

Biology



Undergraduate Handbook

www.bio.umass.edu/biology

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The Field

Biology is the science of life. The vast scope of its subject matter makes biology an extremely diverse field of study. This diversity stems not only from the tremendous variety of life forms with which we share our planet, but also from the multiple levels of organization available for biological investigation. Given an organism, a biologist might choose to investigate how it behaves, how it fits into its ecosystem, the mechanisms by which its genes shape its appearance, what its ancestors were like, how its cells divide, how it grows and develops, or how it derives energy from nourishment. Biological inquiry encompasses perspectives from the planetary to the submicroscopic.

The wide array of biological perspectives is reflected in the many subdisciplines of the field. Genetics, anatomy, physiology, ecology, ethology, botany, neurobiology, systematics, molecular biology, developmental biology, paleontology, and cell biology are just a few of the multitude of specializations that, taken together, compose biology. Given the plethora of approaches that coexist under the biological umbrella, a casual observer might believe that biology is an intellectually fragmented and diffuse endeavor. Fortunately, biology, in all of its glorious diversity, is unified by a few grand ideas. In particular, the theory of evolution provides a conceptual framework that draws together the far-flung threads of biological thought.

Like other scientists, biologists use the scientific method to develop explanations for the patterns and processes that they observe in the natural world. The practice of biology thus involves both systematic observation, often aided by sophisticated instruments, and experimentation. Biologists may work in laboratories or in the field; some of the best biological research combines data gathered in both settings.

Career Opportunities

For many biology majors, undergraduate studies are preliminary to the pursuit of an advanced degree that will lead to a career as a medical doctor, veterinarian, academic, or scientist. A graduate degree is not, however, required to pursue a career related to biology. A bachelors degree in biology can lead to employment in the large and growing biotechnology, health care, or pharmaceutical industries. Many openings in these dynamic, high-tech fields require a degree in the life sciences. Biology majors are likewise well prepared for careers as secondary-school science teachers. Certain government agencies, including the National Park Service and the Environmental Protection Agency, also regularly hire biology graduates, as do private environmental and conservation organizations. Employers of all types recognize that a person with a science degree is likely to be comfortable with logical, quantitative thinking.

The Major

The Biology major is open to all students with an interest in biology. The course requirements for the major emphasize fundamental scientific concepts while allowing students to tailor a program to their own interests. All majors are required to complete a core sequence that includes basic math and science courses and a two-semester introduction to biology. The elective portion of the degree is more flexible and is intended to allow students to select a personalized array of courses while sampling the breadth of biology.

The Faculty

The Biology faculty includes more than thirty distinguished scientists, many of whom are very prominent in their fields. Most of these researchers regularly invite selected undergraduates to join their research teams. The faculty is proud of the many research opportunities that it is able to extend to undergraduates, but may take even more pride in its commitment to teaching. Many excellent teachers fill the ranks of the Biology faculty, including four winners of the prestigious UMass Distinguished Teacher Award.

Transfers

Courses completed elsewhere and accepted for transfer credit may substitute for some required courses. All post-introductory biology courses, however, must be completed in UMass Amherst.

The Minor

An undergraduate minor in Biology requires successful completion of at least 18 credits (all with grade of 'C' or better) from the Biological Sciences Core:

- 1) Biol 151, 152, and 153 (lab) Intro Biology I and II
- 2) Three additional Biology Department courses chosen from the list of approved courses* for the major (see page 4), subject to the following stipulations.
 - a) Each of the three courses must be from a different subject area (see page 4 for a list of courses in each area).
 - b) No more than one of the three courses may also be used to satisfy the requirements of another major.
 - c) Only 3-credit and 4-credit courses may be used.
 - d) Only Biology Department courses may be used.
 - e) All three courses must be taken at UMass Amherst.

*Note that some courses on the list of courses approved for the major are restricted to Biology majors. These courses are not available to students pursuing a minor.

Honors

Highly motivated and academically accomplished majors may choose an honors track. The honors track provides opportunities for close interaction with faculty, and for participation in original biological research.

To be eligible for Departmental Honors, a student must be a member of the Commonwealth Honors College (for info about joining, see www.honors.umass.edu/joining-honors-college). Honors College members who wish to enroll in Departmental Honors should contact Gerry Downes or Lynn Adler (the Biology honors coordinators). This is best done during the sophomore or junior years.

The following academic requirements must be completed to graduate with Departmental Honors:

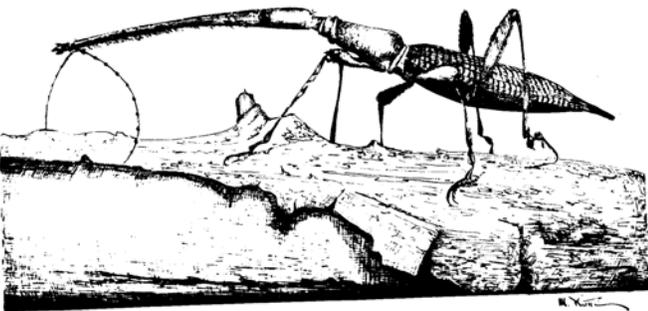
- One Biology honors course at any level with grade of B or better
- One Biology honors course numbered 300 or higher with grade of B or better
- Either BIOL 499Y “Honors Research” and BIOL 499T “Honors Thesis” with grade of B or better in both, OR an Honors Project Seminar. Contact a Biology honors coordinator to find out if any current seminars are accepted for Biology departmental honors.

Dissection

The laboratory component of some Biology courses includes the examination and/or dissection of animals. For a description of the use of animals in a particular course, contact the course instructor or the Biology Undergraduate Office.

Study Abroad

Students are encouraged to spend one or two semesters studying abroad. Study abroad offers a valuable opportunity for enrichment and to gain perspective on the field of biology.



Course requirements

At least 67 credits, with a minimum grade of C- required in courses in the Math and Physical Sciences Core, and a minimum grade of C in all other courses counted toward the major requirements.

Note: students considering a double major should be sure to read the stipulation described at the bottom of this page.

A. Math and Physical Sciences Core (30 credits)

1. PHYSIC 131 and 132 Introductory Physics;
2. CHEM 111 and 112 General Chemistry;
3. CHEM 261, 262, and 269 Organic Chem/Organic Lab;
4. One of the following courses:
 - STATISTC 240 Intro to Statistics;
 - RES ECON 212 Intro Statistics/Life Science;
5. One of the following courses:
 - MATH 127 Calculus for Life & Social Sciences;
 - MATH 128 Calculus for Life & Social Sciences;
 - STATISTC 501 Methods of Applied Statistics;
 - CMPSCI 121 Problem Solving with Computers.

B. Biological Science Core (37 credits)

1. BIOL 151, 152, and 153 (lab) Introductory Biology; *Notes:*
 - 1) *Biology majors must achieve a grade of C or better in BIOL 151, 152, and 153 before additional Biology courses may be taken.*
2. BIOL 312 Writing in Biology.
3. At least 25 additional credits in biological science courses numbered 200 or above. These credits must include:
 - a) at least 13 credits in courses numbered 315 and above;
 - b) at least one course related to plant biology and one course related to animal biology;
 - c) at least two courses with a laboratory or field component;
 - d) at least one course in four of the following five areas: Genetics and Molecular Biology, Cellular Biology and Development, Physiology, Evolution and Biodiversity, Ecology and Behavior.

The 25 additional credits may include up to 3 credits of independent study, up to 3 credits of teaching practicum in a Biology Department course, and up to 6 credits from an off-campus internship enrolled through Career Services. However, no more than 6 total credits from these sources (independent study, teaching practicum, internship) may be counted toward the 25 additional credits. Note that Biol 494LI does not count toward the 25 additional credits.

The 25 additional credits **MUST** be taken at UMass Amherst. Note that this stipulation means that we do not accept courses taken in other departments at UMass Amherst (with the exception of the non-Biology UMass courses that are on the list of approved courses), or at other colleges. (Exceptions: With advance approval from his or her advisor, a student may substitute 500-level courses taken in a UMass Amherst department other than the Biology Department, Five College courses, or courses taken as part of a study-abroad program.)

Elective courses for the biology core

The following lists specify the courses that may be taken toward fulfillment of the biology core requirement. If a course appears in more than one area, it may be used to fill only one area requirement.

GENETICS and MOLECULAR BIOLOGY

BIOL 311 General Genetics (formerly BIOL 283)
BIOL 284 Genetics Lab [LAB]
BIOL 285 Cell & Molecular Biology
BIOL 379H Genomics and Bioinformatics
BIOL 383H Gene and Genome Analysis [LAB] [PLANT]
BIOL 397MH Cell & Molecular Biology Lab [LAB, PLANT]
BIOL 484 Cancer Genetics
BIOL 486H Molecular Biology of Model Systems [LAB] [PLANT]
BIOL 497G Human Genome Analysis
BIOL 514 Population Genetics
BIOL 583 Advanced Genetics
BIOL 597GE Evolutionary Genetics

CELLULAR BIOLOGY and DEVELOPMENT

BIOL 285 Cell & Molecular Biology
BIOL 397MH Cell & Molecular Biology Lab [LAB, PLANT]
BIOL 475 Plant Cell Biology [PLANT]
BIOL 477H Bioimaging [LAB]
BIOL 523 Histology [LAB]
BIOL 559 Cell and Molecular Biology II
BIOL 580 Developmental Biology
BIOL 582 From DNA to Diversity: Evolution and Development of Animal Form
ANIMSCI 390E Fundamental Vert. Embryology [Lab]
ANIMSCI 581 Cancer Biology

PHYSIOLOGY

BIOL 288 Introductory Physiology
BIOL 397N Neurobiology and Physiology Lab [LAB]
BIOL 497AM Animal Movement
BIOL 510 Plant Physiology [PLANT]
BIOL 564 Human Physiology
BIOL 566 Comparative Animal Physiology
BIOL 568 Endocrinology
BIOL 572 Neurobiology
BIOL 597MN Modern Methods in Neurobiology
BIOL 597NB Developmental Neurobiology
BIOL 597NE The Neural Basis of Animal Behavior
ANIMSCI 372 Animal Diseases
ANIMSCI 421 Wildlife Reproduction
ANIMSCI 572 Infection and Immunity

EVOLUTION and BIODIVERSITY

BIOL 273 Marine Vertebrates
BIOL 280 Evolution
BIOL 424 Marine Biology
BIOL 426 New England Flora [LAB][PLANT]
BIOL 487H Tropical Field Biology [LAB] [PLANT]
BIOL 514 Population Genetics
BIOL 521 Comparative Vertebrate Anatomy [LAB]
BIOL 528 Principles of Evolution
BIOL 540 Herpetology [LAB]
BIOL 542 Ichthyology [LAB]
BIOL 544 Ornithology [LAB]
BIOL 548 Mammalogy [LAB]
BIOL 582 From DNA to Diversity: Evolution and Development of Animal Form
BIOL 597GE Evolutionary Genetics
BIOL 597PD Dimensions of Plant Diversity [LAB] [PLANT]
ENVIRSCI 515 Microbiology of the Soil

ECOLOGY and BEHAVIOR

BIOL 287 Introductory Ecology
BIOL 421 Plant Ecology [LAB] [PLANT]
BIOL 422H Experimental Methods in Ecology [LAB] [PLANT]
BIOL 426 New England Flora [LAB][PLANT]
BIOL 487H Tropical Field Biology [LAB] [PLANT]
BIOL 544 Ornithology [LAB]
BIOL 550 Animal Behavior [LAB]
BIOL 551 Animal Communication
BIOL 596Z Amazon Aquatic Ecology [LAB]
NRC 590AE Aquatic Ecology
NRC 590IE Invasion Ecology
NRC 590M Marine Ecology
NRC 547 Global Change Ecology
NRC 566 Restoration Ecology
NRC 470 Ecology of Fish [Lab]

MISCELLANEOUS

BIOL 335 Topics in Plant Biology [PLANT]
BIOL 401 Great Papers in Biology
BIOL 461 Vertebrate Collections Management

[PLANT] = Course that fulfills the “plant course” requirement.

[LAB] = Course that fulfills the “lab or field component” requirement.

CHECKLIST FOR BIOLOGY GRADUATION REQUIREMENTS

MATH COURSES (all grades C- or better)

TAKE **ONE** COURSE FROM GROUP A, AND **ONE** FROM GROUP B

group A	{	STAT 240 Intro to Stats	_____	Cannot sub Stat 111, Stat 140, or equivalent
		RES ECON 212 Intro Stat/Soc Sci	_____	
group B	{	MATH 127 Calculus I	_____	
		MATH 128 Calculus II	_____	
		STAT 501 Methods of Applied Stats	_____	
		CMPSCI 121 Intro to Problem Solving	_____	

PHYSICAL SCIENCE COURSES (all grades C- or better)

PHYSICS 131 and 132 Intro Physics I & II	_____	_____
CHEM 111 and 112 General Chem I & II	_____	_____
CHEM 261 and 262/269 Org Chem I & II	_____	_____

BIOLOGY COURSES (all grades C or better, except Biol 494LI, D or better)

BIOL 151 and 152/153 Intro Biology I & II	_____	_____	_____
BIOL 312 Writing in Biology	_____		
BIOL 494LI Life After Biology**	_____		

Courses below this line must be from the approved courses list and must total 25 credits. # CR 200 # CR 315+ (at least 13 CR must be 315+)

Genetics COURSE	# _____	_____	_____] must have four of five
Cell COURSE	# _____	_____	_____	
Physiol COURSE	# _____	_____	_____	
Evolution COURSE	# _____	_____	_____	
Ecol COURSE	# _____	_____	_____	
other COURSE	# _____	_____	_____	animal course? _____
other COURSE	# _____	_____	_____	plant course? _____
other COURSE	# _____	_____	_____	IE course**? _____
other COURSE	# _____	_____	_____	two labs? _____
other COURSE	# _____	_____	_____	
other COURSE	# _____	_____	_____	

total credits _____ + _____ grand total _____

Integrative Experience for Biology majors

In addition to the major requirements, all Biology majors must complete a University general education requirement known as the Integrative Experience (IE). The IE should be completed in the junior or senior year. It has two components:

1. Take Biology 494 LI, Life After Biology (1-cr seminar, offered every semester)
2. Make sure that your upper-level elective courses include at least one of the following courses:

- Biology 383H Gene and Genome Analysis
- Biology 421 Plant Ecology
- Biology 477H BioImaging
- Biology 487H Tropical Field Biology
- Biology 514 Population Genetics
- Biology 523 Histology
- Biology 540 Herpetology
- Biology 550 Animal Behavior
- Biology 551 Animal Communication
- Biology 572 Neurobiology

Research Opportunities

One of the great advantages of attending a major research institution like UMass is that you can get into a real, working lab and do some research yourself. There's no better way to learn how science is really done, and no better way of gaining an in-depth understanding of your favorite sub-discipline. If you're considering a research career and want to get an idea of what a researcher's work life is like, if you want a chance to explore biology outside of the classroom, or if you just want a richer scientific education, you really should look into getting some research experience.

You can do research during the school year, either for credit (independent study), or as a paid job (funded by a faculty sponsor's research grant). Funds are also awarded each year to twelve Junior Fellows (actually seniors with good academic track records). This program has a competitive selection process. Contact the Biology Undergraduate Office for more info.

Useful contact information

Biology Undergraduate Office, 216 Morrill, 413-545-2287

Call or stop by for info or to make an advising appointment.

Or make an appointment online: <https://umass.campus.eab.com>.

Bruce Byers	Undergraduate Program Coordinator	bbyers@bio.umass.edu	413-545-1236
Meghan Gerson	Biology Advisor	mtgerson@bio.umass.edu	413-577-2929
Emily Fleming	Biology Advisor	etfleming@umass.edu	
Susan Clevenger	Biology Undergrad Assistant	suec@bio.umass.edu	413-545-2287
Carrie Howard	Biology Undergrad Assistant	cahoward@bio.umass.edu	413-545-1783
Wilmore Webley	PreMed Director	wilmore@microbio.umass.edu	
Catherine Eden	PreMed Advisor	ceden@cns.umass.edu	413-545-3819
Faith Nussbaum	PreMed Advisor	fnussbaum@cns.umass.edu	413-545-3819
Dean's Office		220 Morrill	413-545-1969



Answers to questions about registration

What is registration?

Each semester, students can select courses for the *following* semester. Registration for Spring semester courses begins in November, and Fall semester registration begins late March. All course-choosing is done on the web, using the SPIRE system.

Why should I register early?

Without question, prompt registration is the best way to ensure that you get the courses that you want. Every semester, some courses get oversubscribed, including upper-level courses. On the other side of the coin, some less-popular courses may be canceled if too few people register. So, if you really want to have as many choices as possible, register as soon as possible after your enrollment period begins. It's a great way to reduce your beginning-of-the-semester anxiety. You'll feel a lot more relaxed if you arrive back on campus with a full schedule in hand.

When can I register?

Access begins first for seniors, and on various dates thereafter for juniors, sophomores, and freshman. Look carefully at your record on SPIRE so that you know exactly when your registration period begins (look under 'Enrollment Appointment'). If you fail to register as soon as possible, you may find that you cannot get into your preferred courses.

What do I need before I can register?

You need your SPIRE logon ID and password. Your password does not change from semester to semester, so once you get it you don't have to worry about it any more.

What if I don't have my password?

To get your password, you'll have to go to the OIT Help Desk (A109 Lederle) with a photo ID. The Biology department does not have your password. Sorry.

I need help choosing my classes. Who's my advisor?

The Biology Department does not assign you an advisor; you get to choose one (students from other majors should check with their home departments for advising policies). It's nice that you have some choice in the matter, but the downside is that you have to take the initiative to get some advising. Luckily, it's *really* easy to do. Just call 545-2287 or visit Morrill 216. Tell us you'd like to make an appointment with an advisor. We'll set you up with someone whose interests seem to match yours. If all goes well and you like your first advisor, you simply continue to make your future advising appointments with that person. If you don't hit it off with your first advisor, not to worry. Next time, just tell us that you'd like to try someone different. You can also make advising appointments online at <https://umass.campus.eab.com>. You can meet with an advisor anytime.

Is other registration info available on line?

Yes. Check out the Undergraduate Registrar's web site at www.umass.edu/registrar. This site holds a wealth of information. The final exam schedule, the academic calendar, lots of "how to" information, and common questions answered (transcripts, transfer credits, etc., etc.). You can of course also connect to the SPIRE system at any time, and get access to your schedule, grades, transcript, financial aid, and billing information.

Is there a SPIRE trick for finding General Education courses?

If you need a Ged Ed course in a particular category, go to the "Search Schedule of Classes" page. Leave the "Subject" box blank and change the "Session:" box to University. Then scroll down to the "Gen Ed Category" box and choose the category you need (e.g., HS for a history Gen Ed).

Can I change my schedule?

Once the registration period begins, you can change your schedule any time, from any computer with internet access, until access ends about two weeks after the beginning of the semester. Here are a few tips to smooth the process for you.

- If you are unable to make a desired change because a course is full, keep trying. People are adding and dropping continually, so spaces can open up briefly at any time. Persistence often pays off.
- Always add before you drop. Or better yet, use the "swap" function to replace one class with another, or the "edit" function to change labs while remaining in the same lecture. The moment you drop a course, someone else can take your spot. So make sure you're in the course you want before you drop anything. If you drop the lab section of a course with a lab component, you'll automatically be dropped from the lecture, too. If the course is full, you may be unable to get back in.

Answers to questions about registration

How come I can't register for some courses using SPIRE?

A few courses are “off line” and require the professor's signature before you can register. If you want to take such a course (in the Biology Dept.), you'll need to first pick up a course permission form in Morrill 216. Once you have the form, get the appropriate professor to sign it, and then you return it to Sue Clevenger in Morrill 216. Sue will do the processing for you; you don't have to go back to SPIRE to add the course. Note that if you manage to talk a professor into admitting you to an oversubscribed course, you should follow the same procedure as for off-line courses.

The SPIRE system may also prevent you from registering because you haven't met the prerequisites for the course you're trying to register for. If you get this message when you try to register, there are two possible reasons. The first is that you really haven't met the prerequisites. You'll have to choose a different course. The second possibility is that you've met the prerequisites, but the computer doesn't know it. This is especially likely if you're a transfer student and the necessary courses were taken at another institution. If you think that the computer is unjustly denying you access to a course, see Sue Clevenger in Morrill 216 (Biology courses only).

Why do some courses meet from 1:00 A.M. until 1:00 A.M.?

A course listed on SPIRE with a 1:00 A.M. start time is really a course for which the meeting time has not yet been set. The time and place of the course will be chosen later, perhaps by mutual agreement of the course participants. If you've signed up for such a course, be sure to call the course teacher before the beginning of the semester to find out when the first meeting will be. If you can't reach the teacher, come to the Biology Undergrad Office (Morrill 216). There you'll find a list of courses and meeting times.

How do I sign up for independent study?

If you want to do independent study, it's up to you to first make arrangements with a faculty member who will sponsor your project. An advisor can help you identify faculty members that you might approach. Once you've arranged to do independent study for credit, you'll need to register for those credits. To do so, get a course permission form in Morrill 216, fill it out, and have your faculty sponsor sign it. If you're a sophomore sign up for BIOL 296; if you're a junior, BIOL 396; seniors sign up for BIOL 496. Take your signed form to Sue Clevenger in Morrill 216 and she'll take care of adding your credits.

NOTE: If you're doing research for an Honor's thesis, you should contact the Honor's Program to register. It's important that you then notify Sue Clevenger that you've done so, so she'll know which faculty member should deliver your grade.

Can I add a course if I've reached my credit limit?

If your schedule includes 19 credits worth of courses, you won't be able to add any more courses or independent study credits unless you get “credit overload permission.” To get this permission, you must go to the Undergraduate Deans Office (220 Morrill, 545-1969) or apply online at www.cns.umass.edu/students/academic-advising/forms. After you get permission, it usually takes a few days before the approval clears the system and you can add the course.

What if I want to make a change after the registration period is over?

Once the registration period ends, it's no longer possible to change your schedule using SPIRE. You can still add courses, but you must use a “late add” form, which must be signed by the course instructor and by your academic dean (located in the Undergraduate Deans Office, 220 Morrill, 545-1969). The procedure for late drops is a little different. Any time until the midpoint of the semester, you can drop a course for any reason by filling out a “late drop” form and getting the instructor's signature. However, when you do so a “W” will be recorded on your transcript, indicating that you withdrew from the course after the add/drop period. After the midpoint of the semester, a course may be dropped only for extenuating circumstances (e.g. prolonged illness) and only with the permission of your academic dean. The date of the midpoint of each semester is noted in the Academic Calendar that is posted on the Registrar's Office web page. Note that completed late add and late drop forms must be taken to the Registrar's Office, 213 Whitmore.

