Undergraduate Research in BioSciences

Undergraduate research is an important component of the BioSciences programs, and, while not required for the major, undergraduate research can enhance the undergraduate experience and provide opportunities for career development. Research experience is becoming a critical prerequisite for admission to professional schools and is particularly important for those applying for biological graduate programs or 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. The following courses offer opportunities to experience and participate in active research programs at Rice and, for some, in the 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 Freshmen 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 published research article 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 (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 310: Independent Research in Biochemistry & Cell Biology

This course is 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, provide weekly reports, and a research paper (Fall) or poster (Spring), and receive course credit for their effort. Those intending to participate in BIOC 310 undergraduate research should take the BIOC 112 or NSCI 120 or BIOC 211 (with permission). Please read the BIOC 310 manual for complete course information and requirements. (http://www.bioc.rice.edu/bioc310/).

If intending to pursue research off-campus, please submit an application to the BIOC 310 instructor (http://www.bioc.rice.edu/bioc310/) at least 2 weeks before the start of the semester for permission to enroll. The BIOC 310 off-campus regulations may be obtained from the BIOC 310 website. Students working off campus may not take BIOC 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 hr/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 at: 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 Site

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/mail list is a great way to hear about biological and biomedical research opportunities on/off the Rice campus. To join, log on to your OwlSpace account 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

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.
Am I ready for research?
Being prepared for a research experience is less about having the appropriate course prerequisites or experience and more about your awareness of what a research experience entails. Professors search for students at a variety of experience levels. Some professors are looking only for juniors and seniors with upper-level coursework under their belts, whereas others seek freshmen or sophomores with an interest in a multi-year research experiences. Regardless of previous experience or coursework, common indicators of undergraduate research success are diligence, curiosity, responsibility, and interpersonal communication skills. As research at any level requires dedication, you will want to make sure that you have time and space in your schedule (physical and mental) to take on a research project. Do you have time in your schedule for 9+ hours of research per week? Do you have large open blocks of time (3+ hours) to set up and run your experiments? During semesters in which you will be participating in research, we usually recommend that your total credit load, including 3 credits of research, not exceed 15 or 16 hours total.

Decide what you want out of your research experience.
Are you just looking for a job for extra money or do you want research experience? Would you prefer to perform mostly laboratory maintenance or do you want to be performing research as part of an ongoing project in the lab? Do you want to work for pay (including work study) or course credit? In some labs, paid positions will be lab maintenance and actual research will only be available for students working for credit during the academic year. However, many labs offer some paid positions over the summer.

Where do I start?
Join the BioSciences Opportunities site on Owl-Space for research postings and updates. Look at the various research summaries of the faculty on the web (see “Surfing” below). Look for a lab that is interesting to you. Talk to juniors and seniors about their lab experiences. Which labs do they recommend? Discuss your research interests and goals with advisors in the BioSciences Department and ask which research group might be a good match (http://biosciences.rice.edu/Content.aspx?id=2147483822). If you are serious about joining a particular research group, visit the lab, ask to meet the undergrads already working there, and inquire as to the best method of approaching that particular professor.

Surfing for scientists.
If you are having trouble finding a research group that fits your interests, try surfing the web using terms such as: “[topic/model organism/disease] research Houston”. Hopefully your search will return a number of local scientists who are performing research in your area of interest or with your model organism of choice. Read the research summaries of these scientists to learn more about the field. You do not have to limit your search to Rice University, many Texas Medical Center labs and community environmental research organizations are also open to taking on Rice interns.

How do I contact a PI (Principal Investigator, head of a lab)?
Do your homework. Most positions are not advertised, but are filled from among the students who contact the PI. Read about the PI’s work and, if possible, talk with people working in the lab to get a feel for the personality and expectations of the PI. Write a personal email to the PI. Do not send a mass email to multiple faculty members or your email will be considered spam and ignored!! Your introductory email conveys an important first impression and can influence how easy it will be for you to find a lab home. All PIs of research labs will have either a PhD or an MD degree and should be addressed as “Dr.” or “Prof.” and not “Ms., Mrs., or Mr.” In your email, tell the PI who you are (name, year at Rice), why you are looking for a position in a research lab, and why you are interested in his or her lab in particular. Include mention of any relevant course work or prior research experience, even if it was in high school. You also may want to include whether you are looking for a short (1 semester) or longer experience, whether you prefer to work for credit or for money (if you have a preference), and how many hours per week you would like to devote to lab work. Your
application will be looked on with greater favor if it appears that your motivation is scientific interest rather than a
desire to pad a medical school application. If you are considering graduate school after Rice, include this interest in
the letter.

**How many labs should I contact?**
Getting into a lab is partly timing and luck, so do not be discouraged if your first efforts are not successful. You
will probably need to contact a few labs over the course of your search before you find a position. If you know
someone in a lab where you want to work, ask that person to put in a good word for you. If you are not successful
after several attempts, you may wish to ask for feedback on your contact letter from the undergraduate research
coordinators.

**What is expected of me in a lab?**
Your research advisor will expect you to keep regular hours, especially at the beginning. In many labs, you will not
be working directly with the PI, but with a graduate student or postdoctoral fellow who has volunteered to train
you. This person probably is not doing this extra work out of pure altruism, but rather hopes that your addition to
the team will further his or her research agenda. This person has a full-time job even without mentoring you, so be
respectful of his or her time.

It is very difficult to train a student if s/he does not work the same hours as his/her advisor. You will be expected to
work closely with your advisor until you are sufficiently well trained to complete procedures on your own, which
might take weeks or months. Even after those first few weeks, it is advisable to maximize your overlap with your
advisor.

You are expected to ask questions any time you are confused. Your co-workers prefer that you ask them for help
rather than having you risk breaking equipment or wasting time and resources. You are part of a team and should be
very conscientious of the effect that your actions have on others in the lab. Be neat and clean up after yourself,
particularly when using common areas or equipment. Return materials to their proper locations after use. Do not
use your co-worker’s materials unless you have been invited to do so. Complete your lab jobs in a timely fashion.
Let your co-workers know if you will not be able to make it to lab or if you will be late so that any ongoing
experiments can be monitored in your absence. Clearly communicate (both verbally and by email) the days that you
will be gone due to vacations or finals. It is a good practice to post above your bench a paper calendar that lists your
anticipated in-lab times, when you are in classes, and your contact information.

Pay attention and pace yourself. Mistakes are a fact of life, but repeated avoidable mistakes indicate a pattern of
carelessness. Remember that research is a marathon not a sprint. Take the time to perform each experiment as
carefully as you can and take assiduous notes so that problems can be documented and corrected.

You will be judged not only on your performance while you are in the lab, but also on the gracefulness of your exit.
First, let everyone you are working with in the lab know that you will be leaving the lab and when. Prior to leaving
the lab, make sure that you document everything that you have done and leave precise instructions as to where to
find your stocks and other materials. It is crucial that those who will follow you in your research project are able to
pick up where you left off. It is also more than a nice gesture to keep in touch with the PI of the lab. Even if you left
what you believe were explicit notes, your lab mates may still have occasional questions about stocks, protocols,
etc. that you made or used.

**What should I expect throughout my research experience?**
You should expect that your questions about protocols, equipment, and the research subject will be welcomed and
that you will gain valuable experience in the process. You should expect that hard work, regular hours, enthusiasm,
and attention to detail will be rewarded with positive feedback and perhaps a positive letter of recommendation by
your research advisor.

**Establish and guard your good reputation within the community**
You are part of a small close-knit community. Remember that Rice faculty and staff share information about
student behavior good and bad, and that communication crosses departmental boundaries and employee rank. An
administrator in one school at Rice may play tennis with the dean of another school. It is always in your best
interest to treat all Rice employees and students with kindness and respect and to establish a pattern of responsible
behavior throughout campus.
Ecology & Evolutionary Biology Undergraduate Research

EEB program faculty and links to their research web pages
https://biosciences.rice.edu/EEB_faculty.aspx

Houston Zoo and Rice University Consortium in Conservation Biology
This consortium allows students majoring in Ecology & Evolutionary Biology or related fields to further their education by conducting supervised research projects at the Houston Zoo or zoo affiliates (e.g., Steven F. Austin State Park).

Under the Consortium students may conduct research projects at the Houston Zoo or Houston Zoo affiliates to satisfy requirements of EBIO 306. Project concepts for student research will be developed through student meetings with Amy Dunham (Rice University) and Stan Mays (Houston Zoo), as well as interested Rice faculty and Houston Zoo staff. Students will arrange their research project with Rice faculty who will serve as official mentors for course credit. Project proposals will be reviewed and approved in advance by the Houston Zoo's Conservation Committee and the Houston Zoo Institutional Investigative Studies Committee as well as by the Rice Institutional Animal Use and Care Committee (IACUC). For more information see: http://zoo.rice.edu/research.html

Ecological Society of America—job, internship, and grant listings
https://listserv.umd.edu/archives/ecolog-l.html

Evolution Directory—news and lists
http://life.mcmaster.ca/evoldir.html

List of Research Opportunities in Ecology, Animal & Plant Biology, and Marine Science
https://people.rit.edu/~gtfsbi/Symp/ecology.htm

Opportunities for Pre-Veterinary Students
https://people.rit.edu/~gtfsbi/Symp/vetag.htm
How did you find your off-campus research setting?

BIOC 310 and EBIO 306 students respond

*The following are the key ways students found a research position based on a survey in Sp 16. Sample responses are provided with identifying information removed and some parts edited.*

**Using the Web to Identify Labs of Interest (~44% of responses)**

Looked up [relevant] research labs at BCM [and] emailed [the professor].

I looked through a directory of researchers at UTHSC last summer and found [this professor’s] lab. I contacted [the professor] directly via email and began meeting to discuss the work and a potential position as an undergraduate researcher.

I knew I was interested in labs looking at [a particular disease] and looked up labs in Houston that did this type of research

**Biosciences Opportunities (~28% of responses)**

Example: “The opportunity was sent out through Biosciences Opportunity list-serve and I applied and interviewed.”

**Participation in Summer Programs (15% of responses)**

Through previous participation in a TMC summer program

I found my lab through [the director of this summer program]. Additionally, I toured the lab when I took BIOC 115 [in my freshman year]. I secured my research opportunity after submitting my CV, a cover letter, and interviewing with [the director] and multiple PIs.

**Direct/Indirect Contacts (13% of responses)**

My [family member] worked with [this professor] when doing research as a Rice student, and put me in contact. I emailed [the professor], and who agreed to let me try volunteering/observing in the lab. I have been learning and working there since spring 2015.
Surfing for research labs: some tips and Google strings

At Rice
Google: biosciences rice
  click: directory to see full faculty list w/o descriptions
  click: each faculty member to read their bio, or select the BCB, EEB, or SSPB graduate program and program faculty tab at left to see faculty affiliated with each of these grad school programs
  click: individual faculty names to see more research details
  read: faculty bios and pull a few recent research articles
Google: other departments of interest + “rice university” to get to other departmental sites and click “faculty”

At UT Health (McGovern Medical School, School of Dentistry, MD Anderson Cancer Center)
Google: GSBS UTHealth
  pull down: Programs (top bar) and select Ph.D. Programs of Study
  click: the program at the left that interests you
  click: faculty or people
  click: individual faculty names to see more research details
  read: faculty bios and pull a few recent research articles

At Baylor college of medicine
Google: GSBS BCM
  click: programs (black bar at top) and scroll down to see names of graduate programs
  click: name of graduate program of interest
  click: faculty (black bar at top) or embedded in program description text
  click: individual faculty names to see more research details
  read: faculty bios and pull a few recent research articles

Be warned that these surfing instructions change regularly as departments change their site navigation. Hang loose and just keep surfing until you find the faculty pages! In general, searching any topic + research + “Houston” will get you to researchers in that field based in Houston. If you are searching at an institution in another city, try going to that institution’s graduate program website and starting your search there. Going to any graduate program or department page and clicking “people” or “faculty” will get you to faculty listings.

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