substitutions	
Intro Chem	CHEM 121/123 CHEM 122/124 or listed substitutions	CHEM 121/123 CHEM 122/124 or listed substitutions	CHEM 121/123 CHEM 122/124 or listed substitutions	CHEM 121/123 or listed substitutions	CHEM 121/123  or listed substitutions	CHEM 121/123 CHEM 122/124 or listed substitutions	
Orgo Chem	CHEM 211/213 CHEM 212/214, 215 or listed substitutions	CHEM 211/213 CHEM 212/214, 215 or listed substitutions	CHEM 211/213 CHEM 212/214, 215 or listed substitutions			CHEM 211/213 CHEM 212/214, 215 or listed substitutions	
Intro Bio	BIOC 201	BIOC 201	BIOC 201 EBIO 202	BIOC 201 EBIO 202	BIOC 201 EBIO 202	BIOC 201	BIOC 201 EBIO 202
Labs	BIOC 112 or NSCI 120 (recommended, not req) BIOC 211	BIOC 112 or NSCI 120 (recommended, not req) BIOC 211	BIOC 112 or NSCI 120 (recommended, not req) BIOC 211 EBIO 213	BIOC 112 or NSCI 120 (recommended, not req) BIOC 211 EBIO 213	BIOC 112 or NSCI 120 (recommended, not req) BIOC 211 EBIO 213	BIOC 112 or NSCI 120 (recommended, not req) BIOC 211	EBIO 213
Adv Labs	BIOC 311 2 BIOC labs ≥ 300 level	BIOC 311 2 BIOC labs ≥ 300 level	3 EBIO/BIOC 300/400 Labs	1 EBIO 300 lab 1 BIOC/EBIO 300/400 Lab	1 EBIO 300 lab 1 BIOC/EBIO 300/400 lab EBIO 306 (≥ 2 credit hrs)		
Upper Level Lecture Courses in Major Area (≥3 credit hours)	BIOC 301 BIOC 341 2 of these 3: BIOC 302 BIOC 344 BIOC 352	BIOC 301 BIOC 302 BIOC 341 BIOC 344 BIOC 352	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	EBIO 325 EBIO 334 2 EBIO 300/400 level 1 BIOC 300/400 level	EBIO 325 EBIO 334 2 EBIO 300/400 level 1 BIOC 300/400 level	BIOC 301 BIOC 341 1 BIOC ≥ 300 level	4 EBIO 300/400 level courses from EBIO 321, 323, 325, 326, 328, 329, 331, 333, 334, 336, 340, 365, 366, 372, 391, or 433
Broadening Upper Level Lecture Courses	2 NSCI/ENGI ≥ 300 (≥ 3 credit hours)	2 NSCI/ENGI ≥ 300 (≥ 3 credit hours)		1 NSCI/ENGI >300 (≥ 3 credit hours)	1 NSCI/ENGI ≥300 (≥ 3 credit hours)		
Senior Capstone	1 BIOC 400 level (≥ 3 credit hours)	2 BIOC 400 level (≥ 3 credit hours)		EBIO 412	EBIO 412 EBIO 403/404		

\*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).

#### BCB Majors (BA or BS) and BCB 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 111/113 and CHEM 112/114 may be substituted for CHEM 121/123 and CHEM 122/124; 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/ENGI 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.

#### EEB 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 111/113 or 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 EEB majors (BA and BS) must take at least two advanced labs (300/400-level). EEB 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 EEB 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 111/113 and CHEM 112/114 may be substituted for CHEM 121/123 and CHEM 122/124; 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 ENVIROMENTAL STUDIES MINOR\*

Category	B. A. in Environmental Science	B.S. in Environmental Science	Environmental Studies Minor
General Prerequisites	BIOC 201, EBIO 202 CHEM 121/122/123/124 or substitution MATH 101/102 or substitution STAT 280 or STAT 305	BIOC 201, EBIO 202 CHEM 121/122/123/124 or substitution MATH 101/102 or substitution PHYS 101/103 or PHYS 111 (with lab) or PHYS 125 (with lab) PHYS 102/104 or PHYS 112 (with lab) or PHYS 126 (with lab) STAT 280 or STAT 305	Required course: ENST 100
Core Required Courses	ENST 100/ARCH 105, ESCI 115, ESCI 107 (or 109 or 201), EBIO 213, EBIO 325	ENST 100/ARCH 105, ESCI 115, ESCI 107 (or 109 or 201), EBIO 213, EBIO 325	Introductory courses (one): EBIO 124, ESCI 101, ESCI 107, ESCI 109, ESCI 201
Field Experience	2-3 credit hours of field experience: see GA for list of approved courses	2-3 credit hours of field experience: see GA for list of approved courses	
Major Concentration in Ecology & Evolutionary Biology	Two courses from: EBIO 270, EBIO/ENST 323, EBIO 372  One course from: EBIO 270, EBIO 321, EBIO/ENST 323, EBIO 326, EBIO/BIOC 331, EBIO/BIOC 334, EBIO 336, EBIO 338, EBIO 365, EBIO 366, EBIO 372, ESCI/EBIO/ENST 340	Two courses from: EBIO 270, EBIO/ENST 323, EBIO 372  One course from: EBIO 270, EBIO 321, EBIO/ENST 323, EBIO 326, EBIO/BIOC 331, EBIO/BIOC 334, EBIO 336, EBIO 338, EBIO 365, EBIO 366, EBIO 372, ESCI/EBIO/ENST 340	
Advanced Electives	One course from each of the following categories:  Social Sciences: See GA for list of approved courses  Humanities/Architecture: See GA for list of approved courses  Natural Sciences/Engineering: See GA for list of approved courses	One course from each of the following categories:  Social Sciences: See GA for list of approved courses  Humanities/Architecture: See GA for list of approved courses  Natural Sciences/Engineering: See GA for list of approved courses	Two courses from each of the following categories:  ARCH, HUMA, SOCI: See GA for list of approved courses  Natural Sciences/Engineering: See GA for list of approved courses
Capstone Requirement/Adv Field or Research Courses	EBIO 495 Independent Research encouraged	EBIO 495  One course from the following: ESCI 390, ESCI 391, EBIO 403 or 404, ESCI 481	

<sup>\*</sup>This document was created to simplify, but not supersede, information found in the GA (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 NEUROSCIENCE B.A. AND MINOR\***

Category	Neuroscience Major	Neuroscience Minor Natural Sciences & Engineering Track	Neuroscience Minor Humanities and Social Science Track
Foundation Requirements**	BIOC 201 Introductory Biology CAAM 210 Introduction to Engineering Computation CHEM 121/123 General Chem I/Laboratory I CHEM 122/124 General Chem II/Laboratory II MATH 101 Single Variable Calculus I or MATH 105 MATH 102 Single Variable Calculus II or MATH 106 PHYS 125 General Physics (with Lab) PHYS 126 General Physics (with Lab) PSYC 203 Introduction to Cognitive Psychology  SELECT 1 from the following: STAT 305 Introduction to Statistics for Biosciences STAT 310 Probability & Statistics STAT 312 Probability & Statistics for Engineers	NEUR 380/PSYC 380/BIOC 380 Fundamental Neuroscience Systems  NEUR 385/BIOC 385 Fundamentals of Cellular and Molecular Neuroscience	NEUR 380/PSYC 380/BIOC 380 Fundamental Neuroscience Systems  NEUR 362/PSYC 362 Cognitive Neuroscience: Exploring the Living Brain
Core Requirements	NEUR 362/PSYC 362 Cognitive Neuroscience NEUR 380/BIOC 380/PSYC 380 Fundamental Neuroscience Systems NEUR 383/BIOE 380/ELEC 380 Introduction to Neuroengineering NEUR 385/BIOC 385 Fundamentals of Cellular and Molecular Neuroscience	Select three courses from the following list: BIOC 415, BIOE/ELEC 381, BIOE/ELEC/NEUR 481, BIOE 492, COMP 440, EBIO 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	Select three courses from the following list: LING/ANTH 411, NEUR 301, NEUR 302, NEUR 364, PHIL 103, PHIL 303, PHIL 312, PHIL 358, PHIL 359, PSYC 375, PSYC 432
Project-Based Laboratory Courses	BIOC 112 or NSCI 120 (recommended, not req.) BIOC 212 Intermediate Exptl Cell/Mol Neuroscience (required)  Select two courses from the following: BIOC 415 Experimental Physiology BIOC 417 Experimental Cell & Molecular Neuroscience NEUR 310 Independent Research for Neuroscience NEUR 364 Cognitive Neuroscience Lab		
Electives	Select four courses from the following list: BIOC 129 (3 semesters), BIOC 442, BIOC 449, BIOE 492, COMP/ELEC 440, EBIO 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 354, PSYC 375, PSYC 432	Select one course from the following list: LING/ANTH 411, NEUR 301, NEUR 302, NEUR 364, PHIL 103, PHIL 303, PHIL 312, PHIL 358, PHIL 359, PSYC 375, PSYC 432	Select one course from the following list: BIOC 415, BIOE/ELEC 381, BIOE/ELEC/NEUR 481, BIOE 492, COMP 440, EBIO 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

<sup>\*</sup>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 and have the time to commit to it. Freshmen seminars (BIOC 118 and EBIO 119) 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 118: Freshman Seminar in Local Biology Research (BCB) EBIO 119: Freshman Seminar in Local Biology Research (EEB)

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 119 meets in the 1st half of each semester and BIOC 118 meets in the 2nd half of each semester.

### 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, NSCI 120, BIOC 211, or BIOC 212 (with permission). Please read the Independent Research website for complete information and requirements:

http://biosugresearch.rice.edu/

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 <u>at least</u> 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 15 hours per week). 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/undergraduate-studies

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

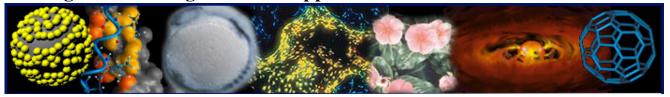
This course for research in EEB is open only to undergraduate majors during their senior year and requires permission of the research supervisor and chair. Applications are due in April of the previous academic year. Registration for EBIO 403/404 implies a commitment to participate in research for at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

https://biosciences.rice.edu/undergraduate-studies

### **BioSciences Opportunities Canvas List**

The **BioSciences Opportunities Canvas** site offers research, internship, and career information and opportunities related to the biological sciences. It also serves as the portal for advising information for BioSciences majors. To join the site and mailing list go to catalog.rice.edu and then search for "BioSciences Opportunities." Click on the site and click "enroll" (use your standard Rice netID and password, if prompted).

### **Finding and Securing Research Opportunities**



### **Contacts for undergraduate research information:**

### Biochemistry & Cell Biology and Biological Sciences

Dr. Dereth Phillips: BIOC 310 and BIOC 299. Office: 03 Herman Brown Hall. Email: derethp@rice.edu

### **Ecology & Evolutionary Biology and Biological Sciences**

Dr. Scott Solomon: EBIO 306. Office: 07 Herman Brown Hall. Email: scott.solomon@rice.edu

### Neuroscience

Dr. Jon Flynn: NEUR 310. Office: 04 Herman 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" Canvas site to receive information about research opportunities at Rice and elsewhere. When you have found a lab of interest, scan through recent research articles from that lab and contact the professor to express your interest. [visit this website for more information: <a href="http://biosugresearch.rice.edu/">http://biosugresearch.rice.edu/</a>]. 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 appropriate to your research topic.

### 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

NEUR 310/401/402—Neuroscience Program

BIOE 400/401—Bioengineering

CHEM 391/491/492/493—Chemistry

CHBE 499—Chemical & Biomolecular Engineering

ESCI 481—Earth Science

KINE/HEAL 495/496—Kinesiology

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

### If your internship does not qualify for above courses, you may inquire about:

**BIOC 299** – Experiential Education in BioSciences

UNIV 295 – Careers Through Internship (CCD)

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 BCB or EEB 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 beyond 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 BCB or EEB 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 118 and EBIO 119 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 BCB, BIOL, EEB, 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 BCB 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/ENGI electives and provides a strong foundation for other 300-level 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 BCB 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 each hour of 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 EEB 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 BCB minor since I'll need to fulfill most of the requirements anyway? Premedical students are not required to complete the BCB 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 EEB, Biological Sciences, and BCB 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 BCB and EEB majors. All Biological Sciences majors can seek advice from any of our departmental advisors.

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. BCB 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 BCB or EEB (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/



### **Rice International Genetically Engineered Machine**



Who are we? We are a competitive undergraduate team, with graduate students and a couple of professors as advisors, who participate in the International Genetically Engineered Machine (iGEM) Jamboree.

What is synthetic biology? Take the cliché "a cell is like a factory," and imagine that DNA has the instructions and blueprints. Synthetic biologists put together "genetic circuits" of DNA to introduce to a cell (most often non-toxic strains of *E. coli*) so it can perform new functions!



Who should join? We seek undergraduate students interested in scientific research at the interface of biology and engineering. We are looking for students from BIOS, BIOE, CHBE, and students of other disciplines in Natural Sciences, Engineering, and beyond! The competition includes public outreach (POLI or SOCI related); a poster, PowerPoint, and Wiki for presentation (graphic designer); and biological models in MATLAB are always a bonus (CAAM)! And if you are business-savvy (ECON), there is fund-raising and marketing.

Keep in mind: The competition cycle begins in late spring and ends with the annual Giant Jamboree in the fall – therefore, students interested in doing wet-lab work with us at Rice will need to make arrangements to spend the summer in Houston.

### **Contact Info:**

Undergraduate Team Leader: Alicia Selvera (as140@rice.edu) Faculty Adviser: Dr. Beth Beason-Abmayr (bbeason@rice.edu)

Follow us on Instagram at RiceuniversityiGEM

Check us out at 2019.igem.org/Team:Rice

**Rice Catalyst**, Rice's premier Undergraduate Science Research Journal, showcases student perspectives on popular science topics and scientific research. For the past twelve years, we have been committed to fostering interdisciplinary interest in scientific writing and dialogue at Rice and beyond. We are extremely passionate about making science accessible and engaging, and we do this through a variety of written, auditory, and visual media including blog posts, podcasts, and an annual magazine publication. Outreach is very important to us: We have partnered with two high schools in the greater



Houston community to provide science mentorship and research guidance, where Catalyst undergraduates interact with students and help them through the process of scientific inquiry and communication. New students are encouraged to stop by the Rice Catalyst Activities Fair booth to join the club listserv and ask questions about the club.

All members, both new and returning, are required to attend

the general retreat held in late August/early September to become more acquainted with the club logistics and other members.

For more information please visit the Catalyst website: <a href="http://catalyst.blogs.rice.edu/">http://catalyst.blogs.rice.edu/</a>
To contact student representatives please email: <a href="mailto:ricecatalyst@gmail.com">ricecatalyst@gmail.com</a>



### What is the Rice University Biosciences Society (RUBS)?

We are a group of students passionate about anything related to the life sciences (including but not limited to: biochemistry, bioengineering, ecology, earth science, biophysics, chemistry, neuroscience, synthetic biology, medicine, *etc.*). Our goal is to bring together curious scientists at any stage of their journey, from Rice undergraduates to faculty members as well as researchers from the Texas Medical Center, to engage in discussions around a shared interest in the biological sciences that will broaden our perspectives and further the knowledge of our community.

### **Our Events and Opportunities**

- Lunch talks Informal networking sessions with professors, PIs, postdocs, graduate students, etc.
- Attending seminars / talks as a group
- Research advising

Join the listserv by stopping by our booth at the club fair or by sending your name and email address to ik52@rice.edu!

Facebook page: Rice University Biosciences Society

Student contacts: Jinyoung Kim (jk52@rice.edu), Cailey Renken (car5@rice.edu)



Rice Oceans Club is an organization dedicated to spreading awareness and appreciation for our shared marine environments through outreach and educational events on-campus and in the greater Houston community. We have partnered with the Houston Museum of Natural Science, Houston Zoo, and

NOAA Flower Garden Banks National Marine Sanctuary for educational volunteering opportunities. Additionally, we host fun oncampus events for students, including our pool party, pub trivia night, and movie screenings,

and we regularly collaborate with other Rice environmental organizations on campaigns such as the Green Dorm Initiative and the Pledge Against Plastic.



Like us on Facebook: <a href="https://www.facebook.com/RiceOceansClub/">https://www.facebook.com/RiceOceansClub/</a>

Follow us on Instagram: @RiceOceansClub

Join the listserv by emailing your name and email address to: riceoceansclub@mailman.rice.edu

**Rice Environmental Society (RES)** is an umbrella organization for environmental and sustainability-related groups on campus. RES allocates funds to different sustainability campaigns across campus and organizes a conference to bring environmental research presentations and companies to the Rice community.

**Some other clubs within the RES umbrella:** Rice Urbanists, Texans for Climate Change Action, Rice Wildlife Conservation Corps, Rice Environmental Club, and Real Food Revolution.

For more information: https://sustainability.rice.edu/res or contact Kathy Yu (ky17@rice.edu).