Biology 409 Molecular Biology

Instructor: Kristopher Blee; Holt 301H; Office hours W 1-2 and M, Tu, Th, F 11-noon.
Office phone 898-5116, Email use course WebCT email tool

Required Items: Permanent fine tip marker for labeling tubes, seriously, get your own pen.
USB memory stick.
Lab course manual (purchase form Omicron).
Bound Laboratory Notebook (Composition style/Quad ruled).
Bruce Alberts et al., Fifth ed. 2007. Molecular Biology of the Cell.

Course Assignments:

1. Reading. Reading assignments are scheduled below from either the Alberts et al. text and / or journal articles that have been posted using the course on-line VISTA site, or both. Students should read the assigned material prior to coming to class.

2. Quizzes. Quizzes will be taken online through the course VISTA site. Quizzes will be timed and consist of 10 to 20 questions (for a total of 20 points) taken from the previous reading, lecture, and lab material. The questions will be multiple choice and / or fill in the blank and / or short answer. When assigned, quizzes will become available through the course website either Monday evening or Tuesday morning. The assigned quiz will remain open from that time until Thursday at 11:55 pm and will not be reopened. Do not put off taking a quiz until 11:55 pm on Thursday, if you do and your computer crashes or you run out of time or etc. this is by your choice. In stead always attempt the quiz by Wednesday, then if you have a problem you can notify me in class Thursday and I can make required changes and you still have time to complete the quiz by the end of Thursday as required. Quizzes are to be your personal efforts and no one else's. While taking the quiz you may use your notes, VISTA Biology 409 course materials, and your text book. Discussion of quiz questions with other students who have not yet taken the quiz or providing other students with copies of quiz questions will be considered a breach of academic honesty.

3. Lab Notebook. You will keep a lab notebook which will be evaluated twice during the semester as scheduled. In format the notebook will have a table of contents where the title for each day of lab is listed along with the date that lab was performed and the page number that lab entry in the book can be found. Save a few pages for this. Entries from each lab period into your lab book will always begin on a right page with the left page empty. The first entry will be the names, phone numbers, and emails of your research group. Lab day entries should be a real-time record of everything that happens in lab in enough detail that someone else could repeat your work or for example use your notebook to find corresponding samples that may be stored in the freezer. Entries would also contain: introductory and procedural comments your instructor makes about a lab; the exact protocol you used; any and all raw data as well as summarized data with titles and legends for tables, graphs, and figures; all numerical values should have units. Protocol handouts and printed figures may be pasted into your notebook. All computer or bioinformatics based activities will similarly be recorded in your notebook, especially the correct reference requested by the authors of the tool or application (always watch for and record these). Legible notebooks that adequately meet all these requirements will receive 15 pts. Illegible, unorganized, and / or incomplete notebooks will receive less than 15 pts. Notebooks with exemplary detail and organization displaying obvious extra effort may receive up to 20 pts.

4. Exams. There will be three exams. Exams 1 and 2 will be held during the first two hours of the lecture/lab period and exam 3 will be given during finals week using scheduling as determined by the course lab meeting times. Each exam will be composed of multiple choice questions, definitions, short answer questions, and data analysis/synthesis questions.

5. Lab assignments. Lab assignment due dates are in bold on the Course Schedule. Lab assignments are assigned in the lab course manual and will be outlined by the instructor during the lab period when assigned. These assignments are creation of formal figures from your results complete with a title, text legend, and a short "Results" section where the data of the figure are noted and analyzed. On these assignments you may work in groups, the same group that collected the data. Data may be shared and discussed among other groups, but the preparation of figures and writing are to be your group's efforts. All lab assignments including the abstract submission, conclusions and future work, and the poster presentation will each be scored out of 10 pts possible. Work that is correct in every sense and meets all requirements of the assignment will receive 8 pts. Incorrect work or incomplete work will receive less than 8 pts. Excellent work displaying obvious extra effort may receive up to 10 pts. With respect to revision assignments your level of performance is expected to increase at each revision, therefore efforts that gained you a score of 8 initially would result in a 7 after grading of a revision where no changes were made. To document change you should turn in three items, the previously scored assignment with the revised assignment along with an additional short paragraph pointing out changes that you made and how they improve your assignment.

6. Attendance. Each week of the semester you can earn up to 10 points for your attendance. It is an all or nothing award, either 10 pts or 0 pts. To earn 10 pts for a week requires full period attendance at the lectures and lab. Absence from a lecture or lab will be scored at any time during scheduled course meeting times and the record of absences kept by the instructor is not disputable.

Grading:

Assignments and point value	
Quizzes (6 at 20 pts each)	120
Exams (3 at 50 pts each)	150
Fig&Result (22 at 10 pts each)	220
Lab Notebook (2 at 20 pts each)	40
Attendance (15 wks at 10 pts each)	150

Grade scale	
90 to 92 to 100%	A- to A
80 to 82 to 87 to 89%	B- to B to B+
70 to 72 to 77 to 79%	C- to C to C+
63 to 67 to 69%	D to D+
less than 63%	F

Course Schedule

WK	DATE	SECTION	LECTURE TOPICS	Alberts,pdf	LABORATORY
1	Jan28	I. The nucleus and genome anatomy	Course intro, nuclear function/challenges	ibo,ibo,lan	Lab intro, safety, research project intro
	Jan31		Evolutionary origin of DNA and nucleus	26-30,for,bel	Nuclei
2	Feb5		Structure of the nucleus **Quiz 1**	wor,ben,mou 533-552	GIMP, figure & results preparation
	Feb7		Genome projects, genome comparisons	11-42,bal	Start genomic DNA isolation
3	Feb12		Chromo seq, repeats, clusters, noncoding	ros,job,pra	DNA isolation, spec analysis
	Feb14		Eukaryote genome structure	ven, mak	Restriction, make gels, EtOH ppt **Nuclei figure & results**
4	Feb19		Unknown genes, unkown-eome **Quiz 2**	553-574,kry	Resuspend, gel, photo, blot
	Feb21		Organelle genomes	855-876,ada	Rinse, UV, bake, DNA blot storage
5	Feb 26	II. Expression of the genome	**EXAM 1** (the first two hours)		Genomes online, NCBI, TAIR
	Feb28		Nuclear structure, transcription & export	704-710,dep	Genevestigator
6	Mar4		The transcriptome	574-575,sch	Geneviestigator/Regulatory elements
	Mar6		Promoters, enhancers, silencers	411-432,coo, mar,iso,ahm	Regulatory elements **DNA gel figure & results**
7	Mar11		Transcriptional activation **Quiz 3**	432-477,boe	Apply plant treatments
	Mar13		Transcription	329-345,arn	Grind tissue, isolate RNA, EtOH ppt **Lab notebook w/SEF due**
8	Mar18		**Spring Break**		
	Mar20		**No Classes**		
9	Mar25		RNA processing	346-357,bla	Pellet, wash, resuspend, spec analysis
	Mar27		mRNA	358-360,par	Plan gel, prep samples, make gels **Intro, 5 bioinf figs & results**
10	Apr1		Regulatory RNA, nova 05 **Quiz 4**	477-497,hut	Gel, photo, blot
	Apr3		Translation	366-399,mar	Rinse, UV, bake, storage
11	Apr8		Protein targeting	695-712,kam,ben	ClustalW, vonHeijne, PSORT **RNA gel figure & results**
	Apr 10		**EXAM 2** (the first two hours)		Design/order oligos for probe synth
12	Apr15	III. Replication, repair, and maintenance of the genome	Nuclear structure, DNA rep & cell cycle	710-712,shu	PCR test of genomic DNA
	Apr17		DNA replication	263-294,bar	Gel of test, photo, PCR probe synth **ClustalW fig & results**
13	Apr22		Homologous recombination **Quiz 5**	304-316,hel	Probe quantification, photo **Revised intro, 5 bioinf figs & results**
	Apr24		DNA repair systems	296-304,mad	Prehybridization, hybridization
14	Apr29		Transposons	316-326,pac	Washes, detection, photo
	May1		Chromosomes	202-210,fuk,bol,ber	**Abstract prep, submission (in class)** **Revised gene seq figure & results**
15	May6		Nucleosomes **Quiz 6**	211-218,ann	Cn3D or MolSoft
	May8		Controlling chromatin structure	219-245,kwa	**Conclusions, future work (in class)** **Revised gel blot figs (2) & results**
16	May13		Epigenetic effects are inherited, nova 07	230-233,mar,ooi	Poster prep **Lab notebook w/SEF due**
	May15		How genes evolve	245-260,duj	**Posters and presentation**
	May16		Biology Department Poster Symposium		Post by 11 am, present from 2 to 3:30
17	May22	**Final based on the lecture Friday 23rd 2-5, based on the lab Thursday 22nd 12-2**			

Upon completion of Biology 409 students should be able to:

1 Describe current hypotheses on the switch to DNA in living genetic systems and the origin of the nucleus.

2 Diagram a typical cell nucleus, label all associated structures and provide functions for them.

3 Describe organization of chromatin within the nucleus and discuss mechanisms responsible.

5 Provide a summary or description of the human genome.

6 Compare genomes and offer explanations reflecting current hypotheses for differences in genome size.

7 Locate online genomics resources for model organisms and utilize these sites to obtain information on genome structure or specific genes/proteins. Describe the actions they would perform or tools they would use online to find a gene by name or if given a sequence, locate similar sequences in other organisms.

8 Explain mechanisms of transport in and out of the nucleus and provide examples. Design an experiment to identify a nuclear localization signal.

9 List and describe different levels of gene regulation. Define and provide roles for silencers, enhancers, repressors, activators, histones, methylation, and peripheral localization. Explain the effects of transcription on chromatin structure and that of chromatin structure on transcription.

10 List and describe steps in processing of RNA to mRNA.

11 Define microRNA's, their functions, and their potential commercial/therapeutic uses.

12 Explain the effects of DNA replication on chromatin structure.

13 Diagram a replication fork with participating proteins and provide functions for the proteins.

14 Describe recombination processes in the context of chromatid crossing over and DNA repair.

15 Provide an explanation for the origin of repetitive sequences in the human genome and summarize functions for repetitive DNA in chromosome functioning.

16 Summarize mechanisms contributing genetic change and provide an overview of how these mechanisms might foster evolution.

17 Use online bioinformatics tools and / or interpret graphically summarized data to create testable hypotheses.

18 Create tables, graphs, and figures complete with titles, legends and results text that are suitable for peer reviewed publication.

19 Write the introduction, methods, results, and conclusions sections of a scientific paper.

20 Plan and describe an experiment(s) to test hypotheses on gene expression and / or gene presence.