KINGSBOROUGH COMMUNITY COLLEGE of The City University of New York
Department of Biological Sciences

Bio 65 – Molecular and Cellular Biology
(4 credits, 6 hrs – 3hrs lecture, 3hrs lab)

Instructor: Ivan Shun Ho, Ph.D.
Office: S118
Telephone: 718 368-4997
Email: ivan.ho@kbcc.cuny.edu

Course Description
The structure and functions of cell components are covered. Emphasis will be placed on the molecular composition of cells and the molecular mechanisms a cell uses to grow and divide. Experiments and computer exercises are designed around fundamental questions in eukaryotic cell biology with an emphasis on biochemical and molecular biological techniques.
Prerequisites: Bio 1400 and Chm 1100

Student Learning Outcomes
1. Increase student understanding of the biological complexity of the cell through the study of the molecular and cellular mechanisms which underlie life.
2. Identify the principal molecules of the cell (DNA, RNA, protein), their interactions with one another, with other cellular components, and with other cells.
3. Develop in-depth knowledge of the molecular and cellular basis of homeostasis and cell division.
4. Define the principles and purposes of fundamental methods commonly used in biotechnology and practice them in a laboratory setting.
5. Analyze data in order to determine genetic relatedness among fish by constructing a cladogram.
6. Write a scientific paper on the molecular etiology of a disease and present it in a professional setting in class.

Course Requirements and Policies
Textbook: Essential Cell Biology, 5th edition by Alberts et. al. 2019

Laboratory: There is no laboratory manual. You are required to bring a 3-ring binder with you to the first lab where you will be given laboratory handouts.

Grading: Lecture and lab are 50% each of your final grade. Point distribution is as follows:

Course requirements	
Laboratory	
Quizzes	25%
Lab exercises	10%
Research Project	15%
Lab participation & techniques	6%
Lecture	
Lecture Exams	24%
Final Exam	20%
Course total	100%

Attendance and Required Materials

- It is expected that students will attend as many Collaborate Live Q&A session as possible. However, these sessions are recorded and the recordings can be accessed conveniently.
- Attendance of the course is based on attending laboratory sessions and participating in academic activities, such as turning in assignments, completing quizzes and exams. If you stop doing any of these activities, you will be assigned a WU (unofficial withdrawal).
- All assignments are submitted in-person during lab sessions. Quizzes take place during lab sessions while lecture exams are completed online using Blackboard course shell. Please ensure you have a reliable internet connection with decent speed to participate in these core academic activities.
- Every test will be timed and automatically submitted once allotted time is over. Students will see only one question at a time on their screen and they cannot go back to previous questions. None of these policies are negotiable.
- Assignments turned in late will receive a 0.
- There are no make-up lecture exams. If one lecture exam is missed the grade you receive on the final exam will substitute it. Missing a second exam will be counted as a 0.
- If a quiz is missed the grade you receive on the following quiz will substitute it. Missing a second quiz will be counted as a 0.
- There are no negotiations for grades. Your grade is the sum of the components listed. There are no extra credit, make-up or "pity" points. It is expected that you give 100% effort in all your endeavors including this course. Therefore, there are no extra points for "working hard".
- All cell phones and other electronic devices should be silenced during all class sessions.

Access-Ability Services (AAS) serves as a liaison and resource to the KCC community regarding disability issues, promotes equal access to all KCC programs and activities, and makes every reasonable effort to provide appropriate accommodations and assistance to students with disabilities. Please contact this office if you require such accommodations and assistance. Your instructor will be glad to make the accommodations you need, but you must have documentation from the Access-Ability office for any accommodations.

How to succeed in Molecular and Cellular Biology:

- Complete all assignments and turn them in on time. Late assignments are not accepted.
- Attend all Blackboard Collaborate Live Q&A sessions
- Read and review the assigned textbook pages, slides, and laboratory handouts BEFORE lecture and lab so you can take better notes and plan your experiments better.
- Review your class notes as soon as possible after lecture and immediately before lecture.
- Participate in a study group on a weekly basis. This can be done through Zoom, Skype, or any other group meeting apps available.
- Know the vocabulary! The study of MCB is like learning a new language. You need to know the vocabulary in order to understand the concepts.
- Get a good night's sleep before the exam.

Required laboratory equipment/items

- Knee-length lab coat
- Goggles
- Nitrile gloves
- Marble notebook

Safety is a priority for the laboratory portion of this course. You must pay attention to and STRICTLY FOLLOW the instructor's directions in performing experiments at all times!

Academic Integrity Policy

Academic dishonesty is prohibited in The City University of New York and is punishable by penalties, including failing grades, suspension, and expulsion. Examples of academic dishonesty include cheating, plagiarism, internet plagiarism, obtaining unfair advantage, and falsification of records. A full definition of each form of academic dishonesty, as well as procedures for imposition of sanctions for violations of the CUNY Policy on Academic Integrity, may be accessed at www.kingsborough.edu.

Lecture Outline

Week 1 Lecture: Introduction to the Cell
a. Cells and genomes
b. Biochemistry of the cell
c. Proteins
Reading Assignment: Chapters 1 (pp 1-27), 2 (pp 39-79) and 4

Week 2 Lecture: DNA
a. DNA and Chromosomes
b. DNA Replication
c. DNA Repair and Recombination
Reading Assignment: Chapters 5 and 6

Week 3 Lecture: From DNA to Protein I
a. Transcription
b. Regulation of Gene Expression
c. Comparison of gene expression and regulation of gene expression between Prokaryotes and Eukaryotes.
Reading Assignment: Chapter 7

Week 4 Lecture: From DNA to Protein II
a. The Mechanics of Translation in Prokaryotes and Eukaryotes
b. Regulation of Translation in Eukaryotes
Reading Assignment: Chapter 8

Week 5 Lecture: Membranes
a. Membrane structure
b. Membrane synthesis
c. Electrical properties of membranes
d. Transport Across Membranes
Reading Assignment: Chapter 11

Week 6 Lecture: The Compartmentalization of Cells
a. Intracellular Compartments
b. Transport of Proteins between the Nucleus and Cytoplasm
c. Transport of Proteins into Mitochondria
d. Transport of proteins into the Endoplasmic Reticulum
Reading Assignment: Chapter 15 (pp 495-511)

Week 7: Intracellular Vesicular Traffic
a. Transport Through the Endomembrane System
b. Transport from the trans Golgi Network to Lysosomes
c. Endocytosis
d. Exocytosis
Reading Assignment: Chapter 15 (pp 511-530)

Week 8: The Cytoskeleton
a. The Dynamic Structure of Cytoskeletal Filaments
b. Molecular Motors
c. Regulation of Cytoskeletal Components
Reading Assignment: Chapter 17

Week 9: The Cell Cycle I
a. Overview of the Cell Cycle
b. Molecular Components of the Cell Cycle
c. Regulation of the Cell Cycle
Reading Assignment: Chapter 18 (pp 611-627)

Week 10: The Cell Cycle II
a. Overview of Mitosis and Cytokinesis
b. Regulation of Mitosis and Cytokinesis
c. Apoptosis
Reading Assignment: Chapter 18 (pp 627-647)

Week 11: Cell Signaling
a. General Mechanisms of Extracellular Signaling through Cell Receptors
b. G-Protein-Linked Cell-Surface Receptors
c. Tyrosine Kinase Receptors
Reading Assignment: Chapter 16

Week 12: Cell Communication
a. Extracellular Matrix and Connective Tissues
b. Epithelial Sheets and Cell Junctions
c. Tissue Maintenance and Renwal
d. Cancer
Reading Assignment: Chapter 20

Laboratory Outline

Week 1 Lab: Introduction
1. Laboratory Safety and policies
2. Measurements and Quantitation
    - Appropriate use of micropipettes
    - Basic laboratory calculations: How to make stock solutions and buffers

Week 2: Restriction Digestion
1. Cutting DNA with restriction endonucleases
    - *Eco*RI
    - *Pst*I
    - *Hind*III
2. DNA Gel Electrophoresis
3. Determining sizes of DNA fragments
    - Constructing a standard curve
    - Determining sizes of unknowns

Week 3: Bacterial transformation
1. Transforming *E. coli* with pGLO plasmid DNA

Week 4: Isolating Plasmid DNA from Transformed E. coli
1. Mini prep of pGLO plasmid DNA
2. Spectrophotometry of DNA Prep product
3. Restriction enzyme digestion of plasmid DNA

Week 5: Chromatography
1. Protein prep of *E. coli* containing GFP
2. Affinity chromatography

Week 6: PCR
1. Using mock crime scene evidence, identify the criminal through amplification of DNA via PCR
2. Gel Electrophoresis of Crime Scene PCR results

Week 7: ELISA Immunodetection
1. Modeling Ag/Ab complexes
2. ELISA assay
3. Analysis of data acquired by ELISA

Week 8/9: Comparative Proteomics with Western Blotting
1. Protein Extract of fish samples
2. PAGE: fish samples & GFP (from Wk5)
3. Transfer of proteins to nitrocellulose
4. Western blotting

Week 10/11: Genetically Modified Organisms
1. DNA extraction of plant samples
2. Identification of GMOs through PCR
3. Analysis of results of PCR

Week 12: Research Paper Presentation