

RNR 170 C 1 - Our place in nature: Biology and the environment

General Education, Tier 1, Natural Sciences, 3 units, Spring Semester

“Science is always wrong. It never solves a problem without creating ten more.”

George Bernard Shaw

Course Description

This course involves the study of nature. Our goal is to understand how living things and physical processes interconnect to produce the environments we live in. We explore the relevance of biology to contemporary issues in human society and the prospect of science-based solutions to problems in the environment, medicine, and agriculture. This is a hybrid course that combines on-line content and independent learning with in-person instruction.

Recommended Background

Some exposure to biology in High School may be helpful, but this is not required.

Course Format and Expected Student Effort

This is a “hybrid course” with on-line content primarily from *Introduction to Biology*, which you will access from the course’s D2L website, and one 50-minute in-person discussion/demonstration/activity per week. There will be hands-on observation, experimentation, and data collection and interpretation associated with most in-person meetings. On-line materials that you will need to study will support some of these activities. You should expect to spend about three hours each week working with on-line materials for this course. This will involve reading and completion of short un-graded quizzes. Additional reading and other activities and assignments associated with this course—including outdoor data collection—should require about one to two additional hours outside the classroom each week. **Learning on-line requires discipline and organization that differs from a strictly in-person course.** (We have created [a document that you can download that explains more about success in on-line courses](#) and how the on-line part of this course will operate.)

Locations and Times

The “in-person” portion of the course is held from **12:00-12:50 every Wednesday throughout the semester in ILC 130**. You are expected to be an active participant in our Wednesday meetings and therefore attendance is important if you want to do well in this course. Midterm Exams will also be held Wednesdays during normal class meeting time.

Instructor Information

Steve Smith

Office: 211 Biological Sciences East (the building about 100 m directly southwest of the Science and Engineering Library)

Mailbox: 325 Biological Sciences East

Contact: azalfalf@ag.arizona.edu, 621-5325 (voice only), [Research web page](#)

Office Hours: Wednesdays 8:00-8:45, 10:00-10:45; Thursdays 1:00-3:00 or email for an

appointment at some other time

Course home page: Log in at [D2L.arizona.edu](https://d2l.arizona.edu) ([D2L Help Site](#))

Communication

You are encouraged to [contact Dr. Smith](#) should you have questions or need assistance. Certain rules apply however. Failure to follow these rules will likely result in your communication being ignored:

1. In written communication, normal English grammar, punctuation and sentence structure are required. Abbreviations, as might be used in a text message, will not be read.
2. The composer of all messages (written or voice) must be clearly identified by first and last name and course number. In emails, this is best done in the subject line. Dr. Smith will not respond to anonymous messages or those not linked to a particular course.

Course Objectives

In this course we will help you:

1. Become an informed “citizen biologist” who is able to interpret and understand biological science in an objective manner. The course should prepare you to continue to learn about biology for the rest of your life.
2. Understand the core concepts within biology that are presented in the following statements:
 - a. Basic units of structure define the function of all living things.
 - b. Biological systems grow and change by processes based upon chemical transformation pathways and are governed by physical laws.
 - c. The growth and behavior of organisms are activated through the expression of genetic information.
 - d. The diversity of life evolved over time by processes of mutation, selection and genetic change.
 - e. Living systems are interconnected and interacting and may be greatly influenced by human activity.
3. Become aware of and practice the activities biologists engage in. These include improving your ability to:
 - a. Use observation, experimentation and hypothesis testing.
 - b. Apply quantitative analysis and mathematical reasoning.
 - c. Develop models to study complex systems.
 - d. View biology as an interdisciplinary science.
 - e. Communicate biology to others.
 - f. Appreciate the relationships between biology and society.

Required Content

Introduction to Biology, which is a free on-line learning platform, is required for this course. It is accessible directly from the course D2L website. Its use will be explained in the first class meeting and on the course FAQ page.

Other reading materials may be assigned during the semester and can be accessed from the Content section of the D2L website. No special tools, supplies or laboratory equipment are

needed.

Topics covered¹

| Week | Topics from <i>Introduction to Biology</i> | Wednesday class topic/activity ² |
|-----------------------------------|---|--|
| 1 | 1. Introduction – What is biology and how is it done | Introduction to the course and its mechanics. Communicating science. |
| 2 | 2. Matter – a. Chemistry in living systems | Thinking like a biologist. |
| 3 | b. Biological macromolecules | Life and water. |
| 4 | 3. Life – Cells as the fundamental unit of life | Statistical significance. |
| 5 | | MIDTERM EXAM 1 (12 Feb) |
| 6 | 4. Energy – Metabolism: The chemical reactions that drive life | * Pigments in nature. |
| 7 | | * Carbon cycling and climate change. |
| 8 | 5. Reproduction – a. Cell division builds organisms and allows them to reproduce | * Glucose, insulin and health. |
| 9 | | MIDTERM EXAM 2 (13 Mar) |
| SPRING BREAK – 15-23 March | | |
| 10 | b. Production and transmission of genetic diversity | * Growth, development and sexual reproduction. |
| 11 | c. Storage, transmission and expression of genetic information | * Nature, nurture, and epigenetics. |
| 12 | 6. Evolution – Genetic change and organisms response to the environment | * Biology of human body weight. |
| 13 | | * Agriculture and food security and sovereignty. |
| 14 | 7. Interdependence – Living systems interact with each other and the non-living environment. | * Climate change: Migration, adaptation or extinction? |
| 15 | | * Tracking nitrogen in the biosphere |
| 16 | | Review of the course |

¹ See Course Schedule in the Content Section of D2L website for additional details.

² Wednesday in-person sessions will typically involve a short lecture/discussion to provide background information and then an individual or group activity (each worth 10 points) that may need to be completed outside class. While attendance is never recorded **attendance is very important**. Beginning in Week 6 (Topics with *), we use examples of biology in contemporary society to present problem-solving experiences. Two 50-minute midterm exams will also be conducted in our Wednesday meetings.

Expected Learning Outcomes

(**Examples** represent potential student responses to a short essay question for a single outcome following completion of this course.)

Students completing this course should be able to:

1. Identify and define key terms, concepts and techniques in biology

Example: *Natural selection is one of the primary forces driving the evolution of biological diversity. A series of experiments beginning in the early 20th century established that natural selection was associated with the accumulation of adaptive genetic changes within populations in response to environmental conditions (Topic 6).*

2. Recognize, explain and relate key biological processes as they occur in nature

Example: *Photosynthesis is the biological process through which light energy, water and carbon dioxide is captured and transformed into carbohydrates. This process occurs in plants, but the carbohydrates that are made provide the source of energy upon which all life forms depend. Within an organism the chemical energy*

ultimately originating from photosynthesis is further transformed through the process of respiration, which occurs in mitochondria of all living cells and produces usable energy that powers life (Topic 4).

3. Apply biological understanding and experimental methods to interpret unfamiliar natural phenomena

Example: *Typical processes of cell division and differentiation are not normally controlled in cancer cells and this lack of control may be largely responsible for the disease that these cells are associated with (Topic 3).*

4. Examine and analyze complex processes in nature to produce integrated explanations of these processes

Example: *The element nitrogen is a critical component of all living things and exists within a planet-wide biogeochemical cycle. In this cycle, nitrogen exists in many different chemical forms, most commonly though as nitrogen gas (N_2) in the atmosphere, which is not usable by most life forms. Importantly, some bacteria (nitrogen fixers) are able to convert N_2 into molecules that other organisms can use. Other soil bacteria and fungi are also able to break down dead organisms to generate a variety of N-containing molecules that may then be utilized by other organisms (Topics 2 & 7).*

5. Use knowledge to formulate potential solutions to biological questions including those directly affecting human society

Example: *Burning fossil fuels and deforestation have resulted in increases in atmospheric CO_2 (a greenhouse gas) that is associated with increasing average temperatures. Widespread reforestation efforts could help to remove CO_2 from the atmosphere and therefore mitigate climate change. Many factors would need to be considered to determine whether this could be successful including rates of photosynthesis and decomposition and longevity of the plants involved as well as economic incentives for this management strategy (Topics 2, 4 & 7).*

6. Summarize and discriminate among possible explanations of natural processes

Example: *Obesity in humans may be related to genetic background, although genetics explains relatively little of the variation in this characteristic in human populations. Genes affecting obesity are most closely involved with regulation of certain metabolic events and with specific obesity related diseases. Despite recent improvements in genetic analysis tools, environmental factors within populations (diet, activity) continue to dominate the manifestation of obesity (Topic 5).*

Notification of Objectionable Materials

This course covers a wide variety of topics in biology, some of which may be considered objectionable. We will discuss such topics as human reproduction and diseases including certain medical interventions, and the role of plants, animals, and microorganisms in nature, biological research and agriculture. Our goal is to conduct this course in such a way that materials that might be objectionable are presented in the most acceptable manner as possible. Consult the Course Schedule for topic coverage and discuss your concerns in advance with Dr. Smith.

Graded Activities and Grading Policies

Grades in this course will be based on your participation and performance in two types of activities:

1. **In-class assignments.** These are based on material presented in lecture/discussion/participation that occurs during Wednesday class meetings. These assignments will involve short written compositions, generally less than 250 words. They may involve some mathematical calculations. Often they will provide you practice in writing clear, concise descriptions of scientific phenomena. Developing this sort of writing is a major activity of this course. Preliminary drafts of three assignments may be submitted for review and comments. Some of these assignments will involve working in small groups. These assignments are generally made available in class on Wednesday and are due in the Dropbox in the D2L website by 1:00 PM on the following Monday although sometimes they are due at the end of the class period in which they are presented. ***No late submissions will be graded unless you have an excuse approved by Dr. Smith in advance of the due date.***
2. **Exams.** We have two 50-minute midterm exams and one 120-minute final exam. Exams cover information from all elements of the course presented up to the day of the exam. They involve short answer and multiple-choice questions. Only your highest single midterm exam score counts toward your final grade. ***There are no make-up midterm exams.***

Number of graded assignments, point values and percentages of final grades.

| Graded activity (% of total points) ¹ | Total number | Points per activity | % of final grade for individual activity |
|--|----------------|---------------------|--|
| Assignments (30.2) ¹ | 13 | 10 | 2.33 |
| Midterm exams (23.3) | 2 ² | 100 | 23.26 |
| Comprehensive final exam (46.5) | 1 | 200 | 46.51 |

¹ Attendance is not regularly recorded and therefore does not directly affect your grade. Nevertheless, it will be very difficult to score well on most assignments if you are absent from our Wednesday in-person meetings.

² Only highest single score counts toward final grade.

Late work

Late work will be accepted only in rare circumstances. As soon as you realize that you will be unable to turn in work on time, contact Dr. Smith immediately via email and explain your situation. He will determine whether late work will be accepted and will inform you of the revised due date and any penalties that will be applied to your grade for the work.

Changes in course content or graded activities

During the semester, Dr. Smith may modify topics covered in the course or in-class assignments. If this occurs, all students will be informed of the changes early enough to allow sufficient preparation. Likewise, there may be occasional opportunities for extra-credit work. These opportunities will be clearly defined by Dr. Smith, and the results of this work will be incorporated into calculation of final grades. ***Personal requests for supplementary extra-credit opportunities will not be granted under any circumstances.***

Grade corrections

If you have a question about any grade you must consult with Dr. Smith via email regarding corrections within seven days of when the grade is posted in the D2L Grades page. No grade changes are possible after this. This includes grades that are improperly entered in the Grades page of the D2L website. It is your responsibility to insure that your grades are entered correctly.

Grading scale for final grades

Final grades are not assigned based on any predetermined thresholds. However, they roughly follow this scale: 90-100% = A; 80-89.9% = B; 70-79.9% = C; 60-69.9% = D; < 60% = E.

Thresholds are not negotiable once set by Dr. Smith for any course and semester.

Incomplete grades

Any incomplete grade given must be verified with a written agreement with the student that specifies the work to be done and a timetable for completion. Incomplete grades are assigned only in extreme circumstances when it is impossible for the student to complete a minor portion of the work required for a course. These grades are not to be used as a mechanism to retake a course because of generally poor performance. For more information see:

<http://www.registrar.arizona.edu/gradepolicy/incomplete.htm>.

Course withdrawal

Students withdrawing from this course must notify the Dr. Smith via email prior to nonattendance in classes and execute a drop or withdrawal in accordance with the UA General Catalog. Any student failing to attend class in two or more successive (Wednesday) classes is subject to automatic withdrawal if arrangements have not been made between student and Dr. Smith in advance of the absence.

Universal Learning

We are committed to the principle of universal learning. This means that our classroom, our virtual spaces, our practices, and our interactions be as inclusive as possible. Mutual respect, civility, and the ability to listen and observe others carefully are crucial to universal learning.

Any student with particular needs should contact the Disability Resources Center, 1224 East Lowell Street, Tucson, AZ 85721, (520) 621-3268, email: uadrc@email.arizona.edu, <http://drc.arizona.edu/> at the start of the semester. You must register and request that the Center or DRC send Dr. Smith official notification via email of your accommodations needs as soon as possible. Please plan to meet with Dr. Smith by appointment or during office hours to discuss accommodations and how course requirements and activities may impact your ability to fully participate.

Attendance Policy

Attendance at in-person (Wednesday) class meeting times is absolutely crucial. In some cases, attendance may be taken and some portion of the 10 points associated with that week's activity awarded based on attendance.

All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion. Absences pre-approved by the UA Dean of Students (or Dean designee) will also be honored. In both of these cases you must notify Dr. Smith via email at least 10 days before your absence. He will attempt to provide

you with an opportunity to access information and activities as similar to that provided students who are present in class. However, this will not involve complete repetition of the lecture/discussion presented to the remainder of the class.

Classroom Behavior

While in class you are expected to conduct yourself in a manner conducive to learning and in a way that does not interfere with other students' concentration. All students must abide by the [University's policy on threatening behavior](#). "Threatening behavior," means any statement, communication, conduct or gesture, including those in written form, directed toward any member of the University community that causes a reasonable apprehension of physical harm to a person or property. A student can be guilty of threatening behavior even if the person who is the object of the threat does not observe or receive it, so long as a reasonable person would interpret the maker's statement, communication, conduct or gesture as a serious expression of intent to physically harm.

All communication devices may not be used during class time for purposes unrelated to this course. Personal computers/tablets/smartphones may be used for note taking or reference during lecture and discussion (in mute mode), but must be shut off during examinations or at other times as determined by Dr. Smith.

Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the [UA Code of Academic Integrity](#) as described in the UA General Catalog.

Confidentiality of Student Records

Learn about your rights and the University's responsibilities related to academic records at: <http://www.registrar.arizona.edu/ferpa/default.htm>

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the Dr. Smith.