BIOCHEMISTRY 673: REGULATION OF METABOLISM **FALL, 2007**
MWF 10:00-11:00, CHEMISTRY 2507 **SYLLABUS**

Assoc. Prof. Jason D. Kahn, Dept. of Chemistry and Biochemistry, UMCP
Office: Chemistry 2500A (Biochemistry, Wing 5 of the Chemistry complex)
Office hours: Mon. 2-3 p.m., Weds. 1-2 p.m., Chemistry 2500A; there is no TA for the course
Contacting me: jdkahn@umd.edu much preferred to 301-405-0058. Please do not drop in to my office or lab, but I will be happy to set up appointments outside of office hours if necessary.
Web and email: Blackboard (elms.umd.edu) and www.biochem.umd.edu/biochem/kahn/bchm673 There is also an e-mail reflector.

This course will cover several examples of regulation and regulatory networks in biochemistry and molecular cell biology. It will be a combination of lectures, discussions of current literature, and student presentations. The final grade will be will be based on class participation (75 pts), a student presentation and short paper (75 pts), one in-class exam (100 pts), and the final exam (150 pts).

The general areas to be covered will include the following:

- Transcriptional regulation by steroid hormone receptors
- Bacterial chemotaxis and its regulation
- Metabolism of carbohydrates and fats, insulin signaling, and diabetes
- G proteins and G-protein coupled receptors
- Identification, modeling, and emergent properties of gene regulation networks

The unifying themes in the course will be as follows:

- How are the activities of enzymes and other proteins regulated at the molecular level? Mechanisms include subcellular localization, phosphorylation cascades and other covalent modifications, proteolysis, receptor dimerization/multimerization/trafficking, allostery, and second messengers.
- What are some essential techniques used for the analysis of signal transduction pathways and networks? These will be explored largely through in-class discussion of papers from the research literature.
- What additional complexities arise when we consider networks rather than just isolated proteins or pathways?

Textbooks and Other Sources:

Recommended:

B.D. Gomperts, I.M. Kramer, and P.E.R. Tatham (2002). *Signal Transduction*. Elsevier Academic Press. Useful background. Available at Amazon.

Other sources:

U. Alon (2007). *An Introduction to Systems Biology: Design Principles of Biological Circuits*. Chapman & Hall/CRC.

D. S. Latchman (2003). *Eukaryotic Transcription Factors*. 4th ed. Academic Press.

Lodish, Berk, Zipursky, Matsudaira, Baltimore, and Darnell (2000). *Molecular Cell Biology*. 4th ed. W.H. Freeman. Available free on the web at http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=Books.

E. Davidson (2006). *The Regulatory Genome: Gene regulatory Networks in Development and Evolution*. Academic Press.

The Signal Transduction Knowledge Environment maintained by Science magazine/AAAS. By subscription at http://stke.sciencemag.org/.

Research papers will be provided as the semester progresses.

Procedures and Grading

The final grade will be will be based on class participation (75 pts), a student presentation and short paper (75 pts), one in-class exam (100 pts), and the final exam (150 pts). Your course grade will be based on your performance relative to a curve and to my expectations. I anticipate roughly 50:50 A's:B's. The curve does not require C's and D's but I will give them without hesitation if necessary. Plus/minus final grades will be given.

The class participation grade (75 pts over the semester) will be assigned based upon your ability and willingness to comment accurately and critically on assigned readings during class periods set aside for discussion. For example, you may be called upon to explain how the experiment in Figure 3 works, or propose the most useful next steps are in dissecting a pathway, or discuss the relationship between the paper we are reading and other work in the field that we have covered. I also encourage discussion during lectures, but it will not affect grading.

The student presentation will be a 20-30 minute presentation of a research paper in one of our focus areas, laying out the importance of the work, the experimental rationale, the results, and any problems with it. You will provide the class with a reference to your paper in advance and a 2-page outline of your presentation. We will have two student presentations per session, with 5 minutes each for questions.

The midterm exam and the final will cover lecture material and the required reading. If you absolutely must miss the midterm, you must call me in advance or within 24 hours after the exam, and you must also present a valid University excuse (please secure a note from the Health Services if possible). Do not miss the final exam.

I expect and enforce adherence to the University's Code of Academic Integrity, found at http://www.studenthonorcouncil.umd.edu/code.html. I expect you to write out and sign the University honor pledge on each exam: "**I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination."** Also, you are hereby notified that "plagiarism" will be interpreted in its broadest sense: ideas from others must be referenced; words from others must be in quotation marks and referenced. Paraphrasing without referencing will be considered plagiarism. Extensive paraphrasing from a single source is unacceptable, referenced or not. As a condition of remaining in the class, you are specifically directed to read my own web page on this: http://www.biochem.umd.edu/biochem/kahn/plagiarism.html.

Approximate Course Schedule

August 29, 2007	Lecture 1 – Introduction to the course and to signal transduction	W
August 31, 2007	Lecture 2 – Steroid hormone receptor signalling	F
September 3, 2007	Labor Day, No Class	M
September 5, 2007	Lecture 3 – Structural biology of hormone receptor-DNA binding	W
September 7, 2007	Lecture 4 – Structural biology of receptor-ligand-Hsp90 binding	F
September 10, 2007	Lecture 5 – Chromatin dynamics during transcription activation	M
September 12, 2007	Lecture 6 – Hsp90 and its pharmacology	W

September 14, 2007	Discussion of Hager and Gannon papers	F
September 17, 2007	No class	M
September 19, 2007	No class	W
September 21, 2007	Special Lecture: Steve Rokita on thyroxine and iodide metabolism	F
September 24, 2007	Discussion of Lindquist papers	M
September 26, 2007	Lecture 7 – Introduction to Bacterial Chemotaxis	W
September 28, 2007	Lecture 8 – Regulation of Chemotaxis	F
October 1, 2007	Lecture 9 – Regulation of Chemotaxis	M
October 3, 2007	Lecture 10 – Engineering chemotaxis	W
October 5, 2007	Catch-up day	F
October 8, 2007	Discussion of Berg papers	M
October 10, 2007	Discussion of mathematical models for chemotaxis	W
October 12, 2007	Two student presentations of papers on nuclear receptors or chemotaxis	F
October 15, 2007	Lecture 11 – Review of glycolysis, gluconeogenesis, glycogen metabolism	M
October 17, 2007	Lecture 12 – Review of integration of metabolism	W
October 19, 2007	**Midterm Examination**	F
October 22, 2007	Lecture 13 – Introduction to regulation by insulin	M
October 24, 2007	Lecture 14 – Public health: causes, implications, and treatment of diabetes	W
October 26, 2007	Lecture 15 – Genetics of Diabetes	F
October 29, 2007	Discussion of insulin signaling papers	M
October 31, 2007	Discussion of genetic linkage papers	W
November 2, 2007	Lecture 16 – G-proteins, molecular clocks	F
November 5, 2007	Lecture 17 – G-protein coupled receptors	M
November 7, 2007	Lecture 18 – Pharmacology of GPCRs	W
November 9, 2007	Discussion of GPCR signalling papers	F
November 11, 2007	Discussion of receptor clustering papers	M
November 14, 2007	Catch-up day	W
November 16, 2007	Two student presentations	F
November 18, 2007	Lecture 19 – Properties of Networks	M
November 21, 2007	Lecture 20 – Designing control circuits	W
November 23, 2007	Thanksgiving recess, no class	F
November 26, 2007	Lecture 21 – Experimental systems biology	M
November 28, 2007	Lecture 22 – Regulatory networks in development and evolution	W
November 30, 2007	Two student presentations	F
December 3, 2007	Discussion of sea urchin development	M
December 5, 2007	Discussion of evolution of signalling pathways	W
December 7, 2007	Catch up day	F
December 10, 2007	Lecture 23 – The Summing Up	M

Final exam: Wednesday, Dec 19, 8:00am-10:00am