BMS 500B MOLECULAR BIOLOGY AND GENETICS
SPRING 2009

Location and meeting times

9:00-10:00 AM CMS 1ST FLOOR CONFERENCE ROOM, MWF

Course Description

This course will provide in depth detail of essential cellular processes at the molecular level by using examples from the current literature. Topics to be covered are: regulation, both transcriptional and translational, RNA interference and microRNAs, DNA replication and repair, genetic recombination, transposition, and protein turnover. In addition, students will be introduced to developmental and mammalian genetics. An outline is presented below.

Objectives

Students will attain familiarity with basic concepts and some advanced material relevant to the topics to be covered (see Course Description). At the conclusion of the course, students will be able to understand and critique data from experiments in the relevant areas, and will be graded using exams that test their retention of basic material and their ability to apply it to real or simulated experimental data.

Prerequisite

BMS500 or equivalent; and BMS 504a or equivalent.

Course Web Site

Some lecture and reading material will be made available on the course web site, which is on SUNY Albany's electronic reserves http://eres.ulib.albany.edu. Click on "electronic reserves course index'. Choose the Department (Biomedical Sciences) or the faculty (Conklin) and then click on BMS500B.

Office hours

M-F, 9-5; meetings should be arranged with individual instructors, as this is a team-taught course.

Grading scheme

A-E; three non-cumulative exams of equal weight.

Course requirements

Readings from the scientific literature will be assigned by individual instructors. Exams will be given on February 13, March 27, and May 6. Exams are open book, but materials must be taken out of your bag or backpack before the beginning of the exam. Exam questions will primarily be short answers and short essays and will require problem solving. Attendance is not taken and students are graded on the basis of their performance on the exams or on homework assignments.

Detailed syllabus:

Mammalian genetics: These lectures will cover fundamental aspects of genetics as they apply to mammals. We will cover classical genetic approaches that are used in humans and in other organisms and the advantages and disadvantages of using mammals for these approaches, as well as some areas unique to mammalian systems. Topics will include
genome comparisons of various mammalian genomes, genetic mapping, single gene vs. multigene traits, quantitative trait analysis, positional cloning, linkage disequilibrium, association, and genome manipulation.

DNA Replication. These lectures will cover the molecular mechanisms of DNA replication. The first lecture will focus on how cells replicate their genomes rapidly and accurately. It will cover the main components of the replication fork, with an emphasis on the structures and catalytic activities of the enzymes involved (polymerases, helicases, nucleases, ligases, etc.). The second lecture will focus on a new class of polymerases, the lesion bypass polymerases, which help cells tolerate damage to DNA.

DNA repair: The basic mechanisms of DNA repair in eukaryotes and prokaryotes will be discussed. These will include mismatch repair, base excision repair, and UV excision repair mechanisms. In addition, we will discuss how DNA damage is tolerated by cells and DNA damage-inducible responses in both prokaryotes and eukaryotes.

DNA recombination: DNA recombination: Topics to be covered include homologous recombination, non-homologous end joining (NHEJ), double strand break repair, biological and technological applications for recombination, model systems and recombination in health and disease. In addition, recent high-impact papers in recombination will be discussed.

Transposition: The three major classes of transposition, their mechanisms of mobility and their relationship with the host cell will be discussed. Emphasis will be placed on elements that play an important role in mammalian genomes.

Transcriptional regulation: These lectures will begin with regulation of gene expression in phage lambda, which illustrates many basic principles. Eukaryotic transcription will be discussed, emphasizing transcription by polIII, mRNA transcription by RNA pol II, and current thoughts on how activators function. In addition, chromatin structure and function, topics of transcriptional repression, silencing, and regulated domains will be discussed, and an introduction will be given to chemical genetics.

Post-transcriptional regulation: Topics covered include mRNA processing, nuclear export, mRNA stability and localization and translational regulation.

RNA interference and microRNAs in regulation of gene expression: Topics covered will include: forms of gene silencing, the discovery of RNAi, RNAi mutants in C. elegans, RNAi biochemistry and the importance of microRNAs in development.

RNA editing: One lecture on the topic of post-transcriptional mRNA editing will be offered. Emphasis will be placed on phenomenology and mechanism.

Protein turnover: These lectures will cover the molecular mechanisms of ubiquitin dependent protein turnover in eukaryotic cells. Emphasis will be placed on mechanisms. Examples with biomedical importance will be discussed.

Epigenetics: An overview of epigenetic phenomena in mammals will be presented, along with current models of epigenetic regulatory molecular mechanisms.

Developmental genetics: These lectures will cover identification of genes required for embryonic development, principles of gene action in developing embryos, homeobox genes, homeotic transformations and patterning of body parts in simple and complex organisms.

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Day	Date	Lecture	Topic	Instructor
Wednesday	21-Jan	1	Course Introduction	Conklin
Friday	23-Jan	2	Mammalian Genetics	Symula
Monday	26-Jan	3	Mammalian Genetics	Symula
Wednesday	28-Jan	4	Mammalian Genetics	Symula
Friday	30-Jan	5	DNA replication	Pata
Monday	2-Feb	6	DNA replication	Pata
Wednesday	4-Feb	7	DNA repair	Fasullo
Friday	6-Feb	8	DNA repair	Fasullo
Monday	9-Feb	9	DNA repair	Fasullo
Wednesday	11-Feb	Review		
Friday	13-Feb	EXAM 1	Lectures 1 - 9	
Monday	16-Feb		Winter Break	
Wednesday	18-Feb			
Friday	20-Feb			
Monday	23-Feb	10	DNA Recombination	Begley
Wednesday	25-Feb	11	DNA Recombination	Begley
Friday	27-Feb	12	DNA Recombination	Begley
Monday	2-Mar	13	Transposition	Curcio
Wednesday	4-Mar	14	Transposition	Curcio
Friday	6-Mar	15	Transcriptional regulation	Morse
Monday	9-Mar	16	Transcriptional regulation	Morse
Wednesday	11-Mar	17	Transcriptional regulation	Morse
Friday	13-Mar	18	Transcriptional regulation	Morse
Monday	16-Mar	19	Transcriptional regulation	Morse
Wednesday	18-Mar	20	Transcriptional regulation	Morse
Friday	20-Mar	21	Transcriptional regulation	Wade
Monday	23-Mar	22	Transcriptional regulation	Wade
Wednesday	25-Mar	Review		
Friday	27-Mar	EXAM 2	Lectures 10 - 22	
Monday	30-Mar	23	Gene silencing	Conklin
Wednesday	1-Apr	24	Gene silencing	Conklin
Friday	3-Apr	25	Post-transcriptional regulation	Tenenbaum
Monday	6-Apr	26	Post-transcriptional regulation	Tenenbaum
Wednesday	8-Apr		Spring Break	
Friday	10-Apr			
Monday	13-Apr			
Wednesday	15-Apr	27	RNA editing	Madison-Antenucci
Friday	17-Apr	28	Protien turnover	Burch
Monday	20-Apr	29	Protien turnover	Burch
Wednesday	22-Apr	30	Developmental genetics	Hanes
Friday	24-Apr	31	Developmental genetics	Hanes
Monday	27-Apr	32	Developmental Genetics	Hanes
Wednesday	29-Apr	33	Epigenetics	Gray
Friday	1-May	34	Epigenetics	Gray
Monday	4-May	Review		
Wednesday	6-May	EXAM 3	Lectures 23-34	

Instructors:

Doug Conklin	GenNYSis	dconklin@albany.edu	591-7154
Derek Symula	Genomics Inst.	symula@wadsworth.org	880-1317
Janice Pata	CMS	jpata@wadsworth.org	402-2595
Michael Fasullo	CMS	mfasullo@ordwayresearch.org	641-6467
Joan Curcio	CMS	joan.curcio@wadsworth.org	473-6078
Randy Morse	CMS	morse@wadsworth.org	486-3116
Joe Wade	CMS	jwade@wadsworth.org	474-5727
Scott Tenenbaum	GenNYSis	stenenbaum@albany.edu	591-7157
Susan Madison-Antenucci	DAI	susanma@wadsworth.org	408-2827
Tom Begley	GenNYSis	tbegley@albany.edu	591-7153
April Burch	DAI	aburch@wadsworth.org	402-2233
Steve Hanes	CMS	hanes@wadsworth.org	474-2821
Todd Gray	DAI	gray@wadsworth.org	473-0076