Molecular and Cell Biology BIO3620

Course Coordinator: Jeremy Seto
Pre-requisites: BIO2450 and ENG1101
Textbook: Essential Cell Biology, 4th Edition (2013), Alberts et al.
Publisher: Garland Science, NY ISBN 978-0815344544

Course Description: An overview of cells including the molecular basis for its structures and functions. Topics introduce key principles of Cell Biology, including cellular energetics and biochemistry, roles of cell membranes and the detailed functions of organelles. Molecular structure of DNA, RNA and Proteins will be discussed as well as Transcription, Translation and Post-translational modifications. Cell signaling pathways, cell cycle and cell death will be discussed, with the detailed reference to its regulations. The laboratory component provides in-depth experimentation with the techniques and tools utilized in the study of molecular and cell biology.

Grading: Total: 60% Lecture/ 40% Lab
Lecture: Exams/Quizzes
Lab: Quizzes/Participation/Presentations/Homework

Week	Lecture Topics	Chapters
1	Introduction to Cells Chemical Components of Cells	1&2
2	Energy Protein	3&4
3	DNA and Chromosomes	5
4	Chromosomes **Exam 1**	5 1-5
5	DNA Replication, Repair and Recombination	6
6	DNA → Protein: The Central Dogma	7
7	Gene Control Mechanisms **Exam 2**	8 6-8
8	Genes and Genomes	10
9	Membrane Structure and Function	11&12
10	Membrane Structure and Function Membrane Transport	11&12
11	**Exam 3** Cellular Compartments	10-12 15&16
12	Cellular Communication Cell Signaling	15&16
13	Cellular Division	18
14	Cancer and Cellular Communities	20
15	**Exam 4**	15, 16, 18, 20

Week	Lab Schedule	Reading Pages
1	• **Micropipetting** and centrifuges • **Metric Conversions** and Scientific measures	
2	• **Plasmid** Purification by **Alkaline lysis** • **Agarose Gel Electrophoresis** • Plasmid Identification using **restriction enzymes** • **In silico Digestion**	Alberts 327-338, 347
3	• Bacterial transformation: **heat shock** • **History of DNA as genetic material** • pGlo/Genotype to Phenotype → Hypothesis test/Predictions	Alberts 174-176
4	**Quiz 1** • Plasmid Structure → Visualize transformation predictions • **Transcriptional Control**	Alberts 248-249 Alberts 331-333
5	• **DNA isolation from Eukaryotes** • Introduction to DNA replication and **PCR** • **Genetics Review**	Alberts 200-202
6	**Crime scene** PCR (Flipped student presentations) • **VNTR, STRs, RFLP** **PTC** Paper and human alleles (**SNP**) (Flipped student presentations)	Alberts 340-344 Alberts 664 Alberts 674-677
7	**Tracing Origins** • **Mitochondrial** Haplotyping **(activity)** (Flipped student presentations) • Using **Transposons** for lineage with **Alu** insertion (Flipped student presentations)	Alberts 302-303,314 Alberts 486-487
8	**Quiz 2** • **Barcoding of Life** (COI and RbcL **activity**) • Tissue Culture demonstration	
9	Introduction to Tissue Culture • **Gene Expression**: RNA isolation and Reverse **Transcription**	
10	• Quantitative **Real-Time PCR** • **Sequencing technology** (Sanger)	Alberts 343-347
11	**Quiz 3** • Bioinformatics • **Primer Design for qPCR**	

Week	Lab Schedule	Reading Pages
12	Sequencing technology (Next Generation Sequencing) • **Illumina** • **Ion Torrent** • **PacBio** • **MinION** • qPCR results review	Alberts 335-339
13	Gene Cloning Workflow • **Transgenic Technology** and **activity** • **Transfection** of Eukaryotic cells (demonstration)	Alberts 351-353
14	GFP Protein purification • Introducing biotechnology: Insulin as an example • Protein **Purification** (**activity**) • Review Transfection	
15	**Quiz 4** • Final Presentations	

BIO3620	NYCCT Gen Ed Common Core	CUNY Common Core
1. Comprehend the principles of biology	• Use the arts, sciences and humanities as a forum for the study of values, ethical principles, and the physical world. • Engage in an in-depth, focused, and sustained program of study	Identify and apply the fundamental concepts and methods of a life or physical science.
2. Appreciate the relationship of the other sciences to biology	Understand and appreciate the range of academic disciplines and their relationship to the fields of professional and applied study	
3. Understand the scientific method, its history and importance to society	Employ scientific reasoning and logical thinking.	Apply the scientific method to explore natural phenomena, including hypothesis development, observation, experimentation, measurement, data analysis, and data presentation
4. Acquire skills in the use of biological equipment and techniques	Acquire and use the tools needed for communication, inquiry, analysis, and productive work.	Use the tools of a scientific discipline to carry out collaborative laboratory investigations.
5. Develop expertise in the written and oral expression of biological ideas	• Acquire and use the tools needed for communication, inquiry, analysis, and productive work. • Communicate in diverse settings and groups, using written (both reading and writing), oral (both speaking and listening), and visual means, and more than one language.	Gather, analyze, and interpret data and present it in an effective written laboratory or fieldwork report
6. Gain skill in the collection of data and in its mathematical treatment and interpretation	• Derive meaning from experience, as well as gather information from observation. • Understand and employ both quantitative and qualitative analysis to describe and solve problems, both independently and cooperatively. • Gather, interpret, evaluate, and apply information discerningly from a variety of sources.	•Gather, analyze, and interpret data and present it in an effective written laboratory or fieldwork report •Identify and apply research ethics and unbiased assessment in gathering and reporting scientific data.
7. Acquire the knowledge needed for a thorough understanding of the major bioethical issues in society	• Use the arts, sciences and humanities as a forum for the study of values, ethical principles, and the physical world. • Understand and apply values, ethics, and diverse perspectives in personal, professional, civic, and cultural/global domains	

ATTENDANCE AND LATENESS

You must attend both lecture and lab. It is expected that you will be in your seat and ready to work at the start of each period. Any 2 latenesses will be considered to be equal to 1 absence. Academic penalties (10%) may be incurred for excessive absences or latenesses based on deficiency in submitted work.

SUGGESTIONS

Read the textbook prior to coming to class. You are responsible for all material, announcements, or assignments mentioned in class whether you are present or not. It is therefore advisable to write down the name of your instructor(s), the office, phone extension and office hours. It is also advised to get the names and phone numbers of several classmates who may be contacted in the event that you are absent. Check Blackboard for announcements, links and schedules from your instructor.

Online resources from the textbook can be found at the publisher's Youtube Channel.
http://www.youtube.com/user/garlandscience

SAFETY

The laboratory component involves chemicals, bacteria and animal tissue. A lab coat is mandatory in the Lab room at all times even on Quiz days. Other personal, protective equipment like gloves should be brought in by students.

LECTURE GRADING (60%)

The lecture will be graded on 4 exams and homework/quizzes/worksheets. Attendance bears **no** weight on the grade, however absences are deleterious to performance in general.

LABORATORY GRADING (40%)

The grades will consist of at least 4 quizzes, participation, homework/prelab assignments and flipped classroom presentations. Attendance bears **NO** weight on the grade, however absences are deleterious to performance in general. Lateness will also be counted towards the participation grade. Flipped Class grades will also be factored in heavily independently of participation.