

# Biology 0200

## The Foundations of Living Systems



*Draft Syllabus 2022*

# Biology 0200

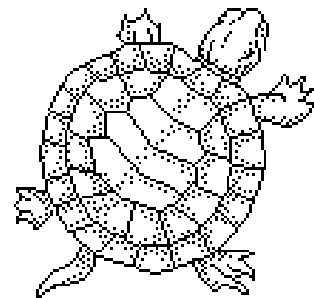
## The Foundations of Living Systems

Bio 0200 is a course for concentrators and non-concentrators in biology. It is based on the assumption that science is an important part of human culture, and that cultural literacy includes a broad knowledge of human thought and analysis, including the natural sciences. Bio 0200 is intended to introduce students to some of the most important aspects of current biological theory, methodology, and research.

The 21st century finds scientific work in the life sciences moving forward at an unprecedented rate, and it is clear that continuing advances in the biological sciences will affect every aspect of society in the years ahead. Therefore, in the same way that students of the sciences could not consider themselves fully educated without knowledge of art, social theory, and literature, students in the humanities and social sciences should approach courses in the sciences as part of their overall educational experience. The intention of this course is to establish links between biology and other disciplines, and to briefly explore some of the ways in which science is related to popular culture.

Biology 0200 is also intended to provide students continuing in the study of biology with a basic background in several important aspects of modern biology. Therefore, students should expect to be challenged by the material and to keep pace with a demanding schedule of lectures and reading assignments. We will not assume extensive background preparation in the sciences, although we *will* assume that students have taken basic high school courses in chemistry and biology.

Biology 0200 will focus on a logical continuum running from the large to the small. We will first examine the community of living things on this planet, trying to establish a sense of the diversity and interdependence of life. From this starting point, the course will consider evolution and its implications for biology and social theory. Understanding the details of evolution requires a knowledge of genetics, and this will be our next topic, followed by some basic biochemistry and molecular biology. The course will conclude with a number of integrating topics, including Infectious Disease, Immunology, and Human Ecology that will attempt to tie together material from genetics, molecular biology, and evolution.



# Questions about Biology 0200

- **Is Biology 0200 intended for Biology majors?**

Yes. In fact, for most upper-level courses in biology, Biology 0200 is a required prerequisite. This course is also a logical follow up course for students who took Biology 0210 in the Fall semester.

- **Is Biology 0200 intended for those not majoring in Biology?**

Yes. Biology 0200 is designed as a course that will combine a basic background in the biological sciences with studies of how biology affects and interacts with other disciplines and with the popular culture. The course will be fast-paced and demanding, but it should be accessible to those with interests outside of science.

- **Can one place out of Biology 0200?**

Yes. If you have a very strong biology background from high school, you may be ready for a more advanced biology course. Students who received an AP score of 4 or 5 should not take Bio 0200. If you didn't take the AP exam, but have had substantial engagement with Biology through other means, you ought to think about whether or not this course is for you. We offer a placement exam to help you do this.

You may access the on-line Placement exam through Banner Self Service. Click on *Enter Secure Area*, then on *Applicant and Student*. The Biology Placement exam is one of the menu items available to students from that page. The exam is currently available and will remain available through the first two weeks of the semester.

Passing the placement exam allows one to take courses that require Bio 0200 as a prerequisite and counts as an unassigned Biology credit for the AB or ScB degree. If you pass the exam, you will not be able to take Biology 0200.

- **Is Biology 0200 a premed course?**

No. It is a basic introductory biology course, and includes a wide range of important non-medical topics such as ecology, evolution, & photosynthesis. We hope that Biology 0200 will include a wide range of students, including premeds, but it is by no means a premed course.



- **What sort of Chemistry background do I need for Bio 0200?**

Glad you asked. We will assume that everyone in the class has taken a high school chemistry course (although we will *not* assume that you remember very much from it). However, you should be familiar with the following basic concepts:

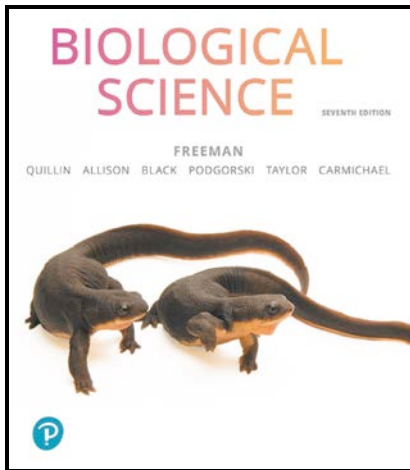
- there are more than 90 naturally occurring **chemical elements**
- each element is represented with a 1 or 2-letter **symbol** (Cu, O, N, Fe, etc..)
- elements combine in fixed proportions to form **compounds** (H<sub>2</sub>O, CO<sub>2</sub>, etc..)
- **atoms** are the smallest units of an element
- atoms contain **protons** (+), **electrons** (-), and **neutrons**
- protons and neutrons are found in the nucleus of the atom
- electrons are arranged around the nucleus in **energy levels** or **orbits** around the nucleus.
- each atom has an **atomic mass** equal to the sum of its protons & neutrons.
- elements have different forms, known as **isotopes** (C<sup>14</sup>, C<sup>13</sup>, C<sup>12</sup>, etc..)
- some isotopes (<sup>235</sup>U, <sup>3</sup>H, etc..) are **radioactive**, meaning that they break down to release particles and energy spontaneously.
- chemical **bonds** may form between atoms to yield **molecules**.
- the **molecular mass** (or molecular weight) of a compound is the sum of the atomic masses in one molecule of the compound.
- There are two important forms of chemical bonds, *ionic* and *covalent*.
- An **ionic bond** is formed between atoms that have gained or lost electrons (such atoms are known as **ions**) (NaCl, MgCl<sub>2</sub>)
- A **covalent bond** is formed between atoms that share a pair of electrons.
- atoms may share one pair of electrons (single bonds), two pairs (double bonds), or three pairs (triple bonds).
- Water may dissociate into OH<sup>-</sup> and H<sup>+</sup> ions. The acidity of water is measured by an index known as pH, which is determined by the hydrogen ion (H<sup>+</sup>) concentration of a solution. Specifically:  
$$\text{pH} = -\log [\text{H}^+]$$

Acidic solutions have low pH values (pH 1-3) , Basic (alkaline) solutions have high pH values (pH 11-13), and pure distilled water has a pH of 7.0.

- *This basic chemical knowledge will be assumed in Biology 0200. Chapter 2 of the textbook (pp. 58-64) includes a review of basic chemistry, which may be helpful if you feel uncertain about any of these concepts.*

- *NOTE: This is not the only chemistry that we will use in Bio 0200. Additional chemistry will be covered as needed to discuss molecular biology and chemical metabolism.*

## books:



The basic textbook for the course will be *Biological Science* (7th Edition) by Scott Freeman. Most lectures will have background reading assigned from this text. Because this textbook has been in print for about two years, used copies of the textbook should be widely available from several sources, in addition to the Bookstore.

Bio 0200 is part of the *Inclusive Access Program* at Brown, which should allow automatic digital access to the textbook. [Note: Although there is a digital companion for this book, known as “*Mastering Biology*,” it will not be necessary for students to purchase it unless they wish.]

We will also include several other reading assignments, which will generally be placed on the course web site. It is your responsibility to review these reading assignments well in advance of the assignment due date. If you have any problems in accessing posted on-line assignments, please notify one of the course staff immediately.

## Staff:

### Instructors:

#### **Ken Miller**

Sidney Frank Hall 211 (x 33410)

Online Office Hours: Mon. 1 - 3 pm, Fri 12 - 2 pm

email: [Kenneth\\_Miller@Brown.edu](mailto:Kenneth_Miller@Brown.edu)

#### **John Stein**

Sidney Frank Hall 354 (x32263)

email: [John\\_Stein@Brown.edu](mailto:John_Stein@Brown.edu)

### Laboratory Manager:

#### **Jody Hall**

Arnold Laboratory 124 (x32967)

Office Hours: Wed. 3 – 5 PM

email: [Jody\\_Hall@Brown.edu](mailto:Jody_Hall@Brown.edu)

\* Or, by appointment (meaning: if you can't make these, we'll be glad to find another time!).

## Class Schedule – Bio 0200 – 2022

Week	Date	Topic	Lab Section Topic
1	Jan 26 Jan 28	Introduction (Miller) Biology & Energy (Miller)	
2	Jan 31 Feb 2 Feb 4	Ecology I - Populations (Miller) Ecology II - Competition (Miller) Evolution I (Miller)	
3	Feb 7 Feb 9 Feb 11	Evolution II (Miller) The Selfish Gene (Miller) Genetics I (Miller)	Natural Selection <i>Evolution Simulation</i>
4	Feb 14 Feb 16 Feb 18	Mitosis / Meiosis (Miller) Genetics II (Miller) <b>EXAM I</b>	Mitosis <i>Laboratory Exercise</i>
5	Feb 21 Feb 23 Feb 25	<i>no class</i> Cells and Molecules (Miller) Protein Structure (Miller)	<i>No section meetings this week: Virtual FlyLab &amp; Genetics Problem Sets</i>
6	Feb 28 March 2 March 4	Enzymes (Miller) Glycolysis & Krebs Cycle (Miller) Ox Phosphorylation (Miller)	Enzymes <i>Laboratory exercise</i>
7	March 7 March 9 March 11	Photosynthesis (Miller) DNA (Miller) The Double Helix (Miller)	Metabolic Pathways Game <i>Laboratory Demonstration</i>
8	March 14 March 16 March 18	Transcription & Translation (Miller) Control of Gene Expression (Miller) <b>EXAM II</b>	Translation & the Genetic Code <i>Simulation</i>
9	March 21 March 23 March 25	Molecular Tools & Techniques (Miller) The Human Genome (Miller) Epigenetics (Miller)	DNA microarrays <i>Simulation</i>
10	April 4 April 6 April 8	Stem Cells & Development (Miller) Cell Phys. / Homeostasis (Stein) Neurons & Membrane Potential (Stein)	Personal Genomics - I <i>Laboratory Exercise</i>
11	April 11 April 13 April 15	Nervous System (Stein) Cardiovascular System (Stein) Cardiovascular System (Stein)	Personal Genomics - II <i>Data Analysis</i>
12	April 18 April 20 April 22	Respiratory Physiology I (Stein) <b>EXAM III</b> Respiratory Physiology II (Stein)	Neuron Action Potentials <i>Simulation</i>
13	April 25 April 27 April 29	Musculoskeletal System (Stein) Sports Physiology (Stein) The Immune System (Stein)	Squid <i>Laboratory Exercise</i>
14	May 2 May 4 May 6	Hormones (Miller) Reproduction (Miller) Human Ecology (Miller)	Jeopardy, Bio 0200 version
15	May 9 May 20	<i>Last Possible Class</i> <b>FINAL EXAM</b> – 9 AM (Friday)	

*Notes on the Class Schedule:* This syllabus is a **tentative** schedule of class topics and lab section assignments. Each Sunday the actual assignments for the following week will be posted by 5:00 pm (eastern time) on the Bio 0200 Canvas Web site.

# Course Procedures

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## lectures

Attendance at lectures is not compulsory, but since most of the course material will be covered in lectures, you will want to come anyway. Besides, if you miss lectures you will be unable to discuss the silly slides and crude attempts at humor that will be commonplace in lecture. Please come on time to class. We will begin promptly at 11:00 and will finish promptly at 11:50. Despite the size of the class, questions are encouraged and we will try to develop an occasional discussion where topics are appropriate.

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## grades

The overall course grade will be derived as follows:

Best Midterm Exam:.....	100 points
Second-Best Midterm Exam:.....	100
Concept Check Completion .....	20
Lab Work: .....	50
Homeworks .....	80
Final Exam: .....	150

We will have three midterm exams during the course of the semester. These will be online exams containing a mix of objective and essay questions on course reading, discussions, and lectures. For each student, we will drop the lowest midterm exam score in figuring grades at the end of the semester. The final exam will be a comprehensive exam similar in format to the hour exams. Lab section work will be evaluated in terms of completion of online simulations, performance on quizzes, and written lab assignments.

### A Note About the Academic Code



All students are reminded that the Academic Code of Brown University requires a standard of honesty and integrity that will be strictly enforced in Bio 0200. Although we encourage students to study and work cooperatively, all work submitted in this course, including homework, written papers, laboratory assignments, and exams must meet the standards of the Academic Code. This means, except for projects that are specifically designated as group activities, that all work submitted for evaluation in Bio 0200 must be a student's own.

Submitting the work of another under such circumstances constitutes a serious violation of the Code and will be dealt with accordingly.



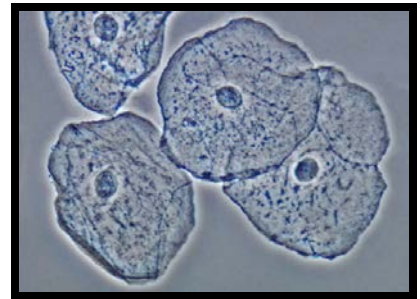
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## labs

Each student will attend a weekly lab/section meeting led by a Teaching Assistant. About half of the section meetings will be devoted to lab work and experimentation. Section work will sometimes include written assignments which teaching assistants will evaluate and hand back to students. Lab section attendance is required. Teaching Assistants will take attendance, and your section grade will be reduced for any unexcused absence. If you have three or more unexcused absences during the course of the semester, you will receive a failing grade on the laboratory section of the course (the equivalent of a *zero* on an hour exam), and you will receive *No Credit* for Biology 0200.

You should request a lab section time that fits your schedule. The labs will meet at several different times (see page 8 of this Syllabus), so it should be possible to find a number of times that will fit your schedule.

To request a lab section time, go to the Laboratory Registration page of the Canvas web site. Section requests will only be accepted between 1 PM on Friday 1/28 and 1 PM on Friday 2/4. Note: **You must be registered for the course in order to sign up for a laboratory section!** (There will be another enrollment period for students with course schedule conflicts).

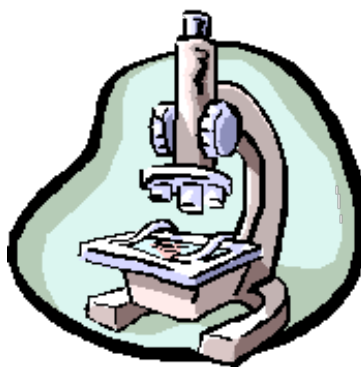


- Also, once labs begin to meet on the week of February 7<sup>th</sup>, if you do not attend your first assigned lab meeting we will assume that you have dropped the course, and may assign your place to someone else. It may then be impossible to find an open spot in a section that meets at a convenient time. Therefore, be sure to solve any conflicts regarding lab meetings before the sections begin to meet during the week of February 7<sup>th</sup>.



**• Important: You must be registered for the course in order to sign up for a laboratory section!**





**Lab Section Meeting Times (*Tentative!*)**

<b>Tuesdays</b>	<b>Thursdays</b>
<b>10:30 – 11:50 am</b>	<b>10:30 – 11:50 am</b>
<b>1:00 – 2:20 pm</b>	<b>1:00 – 2:20 pm</b>
<b>2:30 - 3:50 pm</b>	<b>2:30 - 3:50 pm</b>
<b>4:00 – 5:20 pm</b>	<b>4:00 – 5:20 pm</b>
<b>5:30 – 6:50 pm</b>	<b>5:30 – 6:50 pm</b>
<b>7:00 – 8:20 pm</b>	<b>7:00 – 8:20 pm</b>

Note: Depending on enrollment and student requests for lab times, additional lab sections may be scheduled. Be sure to note your Lab Section Number as well as its time to be sure of attending the proper Section. Labs will meet in rooms B-10 and B-11 of the Biomed Center. The first lab meetings will take place during the week of February 7<sup>th</sup>, 2022.



## exams

Written exams will be based on material from the lectures *and* assigned readings *and* lab section material. The final exam will be comprehensive in scope, and will require you to integrate material from different portions of the course.

- Please check the course syllabus for the dates of the three midterm exams and the final exam, and **plan ahead**. Students excused in writing from any of these exams will have to opportunity to take a makeup exam near the end of the semester. [Note that only your two highest scores on the midterm exams are counted in calculating final grades, as described on page 6 of this Syllabus] Makeups on the final exam will only be allowed in cases of written excuses approved by the Dean's office.

If you find that a mistake has been made in grading a midterm exam, or if you disagree about what the correct answer for an exam question should be, write up an explanation of the contested question(s) and submit a Regrade Request using the Gradescope system. Dr. Miller or Dr. Stein will read your comments and regrade the exam. Exam regrade requests must be submitted within one week of the date the exam is returned to the class.

• **Special Note: The Bio 0200 final exam this year is scheduled for Friday May 20. There is no way to provide extensions for students with exams in other courses near that date or special travel plans. Therefore, please plan now to be prepared for the final exam on that date.**

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## canvas web site

The Bio 0200 Canvas site contains a set of resources and reference material that will be very useful to you during the semester. It will include:

- **Reading and Homework Assignments:** These will be posted at least a week ahead of time
- **Lab Assignments and Protocols:** To be posted before each week's lab.
- **Previous Year's Exams:** We will post exams from last year's course on the site. Answers, too!
- **The Semester Week-by-Week:** Probably the single most important part of the web site, this section contains a week-by-week listing of course materials, including copies of most class handouts and lecture slides.
- **Lecture Videos:** Lectures will be automatically recorded and posted on the website for your reference.

## Bio 0200 Expectations



**Expectations:** The course will cover a wide range of topics in Biology. Students are expected to do assigned readings immediately before or after class, to submit homework assignments on time, to arrive prepared and on time for laboratory sessions, and to participate actively in class discussions and laboratory work.

**Time Commitments:** Over 14 weeks, students will spend 38 hours in class and 6 hours taking written exams. Reading for lectures and exam preparation are expected to take approximately 8 hours per week (112 hours). Laboratory preparation and the 11 laboratories themselves will take 4 hours per week (44 hours). These activities should amount to a total of 200 hours of class time and other work for the semester.

### Bio 0200 Lab Information

We've prepared our own Laboratory documentation for Bio 0200, and will post lab assignments at least a week ahead of time. The posted documents include materials to help you prepare for lab experiments and discussions. For some lab meetings, it will be essential that you bring a printout of the lab documents with you to your lab section meetings.

Be sure to read the laboratory plan ahead of time, and be prepared to take part in the activities for each week of the course.

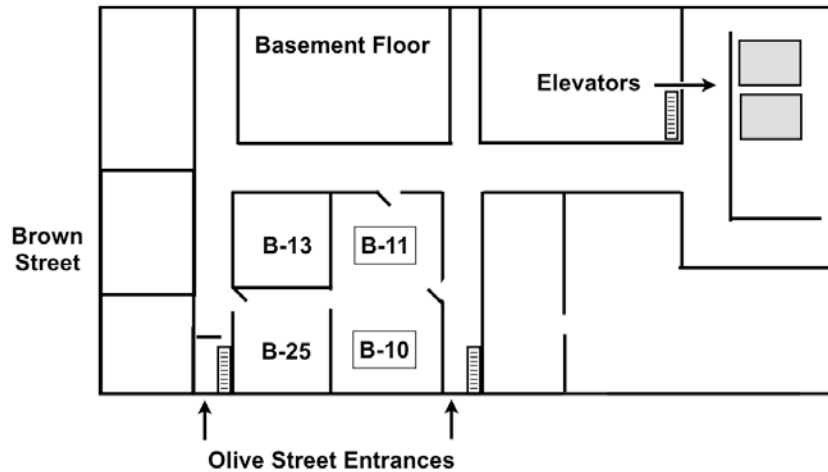
**BIOLOGY 0200**  
**LABORATORY MANUAL**  
Part A (February 4 - March 22)  
Part B available later this semester

CONTENTS:

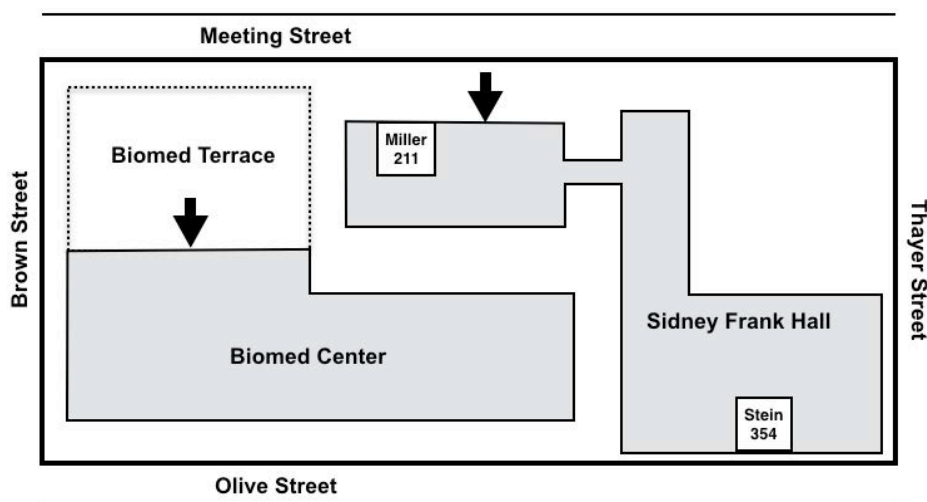
Week	Topic
February 4	Evolution (Computer Simulation)
February 11	Chromosomes
February 18	No Lab Meeting
February 25	Scientific Method/ Enzymes
March 4	Metabolic Pathways Game
March 11	The Double Helix (Discussion)
March 18	DNA Analysis

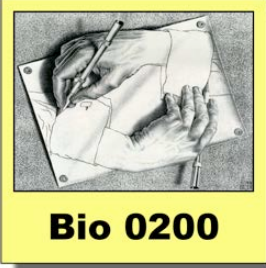
## lab rooms & instructor offices

The Biomed Center is one of the most confusing buildings on the Brown campus. *Sorry about that.* Our Lab Meetings will be held in two rooms on the Basement floor of the Biomed Center, rooms **B-10**, and **B-11**. The Olive Street entrances (the side closest to Faunce House) are locked for security reasons, so you may have to walk around the building to the Meeting Street side, and enter via the terrace, which is the second floor of the building. From there, take the elevators or stairs to the basement.



Jody Hall's office is **room 124** of Arnold Biological Lab on Waterman Street. Profs. Miller & Stein have their offices in Sidney Frank Hall, although on different floors. Miller's is **room 211**, right next to the main building entrance at 185 Meeting Street. Go through the glass doors and make a right turn to find room 211. Stein's is **room 354** in the research wing of the building. If you come into the building through the main entrance on Meeting Street, turn left and walk through the atrium towards Thayer Street across the glass bridge into the research wing. Then take stairs or elevator to the third floor.



	<h1>Biology 0200</h1> <h2>Reading and Study Assignments</h2> <h3>Week 1 (<i>January 26-28, 2022</i>)</h3>
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## January 26 (Introduction)

### Reading Assignments:

There are no required reading assignments for the first lecture. However, for background, you may wish to look through the following:

- Basic Chemical Background: *Freeman* (7/e) 58-64.

### Web Assignment:

- Download an electronic copy of the Syllabus to your personal computer.

## January 28 (Biology & Energy)

### Freeman (7/e) 64-73; 1141-1155. [Water, Energy & Ecosystems]

Properties of Water, pH, Chemical Energy, Chemical Reactions, Energy Flow and Trophic Structures, Biogeochemical Cycles.

### Web Resources:

Two web links with supplemental material:

- The Carbon Cycle
- Trophic Pyramids



### Homework:

- Check the Bio 0200 Canvas web site for a **Homework Assignment**, due by 5:00 pm on Sunday, January 30<sup>th</sup>.

**Note: These reading assignments are tentative and will be updated by the time the semester actually begins.**



***NOTES:***