ADVANCED CELL BIOLOGY
Biology 642
"The Life and Times of a Cell"
Autumn 2006

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OFFICE HOURS: OPEN

TEXT: *Molecular Biology of the Cell, 4th edition,* Alberts, et al.

PREREQUISITES: BIOL 302 (Genetics) and BIOL 301 (Cell Structure and Function). If you have not taken both of these courses (or equivalent) see me immediately.

GOALS OF THE COURSE: This course is designed to expand your understanding of cell biology by focusing on experimental research. We will begin with a discussion on how cells are assembled and how specific organellar proteins are targeted. We will then move to a discussion of cellular communication, both through soluble molecules and through attachments. A discussion of the cytoskeleton will lead to a discussion of cell cycles, with focus on both regulation and mechanics. Finally, we will discuss cancer, since the diseases that are classified as cancer are generally the result of failure of specific regulatory mechanisms in the cell.

The text emphasizes the experimental basis for our current understanding. We will use this as a base, then discuss some articles from the primary literature related to the material in the text. It is generally difficult for students to read these types of articles, so we will spend a significant amount of time on the selected articles. The articles have been chosen as examples of the types of research currently underway. We will discuss experimental approaches used by the authors, the results they have obtained and how their results relate to the goals of the research.

FORMAT OF THE COURSE: Specific sections of the text have been assigned for each class. You will be expected to read the material in advance of the class. I intend to lecture on the material, but also ask questions about the material based on the assumption that you have read the section to be discussed. To help you prepare for the discussions of research articles, there will be specific questions given to you, which you should answer in written form and turn in on the day of the discussion. The answers must be turned in on the day of the discussion. NO LATE PAPERS WILL BE ACCEPTED. These answers may be types of hand written, but if you do write them out, please write legibly.

Class participation will be a significant part of the grade for this course. **Please do not take the course unless you are willing to make a commitment to do the work regularly and participate in the discussions.**

CAPSTONE: Anyone who is a senior Biology major may use this course as a capstone. To do so, you must get a form signed by me and submit it to the office. You must also sign up for BIOL 686, Section 027 (number ***000134***). Since this course involves much that will allow you to demonstrate proficiency in the Gen Ed program goals, completing the course will be sufficient for most areas. However, we are required to assess the "social responsibility" goal of Gen Ed within the capstone as well. For those of you who wish to use this course as a capstone, there will be an additional section of the required paper that will address this part of Gen Ed (see below). You will also be required to discuss your paper with me. This should be a short session, no more that 10-15 minutes.

PAPER: In addition to a midterm exam and a final, there will be a term paper required. For the paper, you will be expected to find an article in the literature (primary article, not a review) published within the past two years. Attach a copy of the article to your paper when you turn it in. Your paper should have the following elements (maximum 10 pages):

1. Introduction: one page describing the background for the article and the hypothesis being tested.
2. Methods: one to two pages summarizing the methods. If any of the methods in the article were not described earlier in class, be sure to read the references they cite and describe the method in enough detail that the reader will understand generally how it is done and what types of information one can expect from it.
3. Results: four pages, briefly describing the results. (A good idea here is to refer to the figures and what is shown in each. You don't necessarily have to describe them all. You can pick the most central to the test of the hypothesis.)
4. Conclusions: two to three pages describing how the results fit with the initial hypothesis. If there are issues raised by the article and not experimentally addressed. Describe an experiment that might help to answer the question.
5. Capstone Students: For those who wish to use this class to fulfill the capstone requirement, there will be an additional requirement of a discussion of federal funding for the type of research described in the article. Much of the work currently being done in cell biology is federally funded. Do you think that is a good idea in general? Do you think the type of research described in the article you have chosen merits federal funding? If so, why? What are the potential gains for society in this type of research? If not, why not? What types of research should be funded by the federal government. This last part should be one to two pages.

You must turn in the title of the article that you wish to write about on *November 3, 2005* and the paper will be due *November 27, 2006*.

GRADING: Grades for the course will be based on participation, on two exams, a midterm and a final and on the term paper. The point distribution will be as follows:

Participation	15% (includes written answers and contributions to discussions)
Miderm	35%
Final	35%
Paper	15%

Tentative Schedule of Topics
(Note, these may change as needed)

Date	Topic	Reading (Alberts)
September 20	**Building a cell:** Compartments of cells; localization signals	Ch. 12, pp 659-672
21	Nuclear transport; mitochondrial uptake	pp 672-680
25	Mitochondria (cont.); chloroplasts; peroxisomes; endoplasmic reticulum	pp 680-709
27	ER (cont.) vesicle transport; ER to Golgi transmission	Ch. 13 pp 711-717
29	**Article:** Milenkovic, et al. (2004) *Proc.Nat.Acad.Sci*. **279**: 22781-22785 Topic: Mitochondrial protein uptake	
October 2	Trans Golgi sorting; secretion; endocytosis	pp 746-752
4	Endocytosis	pp 752-765
6	**Cell Communication:** General principles, signal types	Ch 15. pp 831-852
9	G protein-linked receptors	pp 852-871
11	**Article:** Jiao, et al. (2005) *Mol. Cell. Biol*. **25**: 5752-5762 Topic: Lipid rafts and signal transduction	
13	Enzyme-linked receptors I	pp 871-905
15	Enzyme-linked receptors II	″
18	**Cell Movement:** Cytoskeleton: assembly, dynamic structures	Ch. 16. pp 907-929
20	**Article**: Walker, et al. (2006) Ann. Rheum. Dis. 65: 149-156 Topic: Clinical study on JAK and STATs in rheumatoid arthritis	

23	Regulation of cytoskeleton	pp 929-948
25	Molecular motors	pp 949-968
27	***MIDTERM (through October 23 class)***	
30	Cytoskeleton and cell behavior	pp 969-981
November 1	**The Cell from Birth to Death:** Fundamentals of cell cycles, experimental approaches; regulation	Ch 17 pp 983-1002
3	***Paper Topic Due*** Apoptosis; extrinsic regulation	pp 1002-1025
6	Mechanics of cell division: karyokinesis	Ch 18 pp 1027-1046
8	**Article: :** Cenguilhem, et al. (2006) *J. Biol. Chem.* **280:** 43257-43263 Topic: Rho GTPase and apoptosis after UVB irradiation	
10	***Veterans Day – No Class***	
13	Mechanics of cell division: cytokinesis	1047-1060
15	**Cells in Social Context:** Cell- cell attachments	Ch 19 pp 1065-1090
16	***Last Date to Withdraw***	
17	Extracellular matrices	pp 1090-1118
20	**Article:** Boulter, et al. (2006) *FASEB J.* **20**: E640-E651 Topic: Regulation of cell-matrix adhesion	
22	**Cell cycle regulation gone wrong:** Cancer, introduction	Ch 23 pp 1313-1326
23,24	***Thanksgiving Holiday*** ***No class***	
27	***Term Paper Due*** Preventable causes of cancer, finding critical genes	pp 1326-1340
29	Molecular basis of cancer cell behavior, cancer treatment	pp 1341-1361
December 1	Finish, review	
4	**Final exam** 8-10 am (sorry)	