The Biological Sciences 2 series introduces students to the principles on which all life--from the smallest, simplest organisms to the largest communities--is based. Biological Sciences 2A concentrates on the cellular basis of life, concentrating on the structures and functions of cells and the biological molecules from which they are formed, the ways by which cells acquire, transform, and use chemical energy, and the mechanisms by which genetic information is stored, safeguarded, transmitted from one generation to the next, and used in reproduction and development, with the immune systems serving as a example of complex eukaryotic development. Students are asked to use the principles and information covered in the class to interpret historical and current observations and to solve problems.
BIS 2A: Introductory Biology: Cell Functions

Instructor: Professor Terence M. MURPHY

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Office hours (T 4-5, W 11-12) / other times by appointment

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Head TA: Wesley Sughrue

(Enrollment, grade changes, general questions)
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**Prerequisites:** None, but experience says that those without a basic understanding of chemistry receive a grade one full step lower than those who do.

**Text:** Sadava, et al., Life: The Science of Biology, Eighth Edition. (Hard bound full text or soft-bound Part I only). Readable; all assigned sections relevant, may be covered on exams. Study Guide not needed.

**Web site:** general information and help; lecture schedule; problem sets for discussion sections; objectives (what I want you to know from each lecture); lecture pdfs; podcasts; sample exams; test answers and grades. http://www-plb.ucdavis.edu/courses/bis/2a/bis2a-F09/index.htm

**Mail-list:** Bis002a—f09@ucdavis.edu, by which I (and you) can communicate with the class; archives of the notices will be available through http://listproc.ucdavis.edu/class. (You are responsible for receiving messages sent to your ucdavis.edu address.)

**Discussion sections:** Discussion of issues from lecture, clearing up sticky points; problems relating lecture to “real” situations (and exam questions). Goal: a quiz or other assignment each session. One assignment will be a 4-page paper. Quizzes, paper, and participation count for 20% of your grade.
Tests and grading:

1st Midterm  20%--10/20       A >85% or >80%ile
2nd Midterm  20%--11/17        B >75% or >50%ile
3rd Midterm/Final 40%--12/12  C >65% or >20%ile
Discussion/T.A.  20%              D >50% or >10%ile

Missed exams: There are no early, late, or make-up exams. If you miss an exam for an acceptable reason and have an appropriate written statement from a doctor or clergyman to verify your excuse, your total score will be prorated or (in the case of a final) you will receive an I grade (incomplete).

Clickers: The “interwrite PRS” system will be used to quiz the class during lectures. I am planning 1-3 questions each lecture. These are designed to give me (and you) an idea of your background knowledge or how clear I have been in lecture. To participate, you need to purchase a “clicker,” available at the bookstore. Participation is voluntary, but strongly encouraged (and the same clickers are used in the Physics 7 series). I will start clicker questions at Monday’s lecture.
### Topics:

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**Lectures MWF 10:00-10:50, 123 Science Lecture Hall, (readings in Sadava et al., 8th edn)**

Monday Wednesday Friday
ENROLLMENT: Enrollment will take place at the discussion sections next Tuesday (September 29). You MUST BE PRESENT to retain your place in class (if you are registered) or to get a place (if there is a no-show and you are next on the wait list).
Great Concepts of Science and Biology

1) The universe is regular enough to allow useful predictions.

2) Controlled experiments are essential for scientific inquiry.

   Scientific method:
   - Observation
   - Defining the question
   - Formulating an hypothesis
   - Designing and conducting an experiment

3) Progress in science requires freedom of inquiry.
4) **Living organisms obey all the laws of physics and chemistry.**

**Vitalism:**

E.g. Aristotle: “Life is the *power* of self-nourishment and of independent growth and decay.
Ehrard: “Life is the *power* of movement destined to the service of that which is moved

**Mechanism:**

arose from scientific method (ca. 1500), microscopy (1677), chemistry (ca 1800).

E.g. Purvis et al. (earlier edition) “The most complex biological activities, including the mysterious richness of our human emotions, are probably manifestations of underlying physico-chemical systems.”
5) Functions of living organisms are based on the catalysis of chemical reactions; this takes place in microscopic structures.

- **Complex organization**: each organism has $10^4$-$10^6$ different types of molecules
- **Requirement for energy**: energy needed to maintain complexity (metabolism)
- **Homeostasis**: one of the complexities, maintaining standard conditions in fluctuating environment; based on feedback mechanisms
- **Destructability**: life spans ended by temperature (outside -20 to 120°), solution conditions (desiccation, acid, alkali), radiation (gamma, X ray, UV), poisons
6) Living organisms are formed through reproduction, not spontaneous generation.

- The genetic code provides the basis for complexity and inheritance.

7) All forms of life are subject to natural selection and may change in response to its pressures.

- Organic evolution, which has occurred throughout the past and is responsible for the diversity of species we see today, hasn’t stopped; it is still occurring.

- Variety--1,700,000 species named; 5,000,000 to 50,000,000 species extant (maybe more?--insects, marine microbes); 300,000,000 species have ever lived; (contrast with types of rocks: >120 but <1000)
8) Life has an origin and a history.

That history is reflected in fossils, but also in the physical history of the Earth.
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Why so late?
Why methane then and not now?
Was global warming good?