MCB 3895 Special Topics: Molecular Biology of the Eukaryotic Genome

Course information:
3 credits

Instructors:
Professor Barbara Mellone, PhD
Department of Molecular and Cell Biology
Assistant Professor Stacey Hanlon, PhD
Department of Molecular and Cell Biology

Course description:
An exploration of how genetic information is stored, protected, retrieved, and passed on to the next generation, connecting concepts and principles with the experimental research that lead to their discovery.

Course objectives:
The objective of the course is for students to gain an in-depth understanding of the mechanisms underlying how genetic information is stored in chromosomes, deployed during gene expression and nuclear organization, protected by DNA repair and silencing, and transmitted to the next generation of cells and organisms. This will be accomplished through lectures, in-class discussions and assessments. At the conclusion of this course students will be able to: 1) identify the principles that underlie eukaryotic genome's complexity and regulation; 2) interpret and explain experiments both real and hypothetical; 3) connect concepts related to molecular biology of the genome.

This is an upper level course. Students are expected to have a solid foundation in genetics (MCB 2410 or equivalent) and cell biology as well as basic molecular biology techniques (e.g. PCR, Southern blotting, DNA sequencing, etc.). We will not be covering the genetics and cell biology basics – but moving quickly into the molecular aspects of the biology of the genome. If a student is having trouble with the material, we strongly encourage them to notify the instructors immediately so they may be directed to appropriate background reading.

Course materials:
Required technology: All students must be able to access HuskyCT on demand. Please let the instructors know immediately of any issues related to accessing HuskyCT regularly so that we can work together on a solution.

Required textbook: Molecular Biology: Principles of Genome Function by Nancy Craig, Rachel Green, Carol Greider, Gisela Storz, and Cynthia Wolberger (ISBN 9780198788652). Page numbers corresponding to lecture material and end of chapter problems will be based on the Third Edition.

Course schedule
This is an overview of the topics covered in this course. Any changes to this schedule will be posted on HuskyCT and announced in class.

Week	General topic (Dr. Mellone: blue, Dr. Hanlon: green)	Chapter from Molecular Biology: Principles of Genome Function
1	Intro to DNA and protein structure and interactions	Ch 1, 2 and 3
2	Chromosome structure (histones, centromeres, telomeres)	Ch 4
3	Cell cycle (including mitosis)	Ch 5
4	DNA replication	Ch 6
5	Chromosome condensation and Control of chromosome segregation (checkpoints and mitosis)	Ch 7
6	Transcription basics	Ch 8
7	Reg of Transcription & Exam 1	Ch 7
8	Translation and regulation of translation	Ch 10 and 11
9	Regulatory RNAs	Ch 13
10	DNA damage response, repair mechanisms	Ch 15
11	Double-strand break repair	Ch 16
12	Meiosis	Ch 5
13	Mobile DNA and piRNA	Ch 17
14	Evolution & Exam 2	Ch 18

Learning assessments:
Continuity quizzes (15 points each): At the end of the last class of the week, a short quiz will become available on HuskyCT and will close at the start of the next class. This quiz will help students review key concepts covered in class and connect them to the upcoming lectures. Though each quiz receives only a completion grade, students who answered 95% of the questions correctly will receive 20 bonus points added to their total points.

Homework (25 points each): Each week, a homework assignment will be posted on HuskyCT that is due the following week. The homework will be pulled from the questions at the end of each chapter and will generally be short answer format.

Midterms (160 points each): Two midterms will be administered, one at the end of Week 7 and one at the end of Week 14. The first midterm will cover the first half (Weeks 1-7) of the course, and the second midterm will cover the second half (Weeks 8-14). These midterms will be held in-person during normal class time.

Final Exam (200 points): The final exam is comprehensive and will cover all concepts presented during the semester. The day, time, and location of the final will be determined by the Office of the Registrar sometime in March and announced in class, as well as posted on HuskyCT.

Grade calculation and grading scale:
Your final grade in this course will be calculated by the number of points earned over the whole semester. Each learning assessment (above) is worth a set number of points, and the total points available for this course is 1000:

Assessment	Number of each	Points per assessment	Total (percent)
Continuity quizzes	12	15	180 (18%)
Homework	12	25	300 (30%)
Midterm exams	2	160	320 (32%)
Final exam	1	200	200 (20%)
		Total:	1000 (100%)

Total points earned for the course will convert to a letter grade using the following scale:

Total points	Grade	Letter Grade
≥ 935	94-100	A
895 - 934	90-93	A-
865 - 894	87-89	B+
835 - 864	84-86	B
795 - 834	80-83	B-
765 - 794	77-79	C+
735 - 764	74-76	C
695 - 734	70-73	C-
665 - 694	67-69	D+
635 - 664	64-66	D
595 - 634	60-63	D-
≤ 594	<59	F