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# NATURAL SCIENCES

New Student Advising  
Fall 2019

# NATURAL SCIENCES

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## New Student Advising Fall 2019

Welcome to the Rice University Class of 2023!

This booklet is designed to give you an overview of the departments and undergraduate degree programs available in the Wiess School of Natural Sciences. We've included some general advice and reference information, descriptions of each of our departments and programs, and degree summaries and sample degree plans for each science degree.

This booklet is intended as a supplement to, not a replacement for, other department advising materials. While we have double- and triple-checked all of the information in this booklet for accuracy, it is always possible that an error may still be included.

**The information in the *General Announcements* is the final authority on degree requirements and academic regulations at Rice.**



RICE UNIVERSITY  
Natural Sciences

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# ADVISORS

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As an incoming freshman at Rice, you have many advisors available to you. Your College Magister has chosen four Divisional Advisors who are associated with your residential college, one from each of the four major undergraduate divisions: engineering, humanities, natural sciences, and social sciences. Each residential college also has a group of Peer Academic Advisors available to assist the Divisional Advisors. These advisors can help you explore the majors in each of the four divisions based on your personal interests and short- and long-term plans.

When you declare your major, your department will assign you to a Major Advisor. These faculty members represent a specific department or discipline and know all of the requirements for the major or minor. They can provide you with detailed information related to their discipline, including research opportunities, career paths, professional organizations, and graduate school. You do not need to wait until you declare a major to consult with a Major Advisor. If you are interested in pursuing a major and need specific guidance or advice, contact a Major Advisor. You can find the names and contact information for the Major Advisors in the School of Natural Sciences at the back of this booklet.

Start talking to your advisors as early as possible. There are many paths to each degree and the best courses for you may depend on your preparation and career aspirations. Your advisors can provide you with input on taking classes in a sensible order and also on how to pursue research opportunities.

## DIVISIONAL ADVISORS

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<b>Baker</b>	Dave Caprette	caprette@rice.edu
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## AP CREDIT

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Many Rice freshmen have substantial AP credit, particularly in math, physics, and chemistry. Think carefully about your course plan — just because you have advanced placement does not mean that you have the background needed for the next courses. You do not want to get underwater during your first year. Many students with AP credit for introductory courses still choose to take the introductory sequence at Rice to provide a solid foundation for more advanced coursework. Consult with your advisors to determine the appropriate placement for you.

# DEGREE PLANNING

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Get your prerequisites in early. Identify all prerequisites for future courses so that you are positioned to take the required courses at the right stage in your time at Rice.

Some courses may only be offered once per year or once every other year. Take this into account when planning your schedule.

Remember to look at the courses taught in other departments that overlap with your interests. For example, there are mathematics courses taught in CAAM and STAT that are not offered in MATH.

# CHOOSING A BA OR BS DEGREE

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Most of our departments offer both a Bachelor of Arts degree (BA) and a Bachelor of Science degree (BS). If you have the choice between a BS or a BA, consider the requirements of each degree, your planned major(s) and/or minor(s), and your graduate school or career plans.

In general, a BA program contains more free elective hours than its BS counterpart. This flexibility makes it easier for you to pursue your other interests, a double major, or a minor. The major requirements and a sample degree plan for both the BA and BS are included in this booklet. Look through these to understand the different requirements and how they work with your planned course schedule.

If you are planning to go to graduate school or pursue a career in a scientific discipline, you should consider the BS degree. If you are preparing for a career that is not primarily in that scientific discipline and want to pursue other areas of interest, the BA degree might be right for you.

And, as always, you can talk with your peer and faculty advisors to help you decide which is the right path for you.

# RESEARCH

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Participation in science research is encouraged for all students and is required for several of the BS degrees. Mentored research opportunities complement classroom learning and help you build the skills and confidence you need to compete for top job prospects and spots in graduate and medical schools.

There are many opportunities to conduct research with Rice faculty and with our partners at the Texas Medical Center. You are encouraged to begin research as early as possible and you can participate for multiple semesters or summers. See the Frank Advice section in each department listing for additional program-specific advice.

## **Getting Started**

- Talk to your advisors and to your professors. Did you cover something really interesting in class today? Stay after class for a few minutes or head to office hours to talk to your professor. They can point you towards faculty members who are doing research in that area or working on similar problems.
- Check departmental websites and faculty research pages for descriptions of their research as well as links to their publications.
- Go to departmental seminars and events. Talk to people while you are there; don't just sit in the back. Attend the Rice Undergraduate Research Symposium (held each spring) to see student research poster presentations. Also, look at the posters in the hallways on your way to or from class or lab.



# RESEARCH

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## **Contacting a Potential Advisor**

- Once you've found a group that you might like to join, it's time to contact your potential advisor. The easiest way to do this is to email the faculty member to set up a meeting. Use an informative subject line to make your purpose clear, and open and close your email formally. Provide some of your background information, including what year you are and what your major is. Briefly describe how you found out about their research and express your interest in a specific paper or research topic. Ask them to set up a meeting and provide your availability.
- Show up to your meeting on time and be prepared. Review a few papers and brush up on any appropriate classroom content. Be ready to tell the professor why you are interested in their work and how it fits with your background and your future goals. Also, know your schedule and what time you have available to work in their lab.
- Don't take a negative response personally. There are many reasons a faculty member might not be able to take you on right now. Keep looking; there is a research experience out there that is perfect for you.

# PRE-HEALTH PROFESSIONS

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Majoring in a scientific discipline does not increase your chance of acceptance to medical school. However, strong preparation in the sciences and mathematics is required for medical school study. If you are considering a career in a health-related occupation, consult with your advising team to ensure that your degree plan includes all of the necessary courses.

The Office of Academic Advising (OAA) offers specialized advising services for pre-med and other pre-health professions students. Each fall, they present an introduction to the health professions designed to help new, first-year students. This year, **Freshman Health Professions Advising Orientation** will be offered on **Wednesday, August 28** at 6:30 p.m. in the Grand Hall of the Rice Memorial Center.

# STUDY ABROAD

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International experiences are encouraged for all interested students. If you are considering studying abroad, early planning and consultation is highly recommended. Contact a department Major Advisor as early as possible to discuss all of your available options. Departmental Transfer Credit Advisors will also serve as a valuable resource for information about receiving academic credit for courses completed abroad.

Think about your goals. Do you want to study abroad for a semester or a summer? Do you want to fulfill major, minor or distribution requirements or study something entirely new?

Consider your individual four-year program and evaluate what period for study abroad is most compatible with your overall degree plan and post-graduate plans.

Visit the Rice University Study Abroad website ([abroad.rice.edu](http://abroad.rice.edu)) for all of the information you need to start planning your study abroad experience.

# DEPARTMENTS AND PROGRAMS

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In this section, you will find information about each of our departments and programs, including advice and tips to help you choose your major and design your degree plan. The School of Natural Sciences offers 20 majors and seven minors within our departments and interdisciplinary programs. Here, we list the degree requirements for each major and minor.

The provided degree summaries for each of the degrees offered in the School of Natural Sciences are intended to help you compare majors and provide a starting point for designing your own course schedule.

There are many paths you can choose to complete each degree. Consult with your advising team to develop a personalized degree plan that takes into account your background and interests.

## **Sample Degree Plans**

*The sample degree plan is only one of many possible schedules.*

- The sample degree plans in this booklet assume that you have no AP or transfer credit unless otherwise noted.
- You are assigned a semester in which to take a Freshman Writing Intensive Seminar (FWIS). In all degree plans, the FWIS is shown in the fall semester. If you are assigned to take a FWIS in the spring, swap the Distribution course listed for the spring semester with the FWIS listed for the fall semester.

# BIOSCIENCES

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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, Biological Sciences, and Ecology & Evolutionary Biology, along with Neuroscience and Environmental Science 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.

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.

# BIOSCIENCES

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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 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.

## Degrees Offered

Biochemistry and Cell Biology (BIOC)	BS, BA, Minor
Ecology and Evolutionary Biology (EBIO)	BS, BA, Minor
Biological Sciences	BA

## Frank Advice

- Those without biology AP credit should enroll in BIOC 201, which is a prerequisite for virtually all other biological sciences courses. EBIO 202 is a requirement for those majoring in Biological Sciences and EBIO.
- If you have AP credit and feel confident in your biology background, take BIOC 300 in the fall semester. This course is a transition to the upper level BIOC courses and counts toward a 300-level BIOC requirement if taken before any other 300-level BIOC course.

# BIOSCIENCES

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- Freshman students wishing to take a lab course should take BIOC 112 or NSCI 120. These courses are recommended for students with limited lab experience *but are not required*. BIOC 211 is not available to first year students until the spring semester and requires instructor permission.
- Research opportunities for undergraduates are available in most Bioscience labs.
  - BIOC students should visit the BIOC 310 course website ([www.bioc.rice.edu/bioc310/](http://www.bioc.rice.edu/bioc310/)) for more information and listings of opportunities.
  - All BioSciences students are encouraged to get involved in research as early as possible. Start clicking through faculty research bios on the BioSciences website to find research that interests you. See research course listings for application instructions. Applications for senior honors research (required for some BS students) are due at the end of the Spring semester one year prior to your anticipated graduation date.
  - The BioSciences Opportunities Owl-Space site and mailing list is a great way to hear about biological and biomedical research opportunities on and off the Rice campus. To join, log on to OwlSpace using your netID and select *My Workspace > Membership > Joinable Sites* and select BioSciences Opportunities.
- Not required but highly recommended courses:
  - BIOC 118/EBIO 119 – Freshman Seminar in Local Biology Research
  - BIOC 300 – Paradigms in Biochemistry and Cell Biology
  - BIOC 310/EBIO 306 – Independent Research for Undergraduates
  - EBIO 270 – Ecosystem Management
- Highly qualified students may apply to the Biochemistry & Cell Biology BA-MA-PhD program track. If you are interested in this option, you can find more information on the Biosciences website or talk to your advisor.

## Biochemistry and Cell Biology BA - Requirements

MATH 101* or MATH 105	Single Variable Calculus I or AP/OTH credit in Calculus I
MATH 102 or MATH 106	Single Variable Calculus II or AP/OTH credit in Calculus II
MATH 211	Ordinary Differential Equations and Linear Algebra
PHYS 125/126*	General Physics I and II (with lab)
CHEM 121/122/123/124*	General Chemistry I and II and General Chemistry Lab I & II
CHEM 211/212/213/214*	Organic Chemistry I and II and Organic Chemistry Discussion
CHEM 215*	Organic Chemistry Lab
BIOC 201	Introductory Biology
BIOC 301	Biochemistry I
BIOC 341	Cell Biology

*Two courses from:*

BIOC 302	Biochemistry II
BIOC 344	Molecular Biology and Genetics
BIOC 352*	Physical Chemistry for the Biosciences

BIOC 211*	Intermediate Experimental Biosciences
BIOC 311	Advanced Experimental Biosciences

*Two courses from:*

BIOC 313	Experimental Synthetic Biology
BIOC 318	Microbiology Laboratory
BIOC 320/BIOE342	Laboratory in Tissue Culture
BIOC 333	Bioinnovation Studio: From Basic Research and Ideation to Technology Development
BIOC 415	Experimental Physiology
BIOC 530	Lab Module in NMR Spectroscopy and Molecular Modeling
BIOC 535	Practical X-Ray Crystallography

One independent research experience:

BIOC 310 (if at least 3 credits)
HONS 470/471
BIOC 401/402/412

Two NSCI or ENGR 300-level or higher courses

One capstone course from the list in the 2019 General Announcements

\* MATH 111/112 may substitute for MATH 101  
 CHEM 151/152/153/154 may substitute for CHEM 121/122/123/124  
 CHEM 320 and CHEM 365 may substitute for CHEM 212 and CHEM 215, respectively  
 PHYS 101/102/103/104 or PHYS 111/112 may substitute for PHYS 125/126  
 CHEM 301/302 may substitute for BIOC 352  
 BIOC 212 may substitute for BIOC 211



## Biochemistry and Cell Biology BA

**SAMPLE DEGREE PLAN**

*This is only one of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN 15 credits</b>			<b>FRESHMAN 17 credits</b>		
BIOC 201	Intro Biology	3	CHEM 122	General Chemistry II	3
CHEM 121	General Chemistry I	3	CHEM 124	General Chemistry Lab II	1
CHEM 123	General Chemistry Lab I	1	MATH 102	Single Variable Calculus II	3
MATH 101	Single Variable Calculus I	3	LPAP	Lifetime Physical Activity Elective	1
FWIS	First Year Writing-Intensive Seminar	3	DIST	Distribution Course	3
BIOC 112	Intro Biological Research Challenges	1	OPEN	Open Elective (BIOC 300)	3
BIOC 118	Freshman Seminar in Local Biology Research	1	OPEN	Open Elective	3
<b>SOPHOMORE 15 credits</b>			<b>SOPHOMORE 15 credits</b>		
NSCI/ENG	300+ level Elective	3	BIOC 344	Molecular Biology & Genetics	3
PHYS 125	General Physics I	4	PHYS 126	General Physics II	4
CHEM 211	Organic Chemistry I	3	CHEM 212	Organic Chemistry II	3
CHEM 213	Organic Chemistry Discussion I	0	CHEM 214	Organic Chemistry Discussion II	0
MATH 211	Differential Equations	3	CHEM 215	Organic Chemistry Lab	2
BIOC 211	Experimental Biosciences	2	DIST	Distribution Course	3
<b>JUNIOR 15 credits</b>			<b>JUNIOR 17 credits</b>		
BIOC 301	Biochemistry I	3	BIOC 302	Biochemistry II	3
BIOC 310	Independent Research (Advanced Lab)	3	NSCI/ENG	300+ level Elective	3
DIST	Distribution Course	3	BIOC 311	Advanced Experimental Biosciences	2
OPEN	Open Elective	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
			OPEN	Open Elective (BIOC 310)	3
<b>SENIOR 16 credits</b>			<b>SENIOR 15 credits</b>		
BIOC 341	Cell Biology	3	BIOC	Capstone Course (400 level)	3
BIOC Lab 300+	Advanced Lab	1	OPEN	Open Elective (BIOC 310)	3
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective (BIOC 310)	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3			

## Biochemistry and Cell Biology BS - Requirements

MATH 101* or MATH 105	Single Variable Calculus I or AP/OTH credit in Calculus I
MATH 102 or MATH 106	Single Variable Calculus II or AP/OTH credit in Calculus II
MATH 211	Ordinary Differential Equations and Linear Algebra
PHYS 125/126*	General Physics I and II (with lab)
CHEM 121/122/123/124*	General Chemistry I and II and General Chemistry Lab I and II
CHEM 211/212/213/214*	Organic Chemistry I and II and Organic Chemistry Discussion
CHEM 215*	Organic Chemistry Lab

BIOC 201	Introductory Biology
BIOC 301	Biochemistry I
BIOC 302	Biochemistry II
BIOC 341	Cell Biology
BIOC 344	Molecular Biology and Genetics
BIOC 352*	Physical Chemistry for the Biosciences

BIOC 211*	Intermediate Experimental Biosciences
BIOC 311	Advanced Experimental Biosciences

*Two courses from:*

BIOC 313	Experimental Synthetic Biology
BIOC 318	Microbiology Laboratory
BIOC 320/BIOE342	Laboratory in Tissue Culture
BIOC 333	Bioinnovation Studio: From Basic Research and Ideation to Technology Development
BIOC 415	Experimental Physiology
BIOC417	Experimental Cell and Molecular Neuroscience
BIOC 530	Lab Module in NMR Spectroscopy and Molecular Modeling
BIOC 535	Practical X-Ray Crystallography

One independent research experience:

BIOC 310 (if at least 3 credits)
HONS 470/471
BIOC 401/402/412

Two NSCI or ENGR 300-level or higher courses

Two capstone courses from the list in the 2019 General Announcements

\* MATH 111/112 may substitute for MATH 101  
 CHEM 151/152/153/154 may substitute for CHEM 121/122/123/124  
 CHEM 320 may substitute for CHEM 212  
 CHEM 365 may substitute for CHEM 215  
 PHYS 101/102/103/104 or PHYS 111/112 may substitute for PHYS 125/126  
 CHEM 301/302 may substitute for BIOC 352  
 BIOC 212 may substitute for BIOC 211

## Biochemistry and Cell Biology BS

**SAMPLE DEGREE PLAN**

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN 15 credits</b>			<b>FRESHMAN 17 credits</b>		
BIOC 201	Intro Biology	3	CHEM 122	General Chemistry II	3
CHEM 121	General Chemistry I	3	CHEM 124	General Chemistry Lab II	1
CHEM 123	General Chemistry Lab I	1	MATH 102	Single Variable Calculus II	3
MATH 101	Single Variable Calculus I	3	LPAP	Lifetime Physical Activity Elective	1
FWIS	First Year Writing-Intensive Seminar	3	DIST	Distribution Course	3
BIOC 112	Intro Biological Research Challenges	1	OPEN	Open Elective (BIOC 300)	3
BIOC 118	Freshman Seminar in Local Biology Research	1	OPEN	Open Elective	3
<b>SOPHOMORE 15 credits</b>			<b>SOPHOMORE 18 credits</b>		
NSCI/ENG	300+ Elective	3	BIOC 344	Molecular Biology & Genetics	3
PHYS 125	General Physics I	4	PHYS 126	General Physics II	4
CHEM 211	Organic Chemistry I	3	CHEM 212	Organic Chemistry II	3
CHEM 213	Organic Chemistry Discussion I	0	CHEM 214	Organic Chemistry Discussion II	0
MATH 211	Differential Equations	3	CHEM 215	Organic Chemistry Lab	2
BIOC 211	Experimental Biosciences	2	DIST	Distribution Course	3
			OPEN	Open Elective	3
<b>JUNIOR 17 credits</b>			<b>JUNIOR 18 credits</b>		
BIOC 301	Biochemistry I	3	BIOC 302	Biochemistry II	3
NSCI/ENG	300+ Elective	3	BIOC 341	Cell Biology	3
BIOC 311	Advanced Experimental Biosciences	2	DIST	Distribution Course	3
BIOC 310	Independent Research (Advanced Lab)	3	OPEN	Open Elective (BIOC 310)	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>SENIOR 18 credits</b>			<b>SENIOR 15 credits</b>		
BIOC	Capstone Course	3	BIOC	Capstone Course	3
BIOC 352	Physical Chemistry for Biosciences	3	DIST	Distribution Course	3
BIOC Lab 300+	Advanced Lab	3	OPEN	Open Elective (BIOC 310)	3
OPEN	Open Elective (BIOC 310)	3	OPEN	Open Elective	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3			

## Biochemistry and Cell Biology Minor - Requirements

MATH 101* or MATH 105	Single Variable Calculus I or AP/OTH credit in Calculus I
MATH 102 or MATH 106	Single Variable Calculus II or AP/OTH credit in Calculus II
PHYS 125/126*	General Physics I and II (with lab)
CHEM 121/122/123/124*	General Chemistry I and II and General Chemistry Lab I and II
CHEM 211/212/213/214*	Organic Chemistry I and II and Organic Chemistry Discussion
CHEM 215*	Organic Chemistry Lab
BIOC 201	Introductory Biology
BIOC 301	Biochemistry I
BIOC 341	Cell Biology

*Lab course requirement:*

BIOC 211*	Intermediate Experimental Biosciences
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One BIOC lecture course at the 300-level or above

\* MATH 111/112 may substitute for MATH 101

CHEM 151/152/153/154 may substitute for CHEM 121/122/123/124

CHEM 320 may substitute for CHEM 212

CHEM 365 may substitute for CHEM 215

PHYS 101/102/103/104 or PHYS 111/112 may substitute for PHYS 125/126

BIOC 212 may substitute for BIOC 211

## Ecology and Evolutionary Biology BA - Requirements

MATH 101* <i>or</i> MATH 105	Single Variable Calculus I <i>or</i> AP/OTH credit in Calculus I
MATH 102 <i>or</i> MATH 106	Single Variable Calculus II <i>or</i> AP/OTH credit in Calculus II
EBIO 338 <i>or</i> STAT course	Design and Analysis of Biological Experiments
CHEM 121/123*	General Chemistry I and General Chemistry Lab I
PHYS 125*	General Physics (with lab)

BIOC 201	Introductory Biology
EBIO 202	Introductory Biology II
EBIO 325	Ecology
EBIO 334/BIOC 334	Evolution

BIOC 211*	Intermediate Experimental Biosciences
EBIO 213	Intro Experimental Ecology and Evolutionary Biology

EBIO 412	Advanced Communication in the Biological Sciences
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Two lecture courses in Ecology and Evolutionary Biology from the list in the 2019 General Announcements (GA)

One lecture course in Biochemistry and Cell Biology from the list in the 2019 GA

One EBIO laboratory course from the list in the 2019 GA

Select one BIOC laboratory course from the list in the 2019 GA or complete an additional EBIO lab course from the list in the 2019 GA.

One NSCI or ENGR course (3 credit hours) at the 300-level or above

\* MATH 111/112 may substitute for MATH 101  
 CHEM 151/153 may substitute for CHEM 121/123  
 PHYS 101/103 *or* PHYS 111 may substitute for PHYS 125  
 BIOC 212 may substitute for BIOC 211

One of the advanced laboratory course requirements may be satisfied by taking EBIO 306 for at least two credit hours.

**Ecology and Evolutionary Biology BA**

**SAMPLE DEGREE PLAN**

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN</b>		<b>17 credits</b>	<b>FRESHMAN</b>		<b>15 credits</b>
BIOC 201	Intro Biology	3	EBIO 202	Intro Biology II	3
CHEM 121	General Chemistry I	3	EBIO 213	Intro Lab in EEB	2
CHEM 123	General Chemistry Lab I	1	MATH 102	Single Variable Calculus II	3
MATH 101	Single Variable Calculus I	3	DIST	Distribution Course	3
FWIS	First Year Writing-Intensive Seminar	3	LPAP	Lifetime Physical Activity Elective	1
EBIO 119	Freshman Seminar on Local Biology Research	1	OPEN	Open Elective	3
OPEN	Open Elective	3			
<b>SOPHOMORE</b>		<b>16 credits</b>	<b>SOPHOMORE</b>		<b>16 credits</b>
PHYS 125	General Physics I	4	EBIO 334	Evolution	3
BIOC 211	Experimental Biosciences	2	EBIO 300+	EBIO Lecture	3
STAT 305	Intro to Statistics for Biosciences	4	BIOC Lab	BIOC Laboratory	1
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
			OPEN	Open Elective	3
<b>JUNIOR</b>		<b>16 credits</b>	<b>JUNIOR</b>		<b>15 credits</b>
EBIO 325	Ecology	3	EBIO 300+	EBIO Lecture	3
BIOC 300+	BIOC Lecture	3	DIST	Distribution Course	3
EBIO Lab	EBIO Laboratory	1	OPEN	Open Elective	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3			
<b>SENIOR</b>		<b>15 credits</b>	<b>SENIOR</b>		<b>15 credits</b>
EBIO 412	Advanced Communication in the Biosciences	3	NSCI/ENG	300+ level Elective	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3

## Ecology and Evolutionary Biology BS - Requirements

MATH 101\* or MATH 105      Single Variable Calculus I or AP/OTH credit in Calculus I  
 MATH 102 or MATH 106      Single Variable Calculus II or AP/OTH credit in Calculus II  
 EBIO 338 or STAT course      Design and Analysis of Biological Experiments  
 CHEM 121/123\*              General Chemistry I and General Chemistry Lab I  
 PHYS 125\*                      General Physics I (with lab)

BIOC 201                      Introductory Biology  
 EBIO 202                      Introductory Biology II  
 EBIO 325                      Ecology  
 EBIO 334/BIOC 334          Evolution

BIOC 211\*                      Intermediate Experimental Biosciences  
 EBIO 213                      Intro Experimental Ecology and Evolutionary Biology

EBIO 412                      Advanced Communication in the Biological Sciences

EBIO 306                      Independent Research for Ecology and Evolutionary  
    Biology undergraduates (at least 2 credit hours)  
 EBIO 403/404                  Undergraduate Honors Research in Ecology and  
    Evolutionary Biology

Two lecture courses in Ecology and Evolutionary Biology from the list in the 2019 General Announcements (GA)

One lecture course in Biochemistry and Cell Biology from the list in the 2019 GA

One EBIO laboratory course from the list in the 2019 GA

Select one BIOC laboratory course from the list in the 2019 GA or complete an additional EBIO lab course from the list in the 2019 GA.

One NSCI or ENGR course (3 credit hours) at the 300-level or above

\* MATH 111/112 may substitute for MATH 101  
 CHEM 151/153 may substitute for CHEM 121/123  
 PHYS 101/103 or PHYS 111 may substitute for PHYS 125  
 BIOC 212 may substitute for BIO 211

## Ecology and Evolutionary Biology BS

**SAMPLE DEGREE PLAN**

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN 17 credits</b>			<b>FRESHMAN 15 credits</b>		
BIOC 201	Intro Biology	3	EBIO 202	Intro Biology II	3
CHEM 121	General Chemistry I	3	EBIO 213	Intro Lab in EEB	2
CHEM 123	General Chemistry Lab I	1	MATH 102	Single Variable Calculus II	3
MATH 101	Single Variable Calculus I	3	DIST	Distribution Course	3
FWIS	First Year Writing-Intensive Seminar	3	OPEN	Open Elective	3
EBIO 119	Freshman Seminar on Local Biology Research	1	LPAP	Lifetime Physical Activity Elective	1
OPEN	Open Elective	3			
<b>SOPHOMORE 16 credits</b>			<b>SOPHOMORE 16 credits</b>		
PHYS 125	General Physics I	4	EBIO 334	Evolution	3
BIOC 211	Experimental Biosciences	2	EBIO 300+	EBIO Lecture	3
STAT 305	Intro to Statistics for Biosciences	4	BIOC Lab	BIOC Laboratory	1
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
			OPEN	Open Elective	3
<b>JUNIOR 15 credits</b>			<b>JUNIOR 14 credits</b>		
EBIO 325	Ecology	3	EBIO 300+	EBIO Lecture	3
BIOC 300+	BIOC Lecture	3	EBIO 306	Independent Research	2
EBIO Lab	EBIO Laboratory	1	DIST	Distribution Course	3
NSCI/ENG	300+ level Elective	3	OPEN	Open Elective	3
EBIO 306	Independent Research	2	OPEN	Open Elective	3
OPEN	Open Elective	3			
<b>SENIOR 16 credits</b>			<b>SENIOR 14 credits</b>		
EBIO 403	Senior Research	5	EBIO 404	Senior Research	5
EBIO 412	Advanced Communication in the Biosciences	2	DIST	Distribution Course	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3			



## **Ecology and Evolutionary Biology Minor - Requirements**

BIOC 201

Introductory Biology

EBIO 202

Introductory Biology II

EBIO 213

Intro Experimental Ecology and Evolutionary Biology

Four lecture courses from the list in the 2019 General Announcements

## Biological Sciences BA - Requirements

MATH 101* or MATH 105	Single Variable Calculus I or AP/OTH credit in Calculus I
MATH 102 or MATH 106	Single Variable Calculus II or AP/OTH credit in Calculus II
<i>One course from:</i>	
EBIO 338	Design and Analysis of Biological Experiments
MATH 211	Ordinary Differential Equations and Linear Algebra
STAT 305	Introduction to Statistics for Biosciences

CHEM 121/122/123/124*	General Chemistry I and II and General Chemistry Lab I and II
CHEM 211/212/213/214*	Organic Chemistry I and II and Organic Chemistry Discussion
CHEM 215*	Organic Chemistry Lab
PHYS 125/126*	General Physics I and II (with lab)

BIOC 201	Introductory Biology
EBIO 202	Introductory Biology II

BIOC 211*	Intermediate Experimental Biosciences
EBIO 213	Intro Experimental Ecology and Evolutionary Biology

Three advanced biology lab courses from the list in the 2019 General Announcements

BIOC 301	Biochemistry I
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<i>One course from:</i>	
BIOC 302	Biochemistry II
BIOC 341	Cell Biology
BIOC 344	Molecular Biology and Genetics
BIOC 352*	Physical Chemistry for the Biosciences

Five lecture courses as listed in the EBIO and BIOC Lecture Course Requirements in the 2019 General Announcements, of which one to two must be BIOC.

- \* MATH 111/112 may substitute for MATH 101
- CHEM 151/152/153/154 may substitute for CHEM 121/122/123/124
- CHEM 320 may substitute for CHEM 212
- CHEM 365 may substitute for CHEM 215
- PHYS 101/102/103/104 or PHYS 111/112 may substitute for PHYS 125/126
- CHEM 301 and CHEM 302 may substitute for BIOC 352
- BIOC 212 may substitute for BIOC 211

Biological Sciences BA

**SAMPLE DEGREE PLAN**

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN 16 credits</b>			<b>FRESHMAN 17 credits</b>		
BIOC 201	Intro Biology	3	EBIO 202	Intro Biology II	3
CHEM 121	General Chemistry I	3	CHEM 122	General Chemistry II	3
CHEM 123	General Chemistry Lab I	1	CHEM 124	General Chemistry Lab II	1
MATH 101	Single Variable Calculus I	3	MATH 102	Single Variable Calculus II	3
EBIO 213	Intro Lab in EEB	2	DIST	Distribution Course	3
FWIS	First Year Writing-Intensive Seminar	3	LPAP	Lifetime Physical Activity Elective	1
BIOC 112	Intro Biological Research Challenges	1	OPEN	Open Elective	3
<b>SOPHOMORE 15 credits</b>			<b>SOPHOMORE 15 credits</b>		
EBIO 300+	EBIO Lecture	3	EBIO 300+	EBIO Lecture	3
PHYS 125	General Physics I	4	PHYS 126	General Physics II	4
CHEM 211	Organic Chemistry I	3	CHEM 212	Organic Chemistry II	3
CHEM 213	Organic Chemistry Discussion I	0	CHEM 214	Organic Chemistry Discussion II	0
MATH 211	Differential Equations	3	CHEM 215	Organic Chemistry Lab	2
BIOC 211	Experimental Biosciences	2	DIST	Distribution Course	3
<b>JUNIOR 16 credits</b>			<b>JUNIOR 16 credits</b>		
BIOC 301	Biochemistry I	3	BIOC CORE	BIOC 302, 341, 344, or 352	3
EBIO 300+	EBIO Lecture	3	BIOC/EBIO Lab	Advanced Lab	1
BIOC/EBIO Lab	Advanced Lab	1	DIST	Distribution Course	3
DIST	Distribution Course	3	OPEN	Open Elective (BIOC 310)	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>SENIOR 16 credits</b>			<b>SENIOR 16 credits</b>		
BIOC/EBIO 300+	BIOC or EBIO Lecture	3	BIOC 300+	BIOC Lecture	3
BIOC/EBIO Lab	Advanced Lab	1	DIST	Distribution Course	3
DIST	Distribution Course	3	OPEN	Open Elective (BIOC 310)	3
OPEN	Open Elective (BIOC 310)	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	1

# CHEMICAL PHYSICS

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The Chemical Physics degree is jointly offered by the Department of Chemistry and the Department of Physics and Astronomy. It is designed for students with a strong aptitude in both chemistry and physics.

Students take upper-level courses in both chemistry and physics, focusing on the applications of physics to chemical systems. Schedule a meeting with the Major Advisors listed in this booklet if you are interested in this interdisciplinary major.

## Degrees Offered

Chemical Physics      BS

## Frank Advice

- Chemical Physics is an interdisciplinary field drawing on both Chemistry and Physics. To stay on-track to graduate in any of the three you need to complete the required introductory courses in chemistry, physics and mathematics during your first year.
- Talk to the PHYS 111 instructor about AP physics. It is usually better to take PHYS 111/112 rather than jumping straight into PHYS 201. If you are unsure what to do, speak with the PHYS 111 instructor.
- If you have chemistry AP credit and are confident in your background and ability to focus, you should be fine taking CHEM 211 as a freshman. If you are unsure whether to go straight to organic, start off going to both CHEM 151 and CHEM 211. Stay in the one that feels appropriate and drop the other. CHEM 211 is offered both semesters, so you can alternatively start organic in the spring (taking either CHEM 151 or no chemistry in the fall).
- Research is not required for the degree, but strongly recommended — and fun! Opportunities are available in summer and during the year, but don't feel pressured to start your first year.

## Chemical Physics BS - Requirements

CHEM 121/122/123/124*	General Chemistry I and II and General Chemistry Lab I and II
CHEM 211/213	Organic Chemistry I and Organic Chemistry Discussion
CHEM 215 or CHEM 365	Organic Chemistry Lab
CHEM 301	Physical Chemistry I
CHEM 302	Physical Chemistry II

*One from:*

PHYS 101 and 103	Mechanics (with lab) and Mechanics Discussion
PHYS 111	Honors Mechanics (with lab)

*One from:*

PHYS 102 and 104	Electricity and Magnetism (with lab) and E&M Discussion
PHYS 112	Honors Electricity and Magnetism (with lab)

PHYS 201	Waves, Light, and Heat
PHYS 202	Modern Physics
PHYS 231	Elementary Physics Lab
PHYS 301	Intermediate Mechanics
PHYS 302	Intermediate Electrodynamics
MATH 101 or MATH 105	Single Variable Calculus I or AP/OTH credit in Calculus I
MATH 102 or MATH 106	Single Variable Calculus II or AP/OTH credit in Calculus II
MATH 211	Ordinary Differential Equations and Linear Algebra
or MATH 220	or Honors Ordinary Differential Equations
or MATH 221	or Honors Calculus III
MATH 212 or MATH 222	Multivariable Calculus or Honors Calculus IV

*Three courses from:*

PHYS 311	Introduction to Quantum Physics I
PHYS 312 or CHEM 430	Intro to Quantum Physics II or Quantum Chemistry
CHEM 360	Inorganic Chemistry
CHEM 415	Chemical Kinetics and Dynamics
CHEM 420 or PHYS 425	Classical and Statistical Thermodynamics or Statistical and Thermal Physics

*Two courses from:*

CHEM 366	Inorganic Chemistry Lab
CHEM 367	Materials Chemistry Lab
CHEM 368	Chemical Measurement Lab
CHEM 491 or PHYS 461	Research for Undergraduates (up to 2 hours)
or PHYS 462	or Independent Research
PHYS 332	Junior Physics Lab II

Select two courses from MATH or CAAM course offerings at the 300-level or above

\* CHEM 151/152/153/154 or CHEM 111/112/113/114 may substitute for CHEM 121/122/123/124

Chemical Physics BS

**SAMPLE DEGREE PLAN**

*This is **only one** of many possible ways to fulfill your degree requirements.*

**FALL**

**SPRING**

<b>FRESHMAN</b>			<b>FRESHMAN</b>		
17 credits			17 credits		
CHEM 121	General Chemistry I	3	CHEM 122	General Chemistry II	3
CHEM 123	General Chemistry Lab I	1	CHEM 124	General Chemistry Lab II	1
PHYS 101	Mechanics (with lab)	4	PHYS 102	Electricity & Magnetism (with lab)	4
PHYS 103	Mechanics Discussion	0	PHYS 104	E & M Discussion	0
MATH 101	Single Variable Calculus I	3	MATH 102	Single Variable Calculus II	3
FWIS	First Year Writing-Intensive Seminar	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3

<b>SOPHOMORE</b>			<b>SOPHOMORE</b>		
15 credits			16 credits		
CHEM 211	Organic Chemistry I	3	CHEM 215	Organic Chemistry Lab	2
CHEM 213	Organic Chemistry Discussion	0	CHEM 360	Inorganic Chemistry	3
PHYS 201	Waves, Light and Heat	3	PHYS 202	Modern Physics	3
MATH 212	Multivariable Calculus	3	PHYS 231	Elementary Physics Lab	1
DIST	Distribution Course	3	MATH 211	Differential Equations	3
OPEN	Open Elective	3	DIST	Distribution Course	3
			LPAP	Lifetime Physical Activity Elective	1

<b>JUNIOR</b>			<b>JUNIOR</b>		
16 credits			18 credits		
CHEM 301	Physical Chemistry I	3	CHEM 302	Physical Chemistry II	3
PHYS 301	Intermediate Mechanics	4	PHYS 302	Intermediate Electrodynamics	4
DIST	Distribution Course	3	PHYS 332	Junior Physics Lab II	2
OPEN	Open Elective	3	MATH/ CAAM	300+ level Elective	3
OPEN	Open Elective	3	DIST	Distribution Course	3
			OPEN	Open Elective	3

<b>SENIOR</b>			<b>SENIOR</b>		
17 credits			18 credits		
CHEM 430	Quantum Chemistry	3	CHEM 420	Classical & Statistical Thermodynamics	3
CHEM 491	Research for Undergraduates	2	DIST	Distribution Course	3
MATH/ CAAM	300+ level Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3

# CHEMISTRY

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Chemistry at Rice is where innovation meets collaboration. Two Nobel laureates, dominance in the field of nanoscale science and technology, and significant contributions to both bioscience and materials science have propelled the Department of Chemistry to unparalleled status over the past two decades. Since Chemistry holds a unique position in science and technology, it has been the nucleus of collaboration across departments and schools.

The BS program rigorously prepares students for PhD programs in chemistry and related disciplines. The degree requirements are consistent with the guidelines for certification by the American Chemical Society. BS students complete a series of foundation courses in general chemistry and each of the core areas of chemistry: analytical, biological, inorganic, organic, and physical. Students then complete a specialization in one or more of these areas. This curriculum provides a broad and comprehensive introduction to core areas of chemistry while establishing deep understanding in one or more specific fields.

The BA degree is a more flexible program that provides a broad overview of chemistry, but includes less focused study in any single area. The chemistry BA is an ideal background for premedical students, as it requires only 10 credit hours over the standard premedical requirements. It also couples well with a second major for students who want to pair a science and non-science major for breadth of knowledge.

## Degrees Offered

Chemistry

BS, BA

# CHEMISTRY

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## Frank Advice

- If you have chemistry AP credit and are confident in your background and ability to focus, you should be fine taking CHEM 211 as a freshman. If you are unsure whether to go straight to organic, start off going to both CHEM 151 and CHEM 211. Stay in the one that feels appropriate and drop the other.
- Each student working towards a BS degree must complete advanced work in one specialization: Biological and Medicinal Chemistry, Inorganic Chemistry and Inorganic Materials, Organic Chemistry, or Physical and Theoretical Chemistry.
- BS students need at least eight credit hours of research, typically taken over two or three semesters. Seniors planning to pursue a PhD should take Undergraduate Honors Research (CHEM 492 and 493), which includes independent research, a public presentation of findings, and a formal thesis.
- The best way to connect with a research advisor is to take the Freshman Chemistry Seminar, CHEM 110, which will introduce you to chemistry research labs at Rice and the Texas Medical Center.



## Chemistry BA - Requirements

CHEM 151/152/153/154<sup>a</sup> Honors Chemistry I and II and Honors Chemistry Lab I and II

BIOC 301 <sup>b</sup>	Biochemistry I
CHEM 211/213	Organic Chemistry I and Organic Chemistry Discussion
CHEM 330	Analytical Chemistry
CHEM 360	Inorganic Chemistry

*Two courses from:*

BIOC 352	Physical Chemistry for the Biosciences
CHEM 301	Physical Chemistry I
CHEM 302	Physical Chemistry II

MATH 101 or MATH 105	Single Variable Calculus I or AP/OTH credit in Calculus I
MATH 102 or MATH 106	Single Variable Calculus II or AP/OTH credit in Calculus II
MATH 212	Multivariable Calculus

PHYS 101/103 or 111 or 125 Mechanics (with lab) and Mechanics Discussion or Honors Mechanics (with lab) or General Physics (with lab)

PHYS 102/104 or 112 or 126 Electricity & Magnetism (with lab) and E&M Discussion or Honors Electricity & Magnetism (with lab) or General Physics II (with lab)

*Three courses from:*

BIOC 311	Advanced Experimental Biosciences
CHEM 365	Organic Chemistry Lab
CHEM 366	Inorganic Chemistry Lab
CHEM 367	Materials Chemistry Lab
CHEM 368	Chemical Measurement Lab

*Two courses from:*

BIOC 302	Biochemistry II
CHEM 212 or CHEM 320	Organic Chemistry II
Any lecture course between CHEM 400 and CHEM 489	
Any lecture course between CHEM 495 and CHEM 699	

<sup>a</sup> CHEM 121/122/123/124 may substitute for CHEM 151/152/153/154  
MATH 221/222 may substitute for MATH 212

<sup>b</sup> CHEM students may enroll in BIOC 301 without the prerequisite BIOC 201. Consult with the course instructor.

## Chemistry BA

## SAMPLE DEGREE PLAN

*Sample degree plan without Chemistry AP credit.*

FALL			SPRING		
<b>FRESHMAN</b>			<b>FRESHMAN</b>		
		<b>13 credits</b>			<b>16 credits</b>
CHEM 151	Honors Chemistry I	3	CHEM 152	Honors Chemistry II	3
CHEM 153	Honors Chemistry Lab I	1	CHEM 154	Honors Chemistry Lab II	1
MATH 101	Single Variable Calculus I	3	MATH 102	Single Variable Calculus II	3
FWIS	First Year Writing-Intensive Seminar	3	DIST	Distribution Course	3
DIST	Distribution Course	3	OPEN	Open Elective	3
			OPEN	Open Elective	3
<b>SOPHOMORE</b>			<b>SOPHOMORE</b>		
		<b>16 credits</b>			<b>15 credits</b>
CHEM 211	Organic Chemistry I	3	CHEM 320	Organic Chemistry II	3
CHEM 213	Organic Chemistry Discussion	0	CHEM 365	Organic Chemistry Lab	2
MATH 212	Multivariable Calculus	3	PHYS 102	Electricity & Magnetism (with lab)	4
PHYS 101	Mechanics (with Lab)	4	DIST	Distribution Course	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3			
<b>JUNIOR</b>			<b>JUNIOR</b>		
		<b>17 credits</b>			<b>17 credits</b>
CHEM 301	Physical Chemistry I	3	CHEM 302	Physical Chemistry II	3
CHEM 366	Inorganic Chemistry Lab	2	CHEM 330	Analytical Chemistry	3
DIST	Distribution Course	3	CHEM 368	Chemical Measurement Lab	2
OPEN	Open Elective	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>SENIOR</b>			<b>SENIOR</b>		
		<b>16 credits</b>			<b>12 credits</b>
BIOC 301	Biochemistry I	3	CHEM 360	Inorganic Chemistry	3
CHEM 4XX	Adv. Chemistry Lecture	3	OPEN	Open Elective	3
LPAP	Lifetime Phys. Activity Elective	1	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3			
OPEN	Open Elective	3			

NOTE: There is a lot of flexibility in the completion of advanced coursework. However, not all courses are taught every year — consult your major advisor about your course plan.

## Chemistry BS - Requirements

CHEM 151/152/153/154 <sup>a</sup>	Honors Chemistry I and II and Honors Chemistry Lab I and II
BIOC 301 <sup>b</sup>	Biochemistry I
CHEM 211/213	Organic Chemistry I and Organic Chemistry Discussion
CHEM 301/302	Physical Chemistry I and II
CHEM 330	Analytical Chemistry
CHEM 360	Inorganic Chemistry
MATH 101 or MATH 105	Single Variable Calculus I or AP/OTH credit in Calculus I
MATH 102 or MATH 106	Single Variable Calculus II or AP/OTH credit in Calculus II
MATH 212	Multivariable Calculus
PHYS 101/103 or 111 or 125	Mechanics (with lab) and Mechanics Discussion or Honors Mechanics (with lab) or General Physics (with lab)
PHYS 102/104 or 112 or 126	Electricity & Magnetism (with lab) and E&M Discussion or Honors Electricity & Magnetism (with lab) or General Physics II (with lab)

*Three courses from:*

BIOC 311	Advanced Experimental Biosciences
CHEM 365	Organic Chemistry Lab
CHEM 366	Inorganic Chemistry Lab
CHEM 367	Materials Chemistry Lab
CHEM 368	Chemical Measurement Lab

CHEM 391 Research for Undergraduates (must be for at least three credit hours)

*Five credit hours from:*

CHEM 491	Research for Undergraduates
CHEM 492	Undergraduate Honors Research
CHEM 493	Undergraduate Honors Research
CHEM 700	Teaching Practicum

*Each student must complete advanced work that satisfies the requirements of one specialization.*

<sup>a</sup> CHEM 121/122/123/124 may substitute for CHEM 151/152/153/154  
MATH 221/222 may substitute for MATH 212

<sup>b</sup> CHEM students may enroll in BIOC 301 without the prerequisite BIOC 201. Consult with the course instructor.

<sup>c</sup> Though not required, **MATH 211 is strongly recommended** for students planning to specialize in Physical and Theoretical Chemistry or planning to pursue graduate studies.

## Chemistry BS - Requirements for specializations

### Area of Specialization: Biological and Medicinal Chemistry

CHEM 212/214 <i>or</i>	Organic Chemistry II and Organic Chemistry Discussion II
CHEM 320	<i>or</i> Organic Chemistry II
BIOC 302	Biochemistry II

*Two courses from:*

Any lecture course between CHEM 400 and CHEM 489  
 Any lecture course between CHEM 495 and CHEM 699

### Area of Specialization: Inorganic Chemistry and Inorganic Materials

CHEM 475	Physical Methods in Inorganic Chemistry
CHEM 495	Transition Metal Chemistry

*Two courses from:*

BIOC 302	Biochemistry II
Any lecture course between CHEM 400 and CHEM 489	
Any lecture course between CHEM 495 and CHEM 699	

### Area of Specialization: Organic Chemistry

CHEM 212/214 <i>or</i>	Organic Chemistry II and Organic Chemistry
CHEM 320	Discussion II <i>or</i> Organic Chemistry II
CHEM 401	Advanced Organic Chemistry

*Two courses from:*

BIOC 302	Biochemistry II
Any lecture course between CHEM 400 and CHEM 489	
Any lecture course between CHEM 495 and CHEM 699	

### Area of Specialization: Physical and Theoretical Chemistry

CHEM 430	Quantum Chemistry
CHEM 420	Classical and Statistical Thermodynamics

*One course from:*

CHEM 415	Chemical Kinetics and Dynamics
CHEM 531	Advanced Quantum Chemistry
CHEM 559	Spectroscopy at the Single Molecule/Particle Limit

One course (three credit hours) MATH *or* PHYS at 400-level or above

Chemistry BS

**SAMPLE DEGREE PLAN**

*Sample degree plan without Chemistry AP credit.*

FALL			SPRING		
FRESHMAN		14 credits	FRESHMAN		15 credits
CHEM 151	Honors Chemistry I	3	CHEM 152	Honors Chemistry II	3
CHEM 153	Honors Chemistry Lab I	1	CHEM 154	Honors Chemistry Lab II	1
MATH 101	Single Variable Calculus I	3	MATH 102	Single Variable Calculus II	3
PHYS 101	Mechanics (with lab)	4	PHYS 102	Electricity & Magnetism (with lab)	4
FWIS	First Year Writing-Intensive Seminar	3	DIST	Distribution Course	3
			LPAP	Lifetime Physical Activity Elective	1
SOPHOMORE		15 credits	SOPHOMORE		17 credits
CHEM 211	Organic Chemistry I	3	CHEM 320	Organic Chemistry II	3
CHEM 213	Organic Chemistry Discussion	0	CHEM 360	Inorganic Chemistry	3
CHEM 220	Undergraduate Chemistry Seminar	1	CHEM 365	Organic Chemistry Lab	2
CHEM 366	Inorganic Chemistry Lab	2	CHEM 391	Research for Undergraduates	3
MATH 212	Multivariable Calculus	3	DIST	Distribution Course	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3			
JUNIOR		17 credits	JUNIOR		18 credits
BIOC 301	Biochemistry I	3	CHEM 302	Physical Chemistry II	3
CHEM 301	Physical Chemistry I	3	CHEM 330	Analytical Chemistry	3
CHEM 368	Chemical Measurement Lab	2	CHEM 491	Research for Undergraduates	3
CHEM 491	Research for Undergraduates	3	DIST	Distribution Course	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
SENIOR		17 credits	SENIOR		17 credits
CHEM 492	Undergraduate Honors Research	5	CHEM 493	Undergraduate Honors Research	5
CHEM 4XX	Advanced Chemistry Lecture	3	CHEM 4XX	Advanced Chemistry Lecture	3
CHEM 4XX	Advanced Chemistry Lecture	3	OPEN	Open Elective	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3

NOTE: While the above sample degree plan suggests 19 credit hours of independent research, the BS degree requires at least eight credit hours.

There is a lot of flexibility in the completion of advanced coursework. However, not all courses are taught every year — consult with your major advisor about your course plan.

# EARTH, ENVIRONMENTAL AND PLANETARY SCIENCES

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Do you want to climb active volcanoes, sail around Antarctica, explore the world's oceans, help the global environment, join geophysical expeditions, learn advanced laboratory skills, study the Earth's deep interior, and gain valuable job experience? Explore these opportunities with a degree in Earth Science.

The Department of Earth, Environmental and Planetary Sciences offers undergraduate students the opportunity to pursue exciting careers in energy, the environment, government, education, and academia. We teach skills that prepare students for the challenges of the 21st Century in geology, geophysics, geochemistry, environmental sciences, and more.

The BS major offers five tracks: geology, geochemistry, geophysics, environmental Earth science, or a self-designed track designed by the student and a faculty member (subject to the approval of a department undergraduate advisor). All of the programs of study include experiences with analytical equipment, computer systems, and fieldwork. The BA major provides greater flexibility of course choices.

## Degrees Offered

Earth Science

BS, BA

## Frank Advice

- If you have math AP credit, consider taking more advanced MATH classes during your freshman year.
- Most Earth Science majors participate in undergraduate research, either through the course ESCI 481 Undergraduate Research or through summer research internships. Many undergraduates also present their own research projects at national and international professional conferences.
- Not required but highly recommended courses: Statistics, Environmental Science

## Earth Science BA - Requirements

MATH 101 <i>or</i> MATH 105	Single Variable Calculus I <i>or</i> AP/OTH credit in Calculus I
MATH 102 <i>or</i> MATH 106	Single Variable Calculus II <i>or</i> AP/OTH credit in Calculus II
CHEM 121/123 <i>or</i> 111/113	General Chemistry I and General Chemistry Lab I <i>or</i> AP/OTH Credit in General Chem. I and General Chem. Lab I
CHEM 122/124 <i>or</i> 112/14	General Chemistry II and General Chemistry Lab II <i>or</i> AP/OTH Credit in General Chem. II and General Chem. Lab II
ESCI 101/ENST 101 <i>or</i> 115	The Earth <i>or</i> Introduction to the Earth
ESCI 321	Earth System Evolution and Cycles
ESCI 322	Earth Chemistry and Materials
ESCI 323	Earth Structure and Deformation
ESCI 324	Earth's Interior
ESCI 334	Geological Techniques

*Two to four courses from either Group A or Group B:*

### Group A

*Select one from:*

BIOC 201 <i>and</i> EBIO 202	Introductory Biology <i>and</i> Introductory Biology II
PHYS 101/102/103/104	Mechanics (with lab) and Mechanics Discussion <i>and</i> Electricity & Magnetism (with lab) and Electricity & Magnetism Discussion
PHYS 125/126	General Physics (with lab) <i>and</i> General Physics II (with lab)

### Group B

*Select two from the following options:*

#### Option 1

*Select one from:*

PHYS 101/103	Mechanics (with lab) and Mechanics Discussion
PHYS 125	General Physics (with lab)
PHYS 102/104	Electricity & Magnetism (with lab) and Electricity & Magnetism Discussion
PHYS 126	General Physics II (with lab)

#### Option 2

BIOC 211 <i>and</i> EBIO 213	Intermediate Experimental Biosciences <i>and</i> Intro Experimental Ecology and Evolutionary Biology
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#### Option 3

MATH 211	Ordinary Differential Equations and Linear Algebra
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#### Option 4

CAAM 210	Intro to Engineering Computation
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Four additional ESCI courses at the 300-level or above

Two courses from NSCI *or* ENGR at the 200-level or above

Earth Science BA

**SAMPLE DEGREE PLAN**

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN</b>		<b>15 credits</b>	<b>FRESHMAN</b>		<b>17 credits</b>
ESCI 115	Intro to the Earth	4	ESCI 323	Earth Structure & Deformation	4
MATH 101	Single Variable Calculus I	3	MATH 102	Single Variable Calculus II	3
CHEM 121	General Chemistry I	3	CHEM 122	General Chemistry II	3
CHEM 123	General Chemistry Lab I	1	CHEM 124	General Chemistry Lab II	1
FWIS	First Year Writing-Intensive Seminar	3	DIST	Distribution Course	3
LPAP	Lifetime Physical Activity Elective	1	OPEN	Open Elective	3
<b>SOPHOMORE</b>		<b>13 credits</b>	<b>SOPHOMORE</b>		<b>16 credits</b>
ESCI 321	Earth System Evolution & Cycles	4	ESCI 324	Earth's Interior	4
ELECT	Elective Outside ESCI	3	ELECT	Elective Outside ESCI	3
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
			OPEN	Open Elective	3
<b>JUNIOR</b>		<b>16 credits</b>	<b>JUNIOR</b>		<b>15 credits</b>
ESCI 322	Earth Chemistry & Materials	4	ESCI 334	Geological Techniques	3
ESCI 300+	ESCI Lecture	3	ESCI 300+	ESCI Lecture	3
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>SENIOR</b>		<b>15 credits</b>	<b>SENIOR</b>		<b>15 credits</b>
ESCI 300+	ESCI Lecture	3	ESCI 300+	ESCI Lecture	3
NSCI/ENG	200+ level Elective	3	NSCI/ENG	200+ level Elective	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3



## Earth Science BS - Requirements

MATH 101 or MATH 105	Single Variable Calculus I or AP/OTH credit in Calculus I
MATH 102 or MATH 106	Single Variable Calculus II or AP/OTH credit in Calculus II
CHEM 121/123 or 111/113	General Chemistry I and General Chemistry Lab I or AP/OTH Credit in General Chem. I and General Chem. Lab I
CHEM 122/124 or 112/114	General Chemistry II and General Chemistry Lab II or AP/OTH credit in General Chem. II and General Chem. Lab II
PHYS 101/103 or PHYS 111	Mechanics (with lab) and Mechanics Discussion or Honors Mechanics (with lab)
PHYS 102/104 or PHYS 112	Electricity & Magnetism (with lab) and E&M Discussion or Honors Electricity and Magnetism (with lab)
ESCI 101/ENST 201 or ESCI 115	The Earth or Introduction to the Earth
ESCI 321	Earth System Evolution and Cycles
ESCI 322	Earth Chemistry and Materials
ESCI 323	Earth Structure and Deformation
ESCI 324	Earth's Interior
ESCI 334	Geological Techniques

*Each student must complete the additional courses for one specialization*

### Area of Specialization: Geology

MATH 211	Ordinary Differential Equations and Linear Algebra
ESCI 390	Geology Field Camp (at least 3 hours)
CAAM 210	Introduction to Engineering Computation
ESCI 412 or ESCI 430	Advanced Petrology or Trace-Element and Isotope Geochemistry for Earth and Environmental Science

#### Group A

*Two courses from:*

ESCI 421	Paleoceanography
ESCI 427	Sequence Stratigraphy
ESCI 431	Geomorphology
ESCI 435	Mechanics of Sediment Transport
ESCI 504	Siliciclastic Depositional Systems
ESCI 506	Carbonate Depositional Systems
ESCI 552	Marine Geology Systems

#### Group B

*Two courses from:*

ESCI 410	Optical Mineralogy and Petrography
ESCI 411	Advanced Petrology II
ESCI 418/CEVE 418	Quantitative Hydrogeology
ESCI 419	Materials Characterization
ESCI 426	Introduction to Seismic Interpretation
ESCI 429	Magmatic, Volcanic and Hydrothermal Processes
ESCI 442	Exploration Geophysics
ESCI 463	Structure and Evolution of Tectonic Systems
ESCI 464	Global Tectonics
ESCI 467	Geomechanics
ESCI 472	Earth Systems Modeling: Numerical Tech. & Appl.

## Earth Science BS - Requirements

### Area of Specialization: Geochemistry

BIOC 201	Introductory Biology
MATH 211	Ordinary Differential Equations and Linear Algebra
ESCI 391	Earth Science Field Experience (at least 3 hours)

Four courses from:

ESCI 340/EBIO 340/ENST 340	Global Biogeochemical Cycles
ESCI 410	Optical Mineralogy and Petrography
ESCI 411	Advanced Petrology I
ESCI 412	Advanced Petrology II
ESCI 419	Materials Characterization
ESCI 421	Paleoceanography
ESCI 425/CHEM 425/ENST 425	Organic Geochemistry
ESCI 426	Introduction to Seismic Interpretation: Structural Styles and Seismic Stratigraphy
ESCI 429	Magmatic, Volcanic and Hydrothermal Processes
ESCI 430	Trace-Element & Isotope Geochemistry for Earth and Environmental Science
ESCI 472	Earth Systems Modeling: Numerical Techniques and Applications

Select two to four courses (six credit hours) from the following or from any ESCI course offerings at the 300-level or above:

BIOC 211	Intermediate Experimental Biosciences
CAAM 210	Introduction to Engineering Computation
CEVE 401	Chemistry for Envir. Engineering & Science Lab
CEVE 434/CEVE 534	Fate & Transport of Contaminants in the Envir.
CEVE 550	Environmental Organic Chemistry
CHEM 211/213	Organic Chemistry I & Organic Chemistry Discussion
CHEM 212/214	Organic Chemistry II & Organic Chemistry Discussion II
CHEM 415	Chemical Kinetics and Dynamics
CHEM 495	Transition Metal Chemistry
EBIO 202	Introductory Biology II
MATH 212	Multivariable Calculus

### Area of Specialization: Geophysics

CAAM 210	Introduction to Engineering Computation
ESCI 391	Earth Science Field Experience (at least three hours)
MATH 211	Ordinary Differential Equations and Linear Algebra
MATH 212	Multivariable Calculus
PHYS 201	Waves, Light, and Heat
PHYS 231	Elementary Physics Lab

(continued)

## Earth Science BS - Requirements

### Area of Specialization: Geophysics *continued*

Two courses from:

ESCI 418/CEVE 418	Quantitative Hydrogeology
ESCI 426	Introduction to Seismic Interpretation: Structural Styles and Seismic Stratigraphy
ESCI 440	Geophysical Data Analysis: Digital Signal Processing
ESCI 441	Geophysical Data Analysis: Inverse Methods
ESCI 442	Exploration Geophysics
ESCI 450/CEVE 450	Remote Sensing
ESCI 452	GIS for Scientists and Engineers
ESCI 461	Seismology I
ESCI 462	Tectonophysics
ESCI 463	Structure and Evolution of Tectonic Systems
ESCI 464	Global Tectonics
ESCI 467	Geomechanics
ESCI 472	Earth Systems Modeling: Numerical Techniques and Applications
ESCI 542	Seismology II
ESCI 564	Seismic Reflection Data Process

Two courses from:

- Any course from ESCI course offerings between ESCI 410 and ESCI 475, except for research and special studies
- Any course from MATH, CAAM, or PHYS course offerings at the 300-level or above

CHEM 301	Physical Chemistry I
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### Area of Specialization: Environmental Earth Science

BIOC 201	Introductory Biology
CAAM 210	Introduction to Engineering Computation
ESCI 391	Earth Science Field Experience (at least 3 hours)
MATH 211	Ordinary Differential Equations and Linear Algebra
STAT 280	Elementary Applied Statistics

Select three to four from the following with at least two courses (six credit hours) taken from ESCI course offerings:

CEVE 401	Chemistry for Envir. Engineering & Science Lab
CEVE 406/ENST 406	Introduction to Environmental Law
CEVE 412	Hydrology and Water Resources Engineering
CEVE 434	Fate & Transport of Contaminants in the Environment
CHEM 211/213	Organic Chemistry I and Organic Chemistry Discussion
EBIO 202	Introductory Biology II
ESCI 340/EBIO 340/ENST 340	Global Biogeochemical Cycles
ESCI 410	Optical Mineralogy and Petrography <i>(continued)</i>

## Earth Science BS - Requirements

### Area of Specialization: Environmental Earth Science *continued*

ESCI 418	Quantitative Hydrogeology
ESCI 419	Materials Characterization
ESCI 421	Paleoceanography
ESCI 425/CHEM 425/ENST 425	Organic Geochemistry
ESCI 426	Introduction to Seismic Interpretation: Structural Styles and Seismic Stratigraphy
ESCI 429	Magmatic, Volcanic and Hydrothermal Processes
ESCI 431	Geomorphology
ESCI 435	Mechanics of Sediment Transport
ESCI 442	Exploration Geophysics
ESCI 452	GIS for Scientists and Engineers
ESCI 463	Structure and Evolution of Tectonic Systems
ESCI 467	Geomechanics
ESCI 472	Earth Systems Modeling: Numerical Techniques and Applications
ESCI 504	Siliciclastic Depositional Systems
ESCI 506	Carbonate Depositional Systems
ESCI 540	Earth's Atmosphere
ESCI 552	Marine Geology Systems
PHYS 201	Waves, Light, and Heat
PHYS 231	Elementary Physics Lab

### Area of Specialization: Self-Designed

*Interested students are expected to submit a statement of rationale by the beginning of their third year.*

ESCI 391 Earth Science Field Experience (at least three hours)

*Two courses from:*

BIOC 201	Introductory Biology
CAAM 210	Introduction to Engineering Computation
CHEM 301	Physical Chemistry I
CHEM 302	Physical Chemistry II
MATH 211	Ordinary Differential Equations and Linear Algebra
MATH 212	Multivariable Calculus
PHYS 201	Waves, Light, and Heat

Six courses (18 hours) of additional 300-level courses or higher targeting a coherent theme selected with the approval of the department's undergraduate advisor

Earth Science BS

**SAMPLE DEGREE PLAN**

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN</b>		<b>15 credits</b>	<b>FRESHMAN</b>		<b>17 credits</b>
ESCI 115	Intro to the Earth	4	ESCI 323	Earth Structure & Deformation	4
MATH 101	Single Variable Calculus I	3	MATH 102	Single Variable Calculus II	3
CHEM 121	General Chemistry I	3	CHEM 122	General Chemistry II	3
CHEM 123	General Chemistry Lab I	1	CHEM 124	General Chemistry Lab II	1
FWIS	First Year Writing-Intensive Seminar	3	DIST	Distribution Course	3
LPAP	Lifetime Physical Activity Elective	1	OPEN	Open Elective	3
<b>SOPHOMORE</b>		<b>17 credits</b>	<b>SOPHOMORE</b>		<b>17 credits</b>
ESCI 321	Earth System Evolution & Cycles	4	ESCI 324	Earth's Interior	4
PHYS 101	Mechanics (with lab)	4	PHYS 102	Electricity & Magnetism (with lab)	4
PHYS 103	Mechanics Discussion	0	PHYS 104	E & M Discussion	0
ELECT	Specialization	3	DIST	Distribution Course	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>JUNIOR</b>		<b>17 credits</b>	<b>JUNIOR</b>		<b>15 credits</b>
ESCI 322	Earth Chemistry & Materials	4	ESCI 334	Geological Techniques	3
ELECT	Specialization	4	ELECT	Specialization	3
DIST	Distribution Course	3	ELECT	Specialization	3
OPEN	Open Elective	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>JUNIOR SUMMER</b>		<b>3 credits</b>			
ESCI 390 or 391	Geology Field Camp	3			
<b>SENIOR</b>		<b>16 credits</b>	<b>SENIOR</b>		<b>15 credits</b>
ELECT	Specialization	4	ELECT	Specialization	3
ELECT	Specialization	3	ELECT	Specialization	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3

# ENVIRONMENTAL SCIENCE

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The Environmental Science degree is jointly offered by the Department of BioSciences and the Department of Earth, Environmental and Planetary Sciences. It is designed to help students understand environmental issues from a scientific perspective and be able to solve issues using a variety of interdisciplinary perspectives.

The interdisciplinary Environmental Science BS and BA degree paths explore interconnections between humans and the natural environment, drawing courses from BioSciences, Earth Science, 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.

## Degrees Offered

Environmental Science	BS, BA
Environmental Studies	Minor

## Frank Advice

- The environmental science majors address environmental issues in the context of what we know about Earth, ecology, and society. Students declare a concentration in ecology and evolutionary biology or Earth science, which enhances the depth of study in that field.
- The environmental studies minor provides a cross-disciplinary holistic understanding of the challenges and solutions for creating a sustainable world. Undergraduates from a broad range of academic backgrounds undertake a cohesive program of study offering foundational literacy in the social, cultural, and scientific dimensions of environmental issues.

## Environmental Science BA - Requirements

BIOC 201	Introductory Biology
EBIO 202	Introductory Biology II
CHEM 121/122/123/124* or CHEM 111/112/113/144	General Chemistry I and II and General Chemistry Lab I and II or AP/OTH Credit in General Chemistry I & II and General Chemistry Lab I & II
MATH 101 or MATH 105	Single Variable Calculus I or AP/OTH credit in Calculus I
MATH 102 or MATH 106	Single Variable Calculus II or AP/OTH credit in Calculus II
STAT 280 or STAT 305	Elementary Applied Statistics or Introduction to Statistics for Biosciences
ENST 100/ARCH 105	Environment, Culture and Society
ESCI 115 or ESCI110	Introduction to the Earth or The Earth System, Environment, and Society

*One course from:*

ESCI 107	Oceans and Global Change
ESCI 109	Oceanography
ESCI 201/ENST 201	The Science of Climate Change

EBIO 213	Intro Experimental Ecology and Evolutionary Biology
EBIO 325	Ecology

One to two courses (2-3 credit hours) of field experience courses from the list in the 2019 General Announcements (GA)

One advanced Social Sciences elective from the list in the 2019 GA

One advanced Humanities and Architecture elective from the list in the 2019 GA

One advanced Natural Sciences and Engineering elective from the list in the 2019 GA

ESCI 495/EBIO 495	Seminar: Topics in Environmental Science
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\* CHEM 151/152/153/154 may substitute for CHEM 121/122/123/124

*Students must complete the requirements for one major concentration:*

### **Major Concentration: Earth Science**

*Two courses from:*

ESCI 321	Earth System Evolution and Cycles
ESCI 323	Earth Structure and Deformation
ESCI 340/EBIO 340/ENST 340	Global Biogeochemical Cycles

*(continued)*

## Environmental Science BA - Requirements

### Major Concentration: Earth Science *continued*

*At least one course from:*

ESCI 321	Earth System Evolution and Cycles
ESCI 322	Earth Chemistry and Materials
ESCI 323	Earth Structure and Deformation
ESCI 340/EBIO 340/ENST 340	Global Biogeochemical Cycles
ESCI 380/FOTO 390	Visualizing Nature
ESCI 418/CEVE 418	Quantitative Hydrogeology
ESCI 421	Paleoceanography
ESCI 425/CHEM 425/ENST 425	Organic Geochemistry
ESCI 430	Trace-Element and Isotope Geochemistry for Earth and Environmental Science
ESCI 431	Geomorphology
ESCI 435	Mechanics of Sediment Transport
ESCI 452	GIS for Scientists and Engineers
ESCI 467	Geomechanics

### Major Concentration: Ecology and Evolutionary Biology

*Two courses from:*

EBIO 270	Ecosystem Management
EBIO 323/ENST 323	Conservation Biology
EBIO 372	Coral Reef Ecosystems

*At least one course from:*

EBIO 270	Ecosystem Management
EBIO 321	Animal Behavior
EBIO 323/ENST 323	Conservation Biology
EBIO 326	Insect Biology
EBIO 331/BIOC 331	Biology of Infectious Diseases
EBIO 334/BIOC 334	Evolution
EBIO 336	Plant Diversity
EBIO 338	Design and Analysis of Biological Experiments
EBIO 365	Introductory Phycology
EBIO 366	Applied Phycology
EBIO 372	Coral Reef Ecosystems
ESCI 340/EBIO340/ENST 340	Global Biogeochemical Cycles



Environmental Science BA

**SAMPLE DEGREE PLAN**

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN</b>		<b>16 credits</b>	<b>FRESHMAN</b>		<b>16 credits</b>
BIOC 201	Intro Biology	3	EBIO 202	Intro Biology II	3
CHEM 121	General Chemistry I	3	EBIO 213	Intro Lab in EEB	2
CHEM 123	General Chemistry Lab I	1	CHEM 122	General Chemistry II	3
MATH 101	Single Variable Calculus I	3	CHEM 124	General Chemistry Lab II	1
FWIS	First Year Writing Intensive Seminar	3	MATH 102	Single Variable Calculus II	3
OPEN	Open Elective	3	DIST	Distribution Course	3
			LPAP	Lifetime Physical Activity Elective	1
<b>SOPHOMORE</b>		<b>16 credits</b>	<b>SOPHOMORE</b>		<b>16 credits</b>
ESCI 115	Intro to the Earth	4	STAT 305	Intro to Statistics for Biosciences	4
ENST 100	Environment, Culture and Society	3	ESCI 109	Oceanography	3
SOSCI	Social Sciences Elective	3	HUMA	Humanities and Architecture Elective	3
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>JUNIOR</b>		<b>13 credits</b>	<b>JUNIOR</b>		<b>13 credits</b>
EBIO 325	Ecology	3	FIELD	Field Experience	1
FIELD	Field Experience	1	CONC	Major Concentration	3
NSCI	Natural Sciences and Engineering Elective	3	DIST	Distribution Course	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>SENIOR</b>		<b>15 credits</b>	<b>SENIOR</b>		<b>15 credits</b>
CONC	Major Concentration	3	CONC	Major Concentration	3
DIST	Distribution Course	3	EBIO/ESCI 495	Capstone Senior Seminar	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3			

## Environmental Science BS - Requirements

BIOC 201	Introductory Biology
EBIO 202	Introductory Biology II
CHEM 121/122/123/124* or CHEM 111/112/113/144	General Chemistry I and II and General Chemistry Lab I and II or AP/OTH Credit in General Chemistry I & II and General Chemistry Lab I & II
MATH 101 or MATH 105	Single Variable Calculus I or AP/OTH credit in Calculus I
MATH 102 or MATH 106	Single Variable Calculus II or AP/OTH credit in Calculus II
STAT 280 or STAT 305	Elementary Applied Statistics or Introduction to Statistics for Biosciences
PHYS 101/103 or PHYS 111 or PHYS 125	Mechanics (with lab) and Mechanics Discussion or Honors Mechanics (with Lab) or General Physics (with lab)
PHYS 102/104 or PHYS 112 or PHYS 126	Electricity and Magnetism (with lab) and E&M Discussion or Honors E&M (with lab) or General Physics II (with lab)
ENST 100/ARCH 105	Environment, Culture and Society
ESCI 115 or ESCI 110	Introduction to the Earth or The Earth System, Environment, and Society

*One course from:*

ESCI 107	Oceans and Global Change
ESCI 109	Oceanography
ESCI 201/ENST 201	The Science of Climate Change

EBIO 213	Intro Experimental Ecology and Evolutionary Biology
EBIO 325	Ecology

One to two courses (2-3 credit hours) of field experience courses from the list in the 2019 General Announcements (GA)

One advanced Social Sciences elective from the list in the 2019 GA

One advanced Humanities and Architecture elective from the list in the 2019 GA

One advanced Natural Sciences and Engineering elective from the list in the 2019 GA

*One course (at least three credit hours) from:*

EBIO 403 or 404	Undergraduate Honors Research in Ecology and Evolutionary Biology
ESCI 390	Geology Field Camp
ESCI 391	Earth Science Field Experience
ESCI 481	Undergraduate Research in Earth Science

ESCI 495/EBIO 495	Seminar: Topics in Environmental Science
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\* CHEM 151/152/153/154 may substitute for CHEM 121/122/123/124

## Environmental Science BS - Requirements

*Students must complete the requirements for one major concentration:*

### **Major Concentration: Earth Science**

*Two courses from:*

ESCI 321	Earth System Evolution and Cycles
ESCI 323	Earth Structure and Deformation
ESCI 340/EBIO 340/ENST 340	Global Biogeochemical Cycles

*At least one course from:*

ESCI 321	Earth System Evolution and Cycles
ESCI 322	Earth Chemistry and Materials
ESCI 323	Earth Structure and Deformation
ESCI 340/EBIO 340/ENST 340	Global Biogeochemical Cycles
ESCI 418/CEVE 418	Quantitative Hydrogeology
ESCI 421	Paleoceanography
ESCI 425/CHEM 425/ENST 425	Organic Geochemistry
ESCI 430	Trace-Element & Isotope Geochemistry for Earth and Environmental Science
ESCI 431	Geomorphology
ESCI 435	Mechanics of Sediment Transport
ESCI 452	GIS for Scientists and Engineers
ESCI 467	Geomechanics

### **Major Concentration: Ecology and Evolutionary Biology**

*Two courses from:*

EBIO 270	Ecosystem Management
EBIO 323/ENST 323	Conservation Biology
EBIO 372	Coral Reef Ecosystems

*At least one course from:*

EBIO 270	Ecosystem Management
EBIO 321	Animal Behavior
EBIO 323/ENST 323	Conservation Biology
EBIO 326	Insect Biology
EBIO 331/BIOC 331	Biology of Infectious Diseases
EBIO 334/BIOC 334	Evolution
EBIO 336	Plant Diversity
EBIO 338	Design and Analysis of Biological Experiments
EBIO 365	Introductory Phycology
EBIO 366	Applied Phycology
EBIO 372	Coral Reef Ecosystems
ESCI 340/EBIO340/ENST 340	Global Biogeochemical Cycles

Environmental Science BS

**SAMPLE DEGREE PLAN**

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN</b>		<b>16 credits</b>	<b>FRESHMAN</b>		<b>16 credits</b>
BIOC 201	Intro Biology	3	EBIO 202	Intro Biology II	3
CHEM 121	General Chemistry I	3	EBIO 213	Intro Lab in EEB	2
CHEM 123	General Chemistry Lab I	1	CHEM 122	General Chemistry II	3
MATH 101	Single Variable Calculus I	3	CHEM 124	General Chemistry Lab II	1
FWIS	First Year Writing-Intensive Seminar	3	MATH 102	Single Variable Calculus II	3
OPEN	Open Elective	3	DIST	Distribution Course	3
			LPAP	Lifetime Physical Activity Elective	1
<b>SOPHOMORE</b>		<b>17 credits</b>	<b>SOPHOMORE</b>		<b>17 credits</b>
ESCI 115	Intro to the Earth	4	STAT 305	Intro to Statistics for Biosciences	4
ENST 100	Environment, Culture and Society	3	ESCI 109	Oceanography	3
PHYS 101	Mechanics (with lab)	4	PHYS 102	Electricity & Magnetism (with lab)	4
PHYS 103	Mechanics Discussion	0	PHYS 104	E & M Discussion	0
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>JUNIOR</b>		<b>16 credits</b>	<b>JUNIOR</b>		<b>15 credits</b>
EBIO 325	Ecology	3	FIELD	Field Experience	1
FIELD	Field Experience	1	SOSCI	Social Sciences Elective	3
NSCI	Natural Sciences and Engineering Elective	3	CONC	Major Concentration	3
RESEARCH	Research Experience Requirement	3	DIST	Distribution Course	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>SENIOR</b>		<b>18 credits</b>	<b>SENIOR</b>		<b>15 credits</b>
CONC	Major Concentration	3	CONC	Major Concentration	3
HUMA	Humanities and Architecture Elective	3	EBIO/ESCI 495	Capstone Senior Seminar	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3			

## Environmental Studies Minor - Requirements

ENST 100/ARCH 105                      Environment, Culture and Society

*One course from:*

EBIO 124	Introduction to Ecology and Evolutionary Biology
ESCI 101/ENST 101	The Earth
ESCI 107	Oceans and Global Change
ESCI 109	Oceanography
ESCI 110	The Earth System, Environment, and Society
ESCI 201/ENST 201	The Science of Climate Change

Two courses from the Schools of Architecture, Humanities, and Social Sciences listed in the 2019 General Announcements (GA)

Two courses from the Schools of Engineering and Natural Science listed in the 2019 GA

# KINESIOLOGY

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The Kinesiology department is home to two distinct programs (Health Sciences and Sports Medicine) and is one of the first of its kind in the nation to allow students to concentrate their studies in one of these specific sub-disciplines. A flexible curriculum permits undergraduate majors to tailor their coursework to their particular postgraduate needs and also permits them to study abroad, pursue internships, and conduct undergraduate research. With a median class size of 19, students find an active, close-knit community of scholars, teachers, and mentors who take a personal interest in every student major. The Kinesiology programs have one of the largest number of academic majors in the School of Natural Sciences and are among the largest choice of student majors at Rice.

The Health Sciences program provides students with a fundamental background in health promotion and disease prevention. Viewing health from the broader community level, students acquire the knowledge and skills for careers in public health related positions.

The Sports Medicine program provides a strong basic science foundation and then interfaces this foundation with application to the human body. It is the only academic specialization on campus that provides detailed instruction in human anatomy and human physiology in addition to nutrition, biomechanics, motor learning and exercise physiology among other topics.

## **Degree Offered**

Kinesiology BA

## **Frank Advice**

- Students choosing to major in Kinesiology must choose a concentration in either Health Sciences or Sports Medicine when declaring their major. Consult with the department advisor for your program as well as the Health Professions Advising service to ensure that you are choosing the correct pre-requisites as you are planning your degree.
- Be mindful when degree planning of courses that may only be offered once per academic year.

# KINESIOLOGY

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- New majors or those interested in the field are encouraged to enroll in KINE 120: Scientific Foundations of Kinesiology, HEAL 222: Principles of Public & Community Health, or HEAL 119: Introduction to Health & Wellness, prior to upper level courses to gain an understanding of the particular program of interest.
- Qualified students are encouraged to participate in independent research. This independent research allows integral involvement in basic or applied research directed by a faculty advisor. Opportunities are available with a variety of institutions in the Texas Medical Center.
- Students are encouraged to pursue any of a variety of highly competitive internships, which provide practical experience tailored to your interests. The close proximity of Rice to the Texas Medical Center allows you to find experience in a research or medical setting for potentially every aspect of health or medicine.

## Kinesiology BA/Health Sciences - Requirements

HEAL 222	Principles of Public and Community Health
HEAL 313	Foundations of Health Promotion and Education
HEAL 407	Epidemiology
HEAL 422	Theories and Models of Health Behavior
HEAL 460	Planning and Evaluation of Health Promotion and Education
KINE 319	Statistics for the Health Professional

*Eight courses from:*

ANTH 381	Medical Anthropology
ANTH 386	Medical Anthropology of Food and Health
ANTH 446	Advanced Topics in Biomedical Anthropology
BIOC 122	Current Topics in Biology
BIOC 201	Introductory Biology
BIOE 360/ GLHT 360	Appropriate Design for Global Health
ECON 481	Health Economics
ENGL 272	Literature and Medicine
ENGL 273/SWGS 273	Medicine and Media
ENST 315	Environmental Health
GLHT 201	Introduction to Global Health
HEAL 103	Nutrition
HEAL 119	Introduction to Health and Wellness
HEAL 132	Medical Terminology
HEAL 208	Chemical Alterations of Behavior
HEAL 212	Consumer Health and the Media
HEAL 306/SWGS 306	Human Sexuality
HEAL 350	Understanding Cancer
HEAL 360	Violence in America: A Public Health Perspective
HEAL 375	The Built Environment and Public Health
HEAL 379	Internship in Health Sciences
HEAL 380	Disparities in Health in America
HEAL 495	Independent Research in Health Sciences
HEAL 498	Special Topics in Health Sciences
KINE 300	Human Anatomy with Lab
KINE 301	Human Physiology
KINE 326	Exercise Epidemiology
KINE 440	Research Methods
MDHM 201	Introduction to Medical Humanities
PHIL 314	The Philosophy of Medicine
PHIL 315	Ethics, Medicine, and Public Policy
PHIL 336	Topics in Medical Ethics
POLI 329	Health Policy
PSYC 345	Health Psychology
SOCI 313	Demography
SOCI 345	Medical Sociology
SOCI 465/SWGS 465	Gender and Health
SOSC 330	Health Care Reform in the 50 States



## Kinesiology BA/Health Sciences

## SAMPLE DEGREE PLAN

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN</b>			<b>FRESHMAN</b>		
		<b>15 credits</b>			<b>16 credits</b>
HEAL 119	Introduction to Health & Wellness	3	ELECT	Health Sciences Elective	3
FWIS	First Year Writing-Intensive Seminar	3	DIST	Distribution Course	3
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
			LPAP	Lifetime Physical Activity Elective	1
<b>SOPHOMORE</b>			<b>SOPHOMORE</b>		
		<b>15 credits</b>			<b>15 credits</b>
HEAL 222	Principles of Public & Community Health	3	HEAL 313	Foundations of Health Promotion & Education	3
KINE 319	Statistics for the Health Professional	3	ELECT	Health Sciences Elective	3
ELECT	Health Sciences Elective	3	DIST	Distribution Course	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>JUNIOR</b>			<b>JUNIOR</b>		
		<b>15 credits</b>			<b>15 credits</b>
HEAL 407	Epidemiology	3	HEAL 422	Theories & Models of Health Behavior	3
ELECT	Health Sciences Elective	3	ELECT	Health Sciences Elective	3
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>SENIOR</b>			<b>SENIOR</b>		
		<b>15 credits</b>			<b>15 credits</b>
HEAL 460	Planning & Evaluation of Health Promotion & Education	3	ELECT	Health Sciences Elective	3
ELECT	Health Sciences Elective	3	DIST	Distribution Course	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3

## Kinesiology BA/Sports Medicine - Requirements

HEAL 103	Nutrition
KINE 300	Human Anatomy with Lab
KINE 301	Human Physiology
KINE 302	Biomechanics
KINE 310	Psychological Aspects of Sport and Exercise
KINE 311	Motor Learning
KINE 319	Statistics for the Health Professional
KINE 321/KINE 323	Exercise Physiology and Exercise Physiology Laboratory
KINE 440	Research Methods

*Five courses from:*

BIOC 201	Introductory Biology
BIOC 211	Intermediate Experimental Biosciences
BIOC 301	Biochemistry I
BIOC 302	Biochemistry II
BIOC 311	Advanced Experimental Biosciences
BIOC 313	Introductory Synthetic Biology
BIOC 372	Immunology
CHEM 121/123*	General Chemistry I and General Chemistry Lab I
CHEM 122/124*	General Chemistry II and General Chemistry Lab II
EBIO 202	Introductory Biology II
HEAL 132	Medical Terminology
HEAL 407	Epidemiology
KINE 120	Scientific Foundations of Kinesiology
KINE 326	Exercise Epidemiology
KINE 351	Advanced Human Anatomy Lab
KINE 375	Sports Medicine Internship
KINE 403	Sport Nutrition
KINE 410	Case Studies in Human Performance
KINE 412	Motor Control
KINE 415	Psychological Aspects of Sports Injury & Rehabilitation
KINE 421	Adv. Topics in Exercise Phys. & Preventive Medicine
KINE 430	Sports Injury: Evaluation, Management, & Treatment
KINE 495	Independent Research in Sports Medicine
KINE 498	Special Topics in Sports Medicine
KINE 499	Teaching Practicum in Sports Medicine
PHYS 101/PHYS 103	Mechanics (with lab) and Mechanics Discussion
PHYS 102/PHYS 104	Electricity & Magnetism (with lab) and E&M Discussion
PHYS 125	General Physics (with lab)
PHYS 126	General Physics II (with lab)
PSYC 202	Introduction to Social Psychology
PSYC 203	Introduction to Cognitive Psychology
PSYC 321	Developmental Psychology

\* CHEM 111/112/113/114 may substitute for CHEM 121/122/123/124

Kinesiology BA/Sports Medicine

**SAMPLE DEGREE PLAN**

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN</b>		<b>15 credits</b>	<b>FRESHMAN</b>		<b>16 credits</b>
HEAL 103	Nutrition	3	ELECT	Kinesiology Elective	3
KINE 120	Foundations of Kinesiology (Elective)	3	DIST	Distribution Course	3
FWIS	First Year Writing-Intensive Seminar	3	DIST	Distribution Course	3
DIST	Distribution Course	3	LPAP	Lifetime Physical Activity Elective	1
OPEN	Open Elective	3	OPEN	Open Elective	3
			OPEN	Open Elective	3
<b>SOPHOMORE</b>		<b>15 credits</b>	<b>SOPHOMORE</b>		<b>15 credits</b>
KINE 300	Human Anatomy	3	KINE 301	Human Physiology	3
ELECT	Kinesiology Elective	3	ELECT	Kinesiology Elective	3
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>JUNIOR</b>		<b>15 credits</b>	<b>JUNIOR</b>		<b>16 credits</b>
KINE 302	Biomechanics	3	KINE 311	Motor Learning	3
KINE 319	Statistics for the Health Professional	3	KINE 321	Exercise Physiology	3
DIST	Distribution Course	3	KINE 323	Exercise Physiology Lab	1
OPEN	Open Elective	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
			OPEN	Open Elective	3
<b>SENIOR</b>		<b>15 credits</b>	<b>SENIOR</b>		<b>15 credits</b>
ELECT	Kinesiology Elective	3	KINE 310	Psychological Aspects of Sport and Exercise	3
ELECT	Kinesiology Elective	3	KINE 440	Research Methods	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3

# MATHEMATICS

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Mathematics is the study of structure that provides a language and tools for interpreting our world. The Mathematics Department offers training in the traditional areas of pure mathematics: analysis, algebra, geometry, and topology, as well as courses in combinatorics, computational algebraic geometry, and mathematical biology. Rice's Computational and Applied Mathematics (CAAM) and Statistics (STAT) departments offer an array of other mathematical courses. Undergraduates seeking a math degree are also trained in problem solving, analytical thinking, and the logical and precise communication of their ideas. In the marketplace, law schools, and business schools, it is precisely these skills that make math majors a valuable commodity.

The BS program prepares students for PhD programs in mathematics and related disciplines. It requires courses from each of the subfields of mathematics.

The BA program is extremely flexible; it allows students to design their own programs in conjunction with their advisors. This also makes math a popular double major. Today's budding scientist, engineer, computer scientist, economist, or social scientist needs much more mathematical training than did previous generations. The ease and flexibility of the double major in math allows students to get degree credit for their work.

## Degrees Offered

Mathematics

BS, BA, Minor

# MATHEMATICS

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## Frank Advice

- The Math Department website provides detailed information about choosing the proper math course for your first semester at Rice. Look under Academics > Undergraduate > Advising and Transfer Credit for advice on class selection for first-year students.
- If you have AP credit for MATH 101-102, have a strong math background, and are interested in a major with a substantial math component, consider taking Honors Calculus (MATH 221-222) or Honors Differential Equations (MATH 220). Strong students may additionally take Honors Linear Algebra (MATH 354).
- MATH 499 offers a non-lecture undergraduate research experience. You should also consider Research Experiences for Undergraduates and other summer research programs if you are thinking of applying to graduate school in Math. ([www.ams.org/programs/students/students](http://www.ams.org/programs/students/students))
- Not required but highly recommended courses:
  - MATH 221 – Honors Calculus III
  - MATH 222 – Honors Calculus IV
  - MATH 354 – Honors Linear Algebra
  - MATH 356 – Abstract Algebra I
  - MATH 321 – Introduction to Analysis I or MATH 331 - Honors Analysis

## Mathematics BA - Requirements

MATH 101 *or* MATH 105      Single Variable Calculus I *or* AP/OTH credit in Calculus I  
 MATH 102 *or* MATH 106      Single Variable Calculus II *or* AP/OTH credit in Calculus II

*Select one from the following:*

MATH 211 <i>and</i> MATH 212	Ordinary Differential Equations and Linear Algebra <i>and</i> Multivariable Calculus
MATH 211 <i>and</i> MATH 222	Ordinary Differential Equations and Linear Algebra <i>and</i> Honors Calculus IV
MATH 220 <i>and</i> MATH 212	Honors Ordinary Differential Equations <i>and</i> Multivariable Calculus
MATH 220 <i>and</i> MATH 222	Honors Ordinary Differential Equations <i>and</i> Honors Calculus IV
MATH 221 <i>and</i> MATH 222	Honors Calculus III <i>and</i> Honors Calculus IV

Eight courses from MATH course offerings at the 300-level or above

Mathematics BA

**SAMPLE DEGREE PLAN**

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN</b>			<b>FRESHMAN</b>		
		<b>15 credits</b>			<b>16 credits</b>
MATH 101	Single Variable Calculus	3	MATH 102	Single Variable Calculus II	3
FWIS	First Year Writing-Intensive Seminar	3	DIST	Distribution Course	3
DIST	Distribution Course	3	LPAP	Lifetime Physical Activity Elective	1
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
			OPEN	Open Elective	3
<b>SOPHOMORE</b>			<b>SOPHOMORE</b>		
		<b>15 credits</b>			<b>15 credits</b>
MATH 221	Honors Calculus III	3	MATH 222	Honors Calculus IV	3
DIST	Distribution Course	3	MATH 300+	Math Elective	3
OPEN	Open Elective	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>JUNIOR</b>			<b>JUNIOR</b>		
		<b>15 credits</b>			<b>15 credits</b>
MATH 354	Honors Linear Algebra	3	MATH 306 or 356	Elements of Abstract Algebra or Abstract Algebra I	3
MATH 300+	Math Elective	3	MATH 300+	Math Elective	3
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>SENIOR</b>			<b>SENIOR</b>		
		<b>15 credits</b>			<b>15 credits</b>
MATH 321 or 331	Intro to Analysis I or Honors Analysis	3	MATH 300+	Math Elective	3
MATH 300+	Math Elective	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3

## Mathematics BS - Requirements

### Single Variable Calculus

MATH 101 or MATH 105

Single Variable Calculus I or AP/OTH credit in Calculus I

MATH 102 or MATH 106

Single Variable Calculus II or AP/OTH credit in Calculus II

### Differential Equations *One course from:*

MATH 211

Ordinary Differential Equations and Linear Algebra

MATH 220

Honors Ordinary Differential Equations

MATH 381

Introduction to Partial Differential Equations

MATH 423/CAAM 423

Partial Differential Equations I

### Multivariable Calculus *One course from:*

MATH 212

Multivariable Calculus

MATH 221 and 222

Honors Calculus III and Honors Calculus IV

### Linear Algebra *One course from:*

MATH 221

Honors Calculus III

MATH 354

Honors Linear Algebra

MATH 355

Linear Algebra

### Real Analysis *Two courses from:*

MATH 321

Introduction to Analysis I

MATH 322

Introduction to Analysis II

MATH 331

Honors Analysis

MATH 425

Integration Theory

### Algebra

MATH 356

Abstract Algebra I

MATH 463

Abstract Algebra II

### Geometry and Manifolds *One course from:*

MATH 370

Calculus on Manifolds

MATH 401

Differential Geometry of Curves and Surfaces

MATH 402

Differential Geometry

### Complex Analysis *One course from:*

MATH 382

Computational Complex Analysis

MATH 427

Complex Analysis

### Topology *One course from:*

MATH 443

General Topology

MATH 444

Geometric Topology

MATH 445

Algebraic Topology

Students must complete a minimum of 33 credit hours from MATH course offerings at the 300-level or above.



Mathematics BS

**SAMPLE DEGREE PLAN**

This sample plan assumes AP credit.

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN</b>			<b>FRESHMAN</b>		
15 credits			16 credits		
MATH 221	Honors Calculus III	3	MATH 222	Honors Calculus IV	3
FWIS	First Year Writing-Intensive Seminar	3	MATH 300+	Math Elective	3
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective	3	LPAP	Lifetime Physical Activity Elective	1
OPEN	Open Elective	3	OPEN	Open Elective	3
			OPEN	Open Elective	3
<b>SOPHOMORE</b>			<b>SOPHOMORE</b>		
15 credits			15 credits		
MATH 321 or 331	Intro to Analysis I or Honors Analysis	3	MATH 322	Intro to Analysis II	3
MATH 354	Honors Linear Algebra	3	MATH 356	Abstract Algebra I	3
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>JUNIOR</b>			<b>JUNIOR</b>		
15 credits			15 credits		
MATH 463	Abstract Algebra II	3	MATH 443	General Topology	3
DIST	Distribution Course	3	MATH 427	Complex Analysis	3
OPEN	Open Elective	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>SENIOR</b>			<b>SENIOR</b>		
15 credits			15 credits		
MATH 423	Partial Differential Equations I	3	MATH 402	Differential Geometry	3
MATH 300+	Math Elective	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3

## Mathematics Minor - Requirements

*One course from:*

MATH 302	Elements of Analysis
MATH 321	Introduction to Analysis I
MATH 331	Honors Analysis
MATH 381	Introduction to Partial Differential Equations
MATH 382	Computational Complex Analysis

*One course from:*

MATH 306	Elements of Abstract Algebra
MATH 356	Abstract Algebra I
MATH 365	Number Theory
MATH 368	Topics in Combinatorics

*One course from:*

MATH 221	Honors Calculus III
MATH 354	Honors Linear Algebra
MATH 355	Linear Algebra

Select three additional courses from MATH course offerings.

# NEUROSCIENCE

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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 neuroscience minor involves participation in core and elective courses at Rice, Baylor College of Medicine, and the University of Texas Health Sciences Center as well as research in active faculty laboratories throughout the Texas Medical Center.

## Degrees Offered

Neuroscience

BA, Minor

## Frank Advice

- Each student undertaking a major or a minor in neuroscience chooses one of two unique tracks. The Humanities and Social Sciences track represents cognitive and behavioral approaches to neuroscience, whereas the Natural Sciences and Engineering track represents genetics, cellular/molecular, bioengineering, computation, and systems-level investigations.
- There is one required core course for the minor (NEUR 380) and two elective core courses dependent on the chosen track (NEUR 362 and NEUR 385). All three courses are offered in the Spring and any of them are an appropriate first course to choose as an introduction to the neuroscience minor.
- NEUR 310 gives credit for Independent Research. The course can be taken once to count towards the minor, but twice towards the major as a Project Based Laboratory Course and an Elective. However, students can, and often do, repeat the course for general elective credit and to gain real world lab experience. It is fine to do research in different labs, but we suggest that you stick with a lab for multiple semesters to accomplish projects and potentially publish scientific journal articles.

## Neuroscience BA - Requirements

BIOC 201	Introductory Biology
CAAM 210	Introduction to Engineering Computation
CHEM 121/122/123/124* or CHEM 111/112/113/114	General Chemistry I & II & General Chemistry Lab I & II or AP/OTH Credit in General Chemistry I & II & Lab I & II
MATH 101 or MATH 105*	Single Variable Calculus I or AP/OTH credit in Calculus I
MATH 102 or MATH 106	Single Variable Calculus II or AP/OTH credit in Calculus II
PHYS 125/126*	General Physics (with lab) and General Physics II (with lab)
PSYC 203	Introduction to Cognitive Psychology
<i>One course from:</i>	
STAT 305	Introduction to Statistics for Biosciences
STAT 310/ECON 307	Probability and Statistics
STAT 312	Probability and Statistics for Engineers
NEUR 362/PSYC 362	Cognitive Neuroscience: Exploring the Living Brain
NEUR 380/BIOC 380/PSYC 380	Fundamental Neuroscience Systems
NEUR 383/BIOE 380/ELEC 380	Introduction to Neuroengineering: Measuring and Manipulating Neural Activity
NEUR 385/BIOC 385	Fundamentals of Cellular and Molecular Neuroscience
BIOC 212	Intermediate Experimental Cellular and Molecular Neuroscience
<i>Two courses from:</i>	
BIOC 415	Experimental Physiology
BIOC 417	Experimental Cell and Molecular Neuroscience
NEUR 310	Indep. Research for Neuroscience Undergraduates
PSYC 366	Methods in Social Cognitive and Affective Neuroscience
<i>Four courses from:</i>	
BIOC 129*	Brainstem - Teaching Stem through Neuroscience
BIOC 442	Molecules, Memory and Model Animals: Methods in Behavioral Neuroscience
BIOC 449	Advanced Cell and Molecular Neuroscience
BIOE 492	Sensory Neuroengineering
COMP 440/ELEC 440	Artificial Intelligence
EBIO 321	Animal Behavior
ELEC 475	Learning from Sensor Data
NEUR 310	Independent Research for Neuroscience Undergraduates

(continued)

## Neuroscience BA - Requirements *continued*

NEUR 382/ELEC 382	Introduction to Computational Neuroscience
NEUR 411/ANTH 411/ LING 411	Neurolinguistics
NEUR 415/CAAM 415/ ELEC 488	Theoretical Neuroscience: From Cells to Learning Systems
NEUR 416/CAAM 416/ ELEC 489	Neural Computation
PHIL 103	Philosophical Aspects of Cognitive Science
PHIL 303	Theory of Knowledge
PHIL 312	Philosophy of Mind
PHIL 358	Philosophy of Neuroscience
PHIL 359	Animal Minds
PSYC 354	Intro. to Social and Affective Neuroscience
PSYC 375	Neuropsychology of Language and Memory
PSYC 432	Brain and Behavior

\* CHEM 151 and CHEM 153 may be substituted for CHEM 121 and CHEM 123  
 CHEM 152 and CHEM 154 may be substituted for CHEM 122 and CHEM 124  
 MATH 111 and MATH 112 may be substituted for MATH 101 and MATH 102  
 PHYS 101 and PHYS 103 or PHYS 111 may be substituted for PHYS 125  
 PHYS 102 and PHYS 104 or PHYS 112 may be substituted for PHYS 126

Students must complete a minimum of three semesters of BIOC129 (3 credit hours) to use this course to fulfill an elective requirement.

NEUR 310 can be repeated and counted as an elective if a student has chosen NEUR 310 to count as a Project-based Laboratory Course.

Neuroscience BA

**SAMPLE DEGREE PLAN**

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN</b>		<b>14 credits</b>	<b>FRESHMAN</b>		<b>14 credits</b>
BIOC 201	Intro Biology	3	PSYCH 203	Intro to Cognitive Science	3
CHEM 121	General Chemistry I	3	CHEM 122	General Chemistry II	3
CHEM 123	General Chemistry Lab I	1	CHEM 124	General Chemistry Lab II	1
MATH 101	Single Variable Calculus I	3	MATH 102	Single Variable Calculus II	3
BIOC 112	Intro Biological Research Challenges	1	LPAP	Lifetime Physical Act. Elective	1
FWIS	First Year Writing-Intensive Seminar	3	OPEN	Open Elective	3
<b>SOPHOMORE</b>		<b>15 credits</b>	<b>SOPHOMORE</b>		<b>17 credits</b>
CAAM 210	Intro to Engineering Computation	3	STAT 305	Intro to Stat for Biosciences	4
BIOC 212	Intermediate Expl. Neuro.	2	NEUR 380	Fund. Neuroscience Systems	3
PHYS 125	General Physics with Lab I	4	PHYS 126	General Physics with Lab II	4
NEUR 385	Fundamentals of Neuroscience	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>JUNIOR</b>		<b>16 credits</b>	<b>JUNIOR</b>		<b>16 credits</b>
NEUR 385	Fund. Cellular/Molecular Neuro.	3	ELECT	Required Elective Course	3
LAB	Required Lab	2	NEUR 362	Cognitive Neuroscience	3
NEUR 383	Introduction to NeuroEngineering	3	LAB	Required Lab	1
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>SENIOR</b>		<b>18 credits</b>	<b>SENIOR</b>		<b>15 credits</b>
ELECT	Required Elective Course	3	ELECT	Required Elective Course	3
DIST	Distribution Course	3	ELECT	Required Elective Course	3
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3			

## Neuroscience Minor - Requirements

NEUR 380/PSYC 380/BIOC 380    Fundamental Neuroscience Systems

*Each student must also complete the requirements for one area of specialization.*

### **Area of Specialization: Humanities and Social Science**

NEUR 362/PSYC 362                      Cognitive Neuroscience: Exploring the Living Brain

Select at least three courses from the Humanities and Social Sciences specialization electives listed in the 2019 General Announcements (GA).

Select at least one course (at least three credit hours) from the Natural Sciences and Engineering specialization electives listed in the 2019 GA. NEUR 385/BIOC 385 may be used to fill this requirement.

### **Area of Specialization: Natural Sciences and Engineering**

NEUR 385/BIOC 385                      Fundamentals of Cellular and Molecular Neuroscience

Select at least three courses from the Natural Sciences and Engineering specialization electives listed in the 2019 General Announcements (GA).

Select at least one course (at least three credit hours) from the Humanities and Social Sciences specialization electives listed in the 2019 GA. NEUR 362/PSYC 362 may be used to fill this requirement.

At least two of the electives should be completed for the minor only (not shared or double-counted with another major).

# PHYSICS AND ASTRONOMY

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Students in the Department of Physics and Astronomy will acquire and demonstrate a solid foundation of knowledge in physics and/or astronomy and deeper knowledge of subdivisions of the field related to their interests. They will build the theoretical and laboratory skills necessary to succeed in graduate school or in the workplace and become leaders in their chosen discipline.

Students will develop the ability to identify, formulate, and solve challenging scientific and technical problems as encountered in physics and astronomy.

They will acquire basic skills in reading the scientific literature and learn how to communicate scientific results orally and in writing with scientists and the general public.

The BA degrees in physics and astronomy provide a broad liberal education with a concentration in physical science, while allowing time to pursue other interests. Graduates typically seek employment in a range of professional fields or in secondary teaching.

The BS degrees in physics and astrophysics are intended to provide intensive pre-professional training. Options for specialized study include applied physics, biological physics, and computational physics. Most graduates continue in graduate study or find immediate employment in a technical field.

## Degrees Offered

Physics	BS, BA, minor
Astronomy	BA
Astrophysics	BS



# PHYSICS AND ASTRONOMY

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## Frank Advice

- Talk to the PHYS 111 instructor about AP physics. It is usually better to take PHYS 111/112 rather than jumping straight into PHYS 201. If you are unsure what to do, speak with the PHYS 111 instructor.
- The BA degree, particularly, can be solid preparation for medical school, law school, or teaching, but you will need additional course work specific to those areas.
- A senior research project and thesis are required for the BS degrees. Prior to that, there are summer research experiences available with faculty in the department and at many other universities and national labs. Announcements are distributed to majors via email regularly.
- Not required but highly recommended: You should have some exposure to computer programming and numerical mathematics, at least at the level of CAAM 210.

## Physics BA - Requirements

MATH 101 or MATH 105	Single Variable Calculus I or AP/OTH credit in Calculus I
MATH 102 or MATH 106	Single Variable Calculus II or AP/OTH credit in Calculus II
MATH 211	Ordinary Differential Equations and Linear Algebra
or MATH 220	or Honors Ordinary Differential Equations
or MATH 221	or Honors Calculus III
MATH 212 or MATH 222	Multivariable Calculus or Honors Calculus IV

*One from:*

PHYS 101 and 103	Mechanics (with lab) and Mechanics Discussion
PHYS 111	Honors Mechanics (with lab)

*One from:*

PHYS 102 and 104	Electricity and Magnetism (with lab) and E&M Discussion
PHYS 112	Honors Electricity and Magnetism (with lab)

PHYS 201	Waves, Light, and Heat
PHYS 202	Modern Physics
PHYS 231	Elementary Physics Lab
PHYS 311	Introduction to Quantum Physics I

*Two from:*

PHYS 301	Intermediate Mechanics
PHYS 302	Intermediate Electrodynamics
PHYS 312	Introduction to Quantum Physics II
PHYS 355	Introduction to Biological Physics
PHYS 411	Introduction to Nuclear & Particle Physics
PHYS 416	Computational Physics
PHYS 425	Statistical and Thermal Physics
PHYS 480	Introduction to Plasma Physics

Select six additional credit hours of PHYS or ASTR courses at the 300-level or above

CAAM 210	Introduction to Engineering Computation
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Physics BA

**SAMPLE DEGREE PLAN**

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL				SPRING			
<b>FRESHMAN</b>			<b>14 credits</b>	<b>FRESHMAN</b>			<b>16 credits</b>
PHYS 101	Mechanics (with lab)	4		PHYS 102	Electricity & Magnetism (with lab)	4	
PHYS 103	Mechanics Discussion	0		PHYS 104	E & M Discussion	0	
MATH 101	Single Variable Calculus I	3		MATH 102	Single Variable Calculus II	3	
FWIS	First Year Writing-Intensive Seminar	3		DIST	Distribution Course	3	
LPAP	Lifetime Physical Activity Elective	1		OPEN	Open Elective	3	
OPEN	Open Elective	3		OPEN	Open Elective	3	
<b>SOPHOMORE</b>			<b>15 credits</b>	<b>SOPHOMORE</b>			<b>16 credits</b>
PHYS 201	Waves, Light and Heat	3		PHYS 202	Modern Physics	3	
MATH 212	Multivariable Calculus	3		PHYS 231	Elementary Physics Lab	1	
DIST	Distribution Course	3		MATH 211	Differential Equations	3	
OPEN	Open Elective	3		DIST	Distribution Course	3	
OPEN	Open Elective	3		OPEN	Open Elective	3	
				OPEN	Open Elective	3	
<b>JUNIOR</b>			<b>13 credits</b>	<b>JUNIOR</b>			<b>16 credits</b>
PHYS 301	Intermediate Mechanics	4		PHYS 302	Intermediate Electrodynamics	4	
PHYS 311	Intro to Quantum Physics I	3		CAAM 210	Intro to Engineering Computation	3	
DIST	Distribution Course	3		DIST	Distribution Course	3	
OPEN	Open Elective	3		OPEN	Open Elective	3	
				OPEN	Open Elective	3	
<b>SENIOR</b>			<b>15 credits</b>	<b>SENIOR</b>			<b>15 credits</b>
PHYS/ASTR	Advanced PHYS/ASTR lecture	3		PHYS/ASTR	Advanced PHYS/ASTR lecture	3	
DIST	Distribution Course	3		OPEN	Open Elective	3	
OPEN	Open Elective	3		OPEN	Open Elective	3	
OPEN	Open Elective	3		OPEN	Open Elective	3	
OPEN	Open Elective	3		OPEN	Open Elective	3	

## Physics BS - Requirements

One from:

PHYS 101 and 103	Mechanics (with lab) and Mechanics Discussion
PHYS 111	Honors Mechanics (with lab)

One from:

PHYS 102 and 104	Electricity and Magnetism (with lab) and E & M Discussion
PHYS 112	Honors Electricity and Magnetism (with lab)

PHYS 201	Waves, Light, and Heat
PHYS 202	Modern Physics
PHYS 231	Elementary Physics Lab
PHYS 301	Intermediate Mechanics
PHYS 311	Introduction to Quantum Physics I
PHYS 491/493	Undergraduate Research and Undergraduate Research Seminar
PHYS 492/494	Undergraduate Research and Undergraduate Research Seminar
MATH 101 or MATH 105	Single Variable Calculus I or AP/OTH credit in Calculus I
MATH 102 or MATH 106	Single Variable Calculus II or AP/OTH credit in Calculus II
MATH 211	Ordinary Differential Equations and Linear Algebra
or MATH 220	or Honors Ordinary Differential Equations
or MATH 221	or Honors Calculus III
MATH 212 or 222	Multivariable Calculus or Honors Calculus IV

*Each student must complete the additional courses for one major concentration.*

### Major Concentration: Applied Physics

PHYS 302	Intermediate Electrodynamics
PHYS 312 or ELEC 361	Introduction to Quantum Physics II or Quantum Mechanics for Engineers
PHYS 332	Junior Physics Lab II
ELEC 364	Photonics Measurements: Principles and Practice
PHYS 412	Solid State Physics (or approved substitute in applied physics)
PHYS 425	Statistical and Thermal Physics
ELEC 242 and ELEC 244 or ELEC 243	Fundamentals of Electrical Engineering II <i>and</i> Fundamentals of Electrical Engineering II Lab <i>or</i> Electronic Measurement Systems
ELEC 305	Introduction to Physical Electronics
MATH 381 or CAAM 336	Introduction to Partial Differential Equations <i>or</i> Differential Equations in Science and Engineering

### Major Concentration: Biological Physics

PHYS 302	Intermediate Electrodynamics
PHYS 312	Introduction to Quantum Physics II
PHYS 355	Introduction to Biological Physics
PHYS 425	Statistical and Thermal Physics
BIOC 201	Introductory Biology

*(continued)*

## Physics BS - Requirements

### Major Concentration: Biological Physics *continued*

BIOC 211	Intermediate Experimental Biosciences
BIOC 301 <i>or</i> BIOC 341	Biochemistry I <i>or</i> Cell Biology
CHEM 121/122/123/124*	General Chemistry I & II <i>and</i> General Chemistry Lab I & II
CHEM 211/213	Organic Chemistry I and Organic Chemistry Discussion
MATH 381 <i>or</i> CAAM 336	Introduction to Partial Differential Equations <i>or</i> Differential Equations in Science and Engineering

\* CHEM 111/112/113/114 *or* CHEM 151/152/153/154 may substitute for CHEM 121/122/123/124

### Major Concentration: Computational Physics

PHYS 302	Intermediate Electrodynamics
PHYS 312 <i>or</i> PHYS 425	Intro. to Quantum Physics II <i>or</i> Statistical and Thermal Physics
PHYS 416	Computational Physics
CAAM 210	Introduction to Engineering Computation
CAAM 334 <i>or</i> CAAM 335	Matrix Analysis for Data Sciences <i>or</i> Matrix Analysis
CAAM 336	Differential Equations in Science and Engineering
CAAM 453	Numerical Analysis I
COMP 130 <i>or</i> COMP 140	Elements of Algorithms and Computation <i>or</i> Computational Thinking

*Two courses from:*

CAAM 435/MATH 435	Dynamical Systems
CAAM 454	Numerical Analysis II
CAAM 519	Computational Science I
CAAM 520	Computational Science II
CAAM 536/CEVE 555	Numerical Methods for Partial Differential Equations
PHYS 580	Introduction to Plasma Physics

### Major Concentration: General Physics

PHYS 302	Intermediate Electrodynamics
PHYS 312	Introduction to Quantum Physics II
PHYS 332	Junior Physics Lab II
PHYS 425	Statistical and Thermal Physics

*Two courses from:*

PHYS 355	Introduction to Biological Physics
PHYS 411	Introduction to Nuclear and Particle Physics
PHYS 412	Solid State Physics
PHYS 416	Computational Physics
PHYS 480	Introduction to Plasma Physics

MATH 381 <i>or</i> CAAM 336	Introduction to Partial Differential Equations <i>or</i> Differential Equations in Science and Engineering
MATH 382 <i>or</i> CAAM 334 <i>or</i> CAAM 335	Computational Complex Analysis <i>or</i> Matrix Analysis for Data Science <i>or</i> Matrix Analysis

Physics BS - General Physics Concentration

**SAMPLE DEGREE PLAN**

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN</b>		<b>14 credits</b>	<b>FRESHMAN</b>		<b>16 credits</b>
PHYS 101	Mechanics (with lab)	4	PHYS 102	Electricity & Magnetism (with lab)	4
PHYS 103	Mechanics Discussion	0	PHYS 104	E & M Discussion	0
MATH 101	Single Variable Calculus I	3	MATH 102	Single Variable Calculus II	3
FWIS	First Year Writing-Intensive Seminar	3	DIST	Distribution Course	3
LPAP	Lifetime Physical Activity Elective	1	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>SOPHOMORE</b>		<b>15 credits</b>	<b>SOPHOMORE</b>		<b>16 credits</b>
PHYS 201	Waves, Light and Heat	3	PHYS 202	Modern Physics	3
MATH 212	Multivariable Calculus	3	PHYS 231	Elementary Physics Lab	1
DIST	Distribution Course	3	MATH 211	Differential Equations	3
OPEN	Open Elective	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
			OPEN	Open Elective	3
<b>JUNIOR</b>		<b>16 credits</b>	<b>JUNIOR</b>		<b>15 credits</b>
PHYS 301	Intermediate Mechanics	4	PHYS 302	Intermediate Electrodynamics	4
PHYS 311	Intro to Quantum Physics I	3	PHYS 312	Intro to Quantum Physics II	3
CAAM 336	Differential Equations in Science and Engineering	3	PHYS 332	Junior Physics Lab II	2
OPEN	Open Elective	3	CAAM 335	Matrix Analysis	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>SENIOR</b>		<b>18 credits</b>	<b>SENIOR</b>		<b>15 credits</b>
PHYS 425	Statistical and Thermal Physics	3	PHYS 412	Solid State Physics	3
PHYS 411	Introduction to Nuclear and Particle Physics	3	PHYS 492	Undergraduate Research	2
PHYS 491	Undergraduate Research	2	PHYS 494	Undergraduate Research Seminar	1
PHYS 493	Undergraduate Research Seminar	1	DIST	Distribution Course	3
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3			

## Physics Minor - Requirements

*One from:*

PHYS 101 and PHYS 103 PHYS 111	Mechanics (with lab) and Mechanics Discussion Honors Mechanics (with lab)
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*One from:*

PHYS 102 and PHYS 104  PHYS 112	Electricity and Magnetism (with lab) and E&M Discussion  Honors Electricity and Magnetism (with lab)
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MATH 101 <i>or</i> MATH 105	Single Variable Calculus I <i>or</i> AP/OTH credit in Calculus I
MATH 102 <i>or</i> MATH 106	Single Variable Calculus II <i>or</i> AP/OTH credit in Calculus II
MATH 211 <i>or</i> MATH 221	Ordinary Differential Equations and Linear Algebra <i>or</i> Honors Calculus III
MATH 212 <i>or</i> MATH 222	Multivariable Calculus <i>or</i> Honors Calculus IV
PHYS 201	Waves, Light, and Heat
PHYS 202	Modern Physics

Select a minimum of three courses from PHYS course offerings at the 300-level or above.

## Astronomy BA - Requirements

COMP 130 or COMP 140	Elements of Algorithms and Computation or Computational Thinking
MATH 101 or MATH 105	Single Variable Calculus I or AP/OTH credit in Calculus I
MATH 102 or MATH 106	Single Variable Calculus II or AP/OTH credit in Calculus II
MATH 211	Ordinary Differential Equations and Linear Algebra
or MATH 220	or Honors Ordinary Differential Equations
or MATH 221	or Honors Calculus III
MATH 212 or MATH 222	Multivariable Calculus or Honors Calculus IV

*One from:*

PHYS 101 and PHYS 103	Mechanics (with lab) and Mechanics Discussion
PHYS 111	Honors Mechanics (with lab)

*One from:*

PHYS 102 and PHYS 104	Electricity and Magnetism (with lab) and E&M Discussion
PHYS 112	Honors Electricity and Magnetism (with lab)

PHYS 201	Waves, Light, and Heat
PHYS 202	Modern Physics
PHYS 231	Elementary Physics Lab
PHYS 301	Intermediate Mechanics
PHYS 302	Intermediate Electrodynamics
ASTR 230	Astronomy Lab
ASTR 350	Introduction to Astrophysics - Stars
ASTR 360	Introduction to Astrophysics - Galaxy and Cosmo
ASTR 400	Undergraduate Research Seminar (two semesters)

*One from:*

ASTR 451	Astrophysics I: Sun and Stars
ASTR 452	Astrophysics II: Galaxies and Cosmology
ASTR 470	Solar System Physics
PHYS 480	Introduction to Plasma Physics



## Astronomy BA

### SAMPLE DEGREE PLAN

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN</b>		<b>17 credits</b>	<b>FRESHMAN</b>		<b>16 credits</b>
PHYS 101	Mechanics (with lab)	4	PHYS 102	Electricity & Magnetism (with lab)	4
PHYS 103	Mechanics Discussion	0	PHYS 104	E & M Discussion	0
MATH 101	Single Variable Calculus I	3	MATH 102	Single Variable Calculus II	3
FWIS	First Year Writing-Intensive Seminar	3	DIST	Distribution Course	3
LPAP	Lifetime Physical Activity Elective	1	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3			
<b>SOPHOMORE</b>		<b>16 credits</b>	<b>SOPHOMORE</b>		<b>16 credits</b>
PHYS 201	Waves, Light and Heat	3	PHYS 202	Modern Physics	3
MATH 212	Multivariable Calculus	3	PHYS 231	Elementary Physics Lab	1
COMP 140	Computational Thinking	3	MATH 211	Differential Equations	3
DIST	Distribution Course	3	ASTR 230	Astronomy Lab	3
OPEN	Open Elective	4	OPEN	Open Elective	3
			OPEN	Open Elective	3
<b>JUNIOR</b>		<b>14 credits</b>	<b>JUNIOR</b>		<b>14 credits</b>
PHYS 301	Intermediate Mechanics	4	PHYS 302	Intermediate Electrodynamics	4
ASTR 350	Intro to Astrophysics - Stars	3	ASTR 360	Intro to Astrophysics - Galaxy and Cosmo	3
ASTR 400	Undergraduate Research Seminar	1	ASTR 400	Undergraduate Research Seminar	1
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>SENIOR</b>		<b>15 credits</b>	<b>SENIOR</b>		<b>15 credits</b>
ASTR 451	Astrophysics I - Sun and Stars	3	DIST	Distribution Course	3
DIST	Distribution Course	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3

## Astrophysics BS - Requirements

COMP 130 <i>or</i> COMP 140	Elements of Algorithms and Computation <i>or</i> Computational Thinking
MATH 101 <i>or</i> MATH 105	Single Variable Calculus I <i>or</i> AP/OTH credit in Calculus I
MATH 102 <i>or</i> MATH 106	Single Variable Calculus II <i>or</i> AP/OTH credit in Calculus II
MATH 211	Ordinary Differential Equations and Linear Algebra
<i>or</i> MATH 220	<i>or</i> Honors Ordinary Differential Equations
<i>or</i> MATH 221	<i>or</i> Honors Calculus III
MATH 212 <i>or</i> MATH 222	Multivariable Calculus <i>or</i> Honors Calculus IV
<i>One from:</i>	
PHYS 101 and 103	Mechanics (with lab) and Mechanics Discussion
PHYS 111	Honors Mechanics (with lab)
<i>One from:</i>	
PHYS 102 and 104	Electricity and Magnetism (with lab) and E&M Discussion
PHYS 112	Honors Electricity and Magnetism (with lab)
PHYS 201	Waves, Light, and Heat
PHYS 202	Modern Physics
PHYS 231	Elementary Physics Lab
PHYS 301	Intermediate Mechanics
PHYS 302	Intermediate Electrodynamics
PHYS 311	Introduction to Quantum Physics I
PHYS 425	Statistical and Thermal Physics
PHYS 491/493	Undergraduate Research and Undergraduate Research Seminar
PHYS 492/494	Undergraduate Research and Undergraduate Research Seminar
ASTR 230	Astronomy Lab
ASTR 350	Introduction to Astrophysics - Stars
ASTR 360	Introduction to Astrophysics - Galaxy and Cosmo
ASTR 400	Undergraduate Research Seminar (two semesters)
<i>Three courses from:</i>	
ASTR 408	Statistical Methods in Physics and Astronomy
ASTR 451	Astrophysics I: Sun and Stars
ASTR 452	Astrophysics II: Galaxies and Cosmology
ASTR 470	Solar System Physics
PHYS 312	Introduction to Quantum Physics II
PHYS 480	Introduction to Plasma Physics

**Astrophysics BS**

**SAMPLE DEGREE PLAN**

*This is **only one** of many possible ways to fulfill your degree requirements.*

FALL			SPRING		
<b>FRESHMAN 17 credits</b>			<b>FRESHMAN 16 credits</b>		
PHYS 101	Mechanics (with lab)	4	PHYS 102	Electricity & Magnetism (with lab)	4
PHYS 103	Mechanics Discussion	0	PHYS 104	E & M Discussion	0
MATH 101	Single Variable Calculus I	3	MATH 102	Single Variable Calculus II	3
FWIS	First Year Writing-Intensive Seminar	3	DIST	Distribution Course	3
LPAP	Lifetime Physical Activity Elective	1	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3			
<b>SOPHOMORE 16 credits</b>			<b>SOPHOMORE 16 credits</b>		
PHYS 201	Waves, Light and Heat	3	PHYS 202	Modern Physics	3
MATH 212	Multivariable Calculus	3	PHYS 231	Elementary Physics Lab	1
COMP 140	Computational Thinking	4	MATH 211	Differential Equations	3
DIST	Distribution Course	3	ASTR 230	Astronomy Lab	3
OPEN	Open Elective	3	DIST	Distribution Course	3
			OPEN	Open Elective	3
<b>JUNIOR 17 credits</b>			<b>JUNIOR 17 credits</b>		
PHYS 301	Intermediate Mechanics	4	PHYS 302	Intermediate Electrodynamics	4
PHYS 311	Intro to Quantum Physics I	3	ASTR 360	Intro to Astrophysics - Galaxy and Cosmos	3
ASTR 350	Intro to Astrophysics - Stars	3	ASTR 400	Undergraduate Research Seminar	1
ASTR 400	Undergraduate Research Seminar	1	PHYS 312	Intro to Quantum Physics II	3
CAAM 336	Differential Equations in Science and Engineering	3	DIST	Distribution Course	3
OPEN	Open Elective	3	OPEN	Open Elective	3
<b>SENIOR 18 credits</b>			<b>SENIOR 18 credits</b>		
PHYS 425	Statistical and Thermal Physics	3	PHYS 492	Undergraduate Research	2
PHYS 491	Undergraduate Research	2	PHYS 494	Undergraduate Research Seminar	1
PHYS 493	Undergraduate Research Seminar	1	ASTR 452	Astrophysics II - Galaxies and Cosmology	3
ASTR 451	Astrophysics I - Sun and Stars	3	DIST	Distribution Course	3
DIST	Distribution Course	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3
OPEN	Open Elective	3	OPEN	Open Elective	3

# DEGREE REQUIREMENTS

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**From Rice University's General Announcements, in order to graduate from Rice University, all students must:**

- Be registered at Rice University full time for at least four full fall and/or spring semesters.
- Complete the requirements of at least one major and degree program.
- Complete at least 120 semester credit hours (some degree programs require more than a minimum 120 credit hours).
- Complete at least 60 semester credit hours at Rice University.
- Complete at least 48 semester credit hours in upper-level coursework (courses at the 300-level or higher).
- Complete more than half of the upper-level coursework (at least 25 of the 48 minimum semester credit hours) at Rice University.
- Complete more than half of the upper-level coursework required by the declared major(s) at Rice University (as designated by the department or program, some may specify a higher proportion).
- Complete at least 60 semester credit hours outside of major requirements for Bachelor of Arts and Bachelor of Science degrees. Exceptions include:
  - Students pursuing the BA degree with a major in architecture must complete at least 45 credit hours outside of major requirements.
  - Students pursuing the BMus (Bachelor of Music) degree, or a BS degree in engineering are not subject to this "outside of major" requirement.
- Complete all Rice coursework with a cumulative grade point average of at least 1.67 or higher.
- Complete all Rice coursework that satisfy major, minor and/or certificate requirements (as designated by the department or program):
  - with a cumulative grade point average of at least 2.00 or higher.
  - with the actual grade earned (i.e., not on a Pass/Fail basis).
- Satisfy the Writing and Communication Requirement (see below).
- Complete courses to satisfy the Distribution Requirements (see below).
- Complete one Lifetime Physical Activity Program (LPAP) course for one credit. Students with disabilities may make special arrangements to satisfy this requirement.
- Otherwise be a student in good academic and disciplinary standing and not under investigation.

# DEGREE REQUIREMENTS

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## **Writing and Communication Requirement**

All students must complete and pass a First-Year Writing-Intensive Seminar (FWIS). An FWIS is a content-based, 3-credit hour seminar open only to first-year students that can focus on any topic, and in which writing and communication pedagogy plays a significant role in assignments and grading.

## **Distribution Requirements**

Distribution courses introduce the knowledge, intellectual skills and habits of thought characteristic of disciplines or of inquiry across disciplines within three main areas: humanities, social sciences, and natural sciences and engineering. They are broad-based, accessible to non-majors, and provide a foundation that enables students to integrate knowledge from multiple perspectives. No single course is expected to fulfill all the criteria or goals of a distribution group. Courses that presume students' special expertise or that teach techniques or career-based skills without exposure to modes of analysis and scholarship in the relevant discipline are not eligible for distribution credit. Research or independent study courses and internships and practica are also excluded.

Each student is required to complete **at least 3 courses of designated distribution courses of at least 3 credit hours each in each of Distribution Groups I, II, and III**. The 3 courses in each group must include courses in at least two departments in that group. Divisional or interdisciplinary designations, e.g., HUMA or NSCI, count as departments.

Students must complete the distribution requirements in each group by taking courses that are designated as a distribution course at the time of course registration, as published in that semester's *Course Offerings*.

## **Dual-Degree Requirements**

To earn a second four-year bachelor's degree, also known as a dual degree, currently enrolled undergraduates who have not yet completed their first bachelor's degree must:

- be accepted for the second major by the major's department or program.
- fulfill all requirements for the second degree.
- complete at least 30 additional semester hours at Rice University, beyond the hours required for their first degree (these hours are applied to the second degree).

# MAJOR ADVISORS

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## BIOSCIENCES

### Biochemistry and Cell Biology

#### Prospectives, freshmen and undeclared sophomores

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# MAJOR ADVISORS

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## EARTH, ENVIRONMENTAL AND PLANETARY SCIENCES

### Geology and Environmental

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### Geology, Geochemistry, and Geophysics

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## ENVIRONMENTAL SCIENCE

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# MAJOR ADVISORS

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## MATHEMATICS

### Major Advisors

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### Minor Advisors

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### Calculus Coordinator

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## PHYSICS AND ASTRONOMY

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### Computational Physics

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