

Biology 237, Section A
Biochemical Mechanisms in Cell Biology
Spring 2004

“To manage a system effectively, you might focus on the interactions of the parts rather than their behavior taken separately.”

-Russell L. Ackoff, business management guru

Instructor: Dr. Maureen K. Krause, Room 309, Gittleson Hall

Class time: Wednesday, 6:20-8:10 pm

Class location: Monroe 119

Credits: 3

Prerequisites: Biology 137 (Cell), 135 (Genetics), Organic Chem (131 & 132), or equivalents.

Recommended Texts*: *Molecular Cell Biology*, 5th edition, 2003. Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Mondty Krieger, Matthew P. Scott, S. Lawrence Zipursky and James E. Darnell, W. H. Freeman Publishers, New York. Free full text access is available through the internet for this book, as well as for the classic text *Biochemistry*, by Jeremy M. Berg, John L. Tymoczko, and Lubert Stryer, 2002, and the competitor cell textbooks: *Molecular Biology of the Cell*, Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, and James D. Watson, Garland Publishing, 1994; and *The Cell - A Molecular Approach*, 2nd ed., Geoffrey M. Cooper, Sinauer Assoc., 2000.

To access full text, go to <http://www.ncbi.nlm.nih.gov> and click on the “books” tab.

Office Hours: Thursdays: 12-3 pm. You can always make an appointment if your schedule conflicts with the hours listed above, email me with quick questions at biomkk@hofstra.edu, or call me at **463-6178**.

Course definition: We will explore, in depth, biochemical mechanisms involved in a selected few processes in the cell. This semester the theme is “rules and relationships”; in other words, we’ll focus on relationships, from those between the mitochondrion and the nucleus, to those between nucleic acid binding proteins and their targets, as well as the rules that govern their interactions. You will analyze recent research articles and reviews from the primary scientific literature, and hopefully begin to appreciate common biochemical themes and mechanisms by which cells function, as well as their astounding complexity.

Biochemical Mechanisms in Cell Biology Objectives:

- ➡ To provide an opportunity for students to gain a better appreciation for and understanding of the complexity of cellular function.
- ➡ To explore the relationship between protein structure and function.
- ➡ To learn general mechanisms by which cells direct protein function.
- ➡ To examine current research efforts and central questions related to biochemical regulation of cellular processes.
- ➡ To appreciate the multiple levels of control that cells use to regulate function.
- ➡ To develop skills in primary literature searching, review, and comprehension
- ➡ To develop skills in data analysis and interpretation.
- ➡ To develop skills in public presentation of scientific information.

Web sites: (will both be active by 2/9/04. Blackboard will be active immediately):

Hofstra Blackboard: <http://www.hofstra.edu/Academics/Blackboard/>

People page: http://people.hofstra.edu/faculty/maureen_K_Krause/biochemcell04

Grading

Component 1: Participation in topic discussions (approximately 40%)

This is not an undergraduate lecture course, and I don't expect you to act like you're in one. The success of this course is dependent on *your active participation and preparation*. After a very brief introduction and review period, each week we will explore and discuss a specific topic in detail. You will be given a reading list in advance of every discussion as well as some questions to help guide your reading and interpretation. I will expect that you have made every effort to ready and study that material before our discussion and that you come fully prepared to every class. Each week I'll introduce the topic, and you will be expected to contribute to the analysis and interpretation of recent research on the subject. On occasion, you will be also be asked to help lead the discussion. You will also be expected to extend your literature search and review beyond the assigned reading list, so that each student can make a unique contribution to our discussion.

Component 2: Research Paper (approximately 20% of grade)

You are required to write a single research report on a specific biochemical mechanism in cell biology. These reports must exclude those specifically dealt with in discussion, but may cover extensions of those topics. You will develop your own topic, literature review, and specific research focus, which must be consistent though with the semester's "theme". In this paper, you should formulate a hypothesis regarding a biochemical mechanism, and then use the literature to support that hypothesis. The paper should also explore possible future directions for research as well as possible alternative hypothesis. Your paper will be graded on the originality of your hypothesis, the thoroughness of the literature review, logic of supporting arguments, and overall presentation and clarity. Duplication of topics among members of the class is not permitted.

Component 3: Presentation of research paper topic (approximately 20%)

Everyone will benefit from each other's efforts on your papers, because you will present your findings in a 10-15 minute seminar, followed by a brief discussion of your seminar / paper topic. You will be required to use Powerpoint or other professional quality presentation software for your presentation, and you will be graded by both your instructor and peers. Everyone will be required to participate in the post-seminar discussion. Presentations will be given near the end of the semester after you have received written comments and a grade on your paper. Opportunities for software (Powerpoint) training will be provided if necessary.

Component 4: In-class Exams (approximately 20%)

We won't devote entire class sessions to exams, but they are useful to help motivate you to do the readings and review the material! Exams will probably consist of a few essay questions that probe the depth of your understanding.

Dr. Mo's Rough Guide to our semester - certainly subject to some revision

Date	Topic	Comments & Lead Group
Feb 3	Intro and prerequisite quiz	
Feb 10	Review of transcription, Discuss transcriptional control in Eukaryotes	
Feb 17	The nucleolus: DNA, protein, and RNA interactions	I
Feb 24	Nuclear pores: traffic control in nuclear -cytoplasmic interactions quiz	II
March 3**	Translational regulation	III
March 10	Fold 'em and Hold 'em: protein folding, chaperones and the unfolded protein response	I
March 17	More posttranslational events: shipping, import, export	II
March 24	Signal transduction and the cell cycle I	III
March 31	Signal transduction and the cell cycle II quiz	I Draw straws for talk order
April 7	No class: Spring Break	
April 14	No class: Conversion day (follow Monday schedule)	
April 21	Nuclear-mitochondrial interactions I	II Paper due
April 28	Nuclear-mitochondrial interactions II	III
May 5	Presentations and student-directed readings	
May 12	Presentations and student-directed readings	
May 19	Presentations and student-directed readings / quiz	6:15-8:15 final exam slot

Review for 2/11/04: Note: These articles will be available on Blackboard by the evening of Saturday, February 7th.

(<http://www.ncbi.nlm.nih.gov>) Click on Books

MBOC: Molecular Biology of the Cell

MCV: Molecular Cell Biology

Review the general topics:

Protein structure basics

- **MBOC:** Chapter 3, section on protein structure, and chapter 5 *OR*
- **MCB:** Chapter 3

Transcription and translation, including control of gene expression in eukaryotes

- **MBOC:** Chapters 6 (only introduction and RNA and protein synthesis sections), 8 (introduction and RNA synthesis and RNA processing sections only), 9 (all) *OR*
- **MCB:** Chapters 10 (all) and 11 (all)

Eukaryotic Transcriptional control:

Kornberg, R.D. (1999) Eukaryotic transcriptional control. *Trends Cell Biol* 9:M46-49.

Hermanson O, Glass CK, Rosenfeld, MG (2002) Nuclear receptor coregulators: multiple modes of modification. *Trends Endocrinol. Metab.* 13(2):55-60.

Papavassiliou AG. (1998) Transcription-factor-modulating agents: precision and selectivity in drug design. *Mol Med Today.* 4:358-66.

The nucleolus: complex interactions between DNA, RNA and proteins

- Look up nucleolus in the MBC / MBOC / Biochem texts and review the fundamentals.

Required articles:

Gerbi, S.A., Borovjagin, A.V., and T.S. Lange (2003) The nucleolus: a site of ribonucleoprotein maturation. *Curr. Opin. Cell Biol.* 15:318-325

Lamond, A.I., Sleeman, J.E. (2003) Nuclear substructure and dynamics. *Curr. Biol.* 13: R825-R828. (Read this one first)

Tschochner, H., Hurt, E. (2003) Pre-ribosomes on the road from the nucleolus to the cytoplasm. *Trends Cell Biol.* 13: 255-263.

Additional of interest:

Pederson, T. and Politz, J.C. (2000) The nucleolus and the four ribonucleoproteins of translation. *J. Cell Biol.* 148: 1091-1095.

Moss, T. and Stefanovsky, V.Y. (2002) At the center of eukaryotic life. *Cell* 109:545-548.

Alvarez, M., Rhodes S.J., Bidewell, J.P. (2003) Context-dependent transcription: all politics is local. *Gene* 313:43-57.