University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

Cell and Molecular Biology For Environmental Scientists - Genes to Ecosystems

Number of credits: 3

MEES 680
Fall Semester

Course Objectives / Overview

The biological world operates on a multitude of scales - from molecules to tissues to organisms to ecosystems. Throughout these myriad levels runs a common thread: the communication and onward passage of information, from cell to cell, from organism to organism and ultimately, from generation to generation. But how does this information come alive to govern the processes that constitute life? The answer lies in the molecular components that cooperate through a series of carefully-regulated processes to bring the information in our genome to life. These components and processes lie at the heart of one of the most fascinating subjects to engage the minds of scientists today: molecular biology. For environmental scientists, molecular biology provides new insights into what it takes to make a stable ecosystem. Through lectures, lab simulations, online assessments, and reading of current papers, each student will gain an appreciation for the approaches taken to yield the information from which conclusions are made and what still may need to be done to obtain the appropriate outcome.

Expected Course Learning Outcomes

[1. Students will gain literacy in central dogma, approaches and avenues of research in environmental molecular science & technology, including

a. Molecular Principles and Diversity of Life
b. Development of Tools to Modify Life
c. Tracking the Molecular Evolution of Life
d. Molecular Hallmarks of Symbiosis/Parasitism
e. Synthetic Biology

This literacy will include the development of scholarship through critical reading and synthesis of scientific literature, including evaluation of hypotheses and approaches, central theories and assumptions, and inferential logic.

2. Students will demonstrate mastery of

a. Knowledge of principle theories and ideas relating to molecular systems through multiple choice examinations

INSTRUCTOR DETAILS:

Allen Place
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410-234-8828

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410-234-8833

CLASS MEETING DETAILS:

Dates: Mon. and Wed.
Times: 8am – 9:20am
Originating Site: CourseForum http://130.85.169.194:3455/admin/directory.html
IVN bridge number: (https://zoom.us/j/97960940818?pwd=WkVhcGEwb25CUXVCSGxkTzlSWlY2Zz09)
Phone call in number:
(+1 301 715 8592 US (Germantown)
Meeting ID: 979 6094 0818
Passcode: 947222)
Room phone number:
(N/A)

CURRICULUM FULLFILMENT:

MEES 680 fulfills a Foundation course MEES requirement.

Prerequisites

Undergraduate biochemistry and/or cell biology

Teaching Assistant

N/A

b. Ability to express ideas relating to molecular systems in quantitative terms; Ability to synthesize ideas across systems and scales (from molecules to communities)

Course Assessment / Grading

Course organization: There will be two written examinations available on CourseForum, weekly homework assignments, one assignment on molecular phylogenetic analysis and a final project. We will discuss recent papers in class throughout the course. We will be using Labster simulations as homework.

Grading:

First Exam:	10%
Second Exam:	10%
Student Paper Discussion:	15%
Phylogeny Assignment:	15%
Final Project:	20%
Attendance/participation:	30%

Tentative Weekly Course Schedule

The Cogs in the Machinery of Life – A Gallery of Size, Shape and Charge

August 31, Lecture 1: AP: Molecules of Life

September 2, Lecture 2: AP: Carbohydrates and Lipids

September 7, Labor Day - No Class Watch video of Lecture 4 & 5

September 9, Lecture 3: AP: Amino acids, Nucleic Acids and Metabolites

September 14, Lecture 4:AP: Evolution of Metabolic Pathways

The Machinery of Life – Making DNA, Making RNA, Making Proteins, Making Membranes, Making a Cell

September 16, Lecture 5: AP:MacVector Tutorial

September 21, Lecture 6: AP:Chromatin and Nucleus

September 23, Lecture 7: AP: Protein Sorting and Trafficking

September 28, Lecture 8: YL Making DNA

September 30, Lecture 9: Yl Making RNA

October 5, Lecture 10: YL Transcriptional Regulation

October 7, Lecture 11: YL Splicing

October 12, Lecture 12: YL Light-dependent Reactions of Photosynthesis

October 14, Lecture 13: YL Carbon Fixing Reactions of Photosynthesis

October 19, Lecture 15: FC Viruses (Non-coding RNAs)

October 21, Exam 1: The exam will place on EDGE.EDX on October 21 at 8:30 AM.

Are the Cogs and Machinery Shared and How do you know?

October 26: Lecture 16: TB: Next- Generation DNA Sequencing ,Bioinformatics and computational biology; sequence alignments, protein structure alignments, orthologues, paralogues, gene duplication, lateral gene transfer, data mining, phylogenetic trees, molecular versus physical taxonomy

October 28 Lecture 17: TB: Comparing Sequences and Making Phylogenetic Trees

October 30, Lecture 18: TB: Horizontal and Vertical Gene Transfer

Using Variation in the Machinery

November 2, Lecture 19 LP: Using Variation for Population Studies.

November 4, Lecture 20: LP: Population and Landscape Genomics

Manipulating & Detecting the Machinery – The Researcher's Toolbox

November 11, Lecture 21: CB: Basic molecular biological tools, Part I

November 16, Lecture 22: YL: Basic molecular biological tools, Part II

November 18, Lecture 23, AP Protein Purification

November 23, Lecture 23 RM Microbiomes - Environmental and Gastrointestinal

November 25: Exam 2:The exam will place on EDGE.EDX on November 25 at 8:30 AM.

November 26, Thanksgiving

Modifications to the Machinery

November 30, Lecture 25:AP Ubiquitination, Glycoslation

December 2, Lecture 26:YL Phosphorylation

December 7, Lecture 27: BO Proteomics

December 9, Student Project Presentations

Required textbooks, reading and/or software or computer needs

Suggested textbook: Molecular Biology - Principles of Genome Function 2nd edition

Course Communication

[Discussion questions should be posted on the Course Forum at http://130.85.169.194:3455/admin/directory.html; Contact the instructors by email.]

Resources

[Course website: http://130.85.169.194:3455/admin/directory.html]

Campus Policies

The University of Maryland Center for Environmental Science has drafted and approved various academic and research-related policies by which all students and faculty must abide. Please visit the following website for more information on the University of Maryland Center for Environmental Science Code of Academic Integrity and Policy III-1.00: Policy on Faculty, Student and Institutional Rights and Responsibilities for Academic Integrity.

Course-Specific Policies and Expectations

[N/A.]