BMS 500B Molecular Biology and Genetics
Spring 2010

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 19th, March 19th, and April 30th. 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.

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.

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	20-Jan	1	Course Introduction	Conklin
Friday	22-Jan	2	Mammalian Genetics	Symula
Monday	25-Jan	3	Mammalian Genetics	Symula
Wednesday	27-Jan	4	Mammalian Genetics	Symula
Friday	29-Jan	5	DNA replication	Pata
Monday	1-Feb	6	DNA replication	Pata
Wednesday	3-Feb	7	DNA repair	Fasullo
Friday	5-Feb	8	DNA repair	Fasullo
Monday	8-Feb	9	DNA repair	Fasullo
Wednesday	10-Feb	10	DNA repair	Fasullo
Friday	12-Feb	Review		
Monday	15-Feb			
Wednesday	17-Feb	EXAM 1	Lectures 1 - 9	
Friday	19-Feb		No Class	
Monday	22-Feb	11	Transcriptional regulation	Morse
Wednesday	24-Feb	12	Transcriptional regulation	Morse
Friday	26-Feb	13	Transcriptional regulation	Morse
Monday	1-Mar	14	Transcriptional regulation	Morse
Wednesday	3-Mar	15	Transcriptional regulation	Morse
Friday	5-Mar	16	Transcriptional regulation	Morse
Monday	8-Mar	17	Transcriptional regulation	Wade
Wednesday	10-Mar	18	Transcriptional regulation	Wade
Friday	12-Mar	19	Transcriptional regulation	Wade
Monday	15-Mar	20	Transcriptional regulation	Wade
Wednesday	17-Mar	Review		
Friday	19-Mar	EXAM 2	Lectures 10 - 22	
Monday	22-Mar	21	Gene silencing	Conklin
Wednesday	24-Mar	22	Gene silencing	Conklin
Friday	26-Mar	23	Gene silencing	Conklin
Monday	29-Mar		Spring Break	
Wednesday	31-Mar			
Friday	2-Apr			
Monday	5-Apr			
Wednesday	7-Apr	24	Protein turnover	Burch
Friday	9-Apr	25	Protein turnover	Burch
Monday	12-Apr	26	Protein turnover	Burch
Wednesday	14-Apr	27	Developmental genetics	Hanes
Friday	16-Apr	28	Developmental genetics	Hanes
Monday	19-Apr	29	Developmental Genetics	Hanes
Wednesday	21-Apr	30	Epigenetics	Gray
Friday	23-Apr	31	Epigenetics	Gray
Monday	26-Apr	32	Epigenetics	Gray
Wednesday	28-Apr	Review		
Friday	30-Apr	EXAM 3	Lectures 23-34	

Instructors:

Doug Conklin	CRC	dconklin@albany.edu	591-7154
Derek Symula	DAI	symula@wadsworth.org	880-1317
Janice Pata	CMS	jpata@wadsworth.org	402-2595
Michael Fasullo	CMS	mfasullo@ordwayresearch.org	641-6467
Randy Morse	CMS	morse@wadsworth.org	486-3116
Joe Wade	CMS	jwade@wadsworth.org	474-5727
April Burch	DAI	aburch@wadsworth.org	402-2233
Steve Hanes	CMS	hanes@wadsworth.org	474-2821
Todd Gray	DAI	gray@wadsworth.org	473-0076