MOLECULAR BIOLOGY METHODS

UNIVERSITY OF NEBRASKA - LINCOLN

CHEM936 SPRING 2022

CLASS MEETS: T TH 10:30 AM – 11:45 AM HAH 548

INSTRUCTOR

Dr. Catherine Eichhorn
Assistant Professor of Chemistry

HOW TO REACH DR. EICHHORN

Email: ceichhor@unl.edu
Office Hours: Th 12:30 – 2 pm (HAH 723) or by appointment

COURSE DESCRIPTION

This course focuses on the fundamentals of molecular biology and biotechnology including methods for genome manipulation, DNA cloning, sequencing, annotation, recombination, mutagenesis, and expression as well as applications in imaging, molecular diagnostics, and therapeutics. In addition, the course will cover computational approaches for comparative analysis, biomolecular structure modeling, and accessing information from genomic databases.

LEARNING OBJECTIVES

01 Gain a strong theoretical understanding of basic cellular function and how these systems can be harnessed for genome manipulation.
02 Gain a practical, working knowledge of molecular biology methods.
03 Be able to identify appropriate methods and design experimental protocols to answer a research question.

RESOURCES

All required materials will be posted to the course Canvas page.

REQUIRED TECH

Computer/ Tablet

Internet Access

Browser/ PDF Reader

DETAILED COURSE INFORMATION IN CANVAS UNDER CLASS ESSENTIALS

COURSE FORMAT & POLICIES

The course will be in person and you are encouraged to attend in person for optimal engagement with the material, peers, and instructor. If in-person classes are cancelled, you will be notified of the instructional continuity plan for this class by Canvas or email. The course format is subject to change upon University policies. University policies can be found at go.unl.edu/coursepolicies.

ACCESSIBILITY

If you need any accessibility-based accommodations, please let me know so appropriate arrangements can be made. See the University Policy page on Canvas under Class Essentials for more information.

The UNL Library has laptops to check out (https://libraries.unl.edu/laptops).

ACADEMIC INTEGRITY

Your intellectual growth depends on responsibility, honesty, and doing your own work. Presenting the work of others as your own by taking ideas from others (plagiarism) or copying other's work is dishonest (cheating), hurts your reputation and credibility, and will result in a failing grade on the assignment and potentially disciplinary action. See the University Policy page on Canvas under Class Essentials for more information.

HEALTH AND WELL-BEING

These are not normal times. Please be kind to yourself, and to others. If you are struggling, please reach out to me. CAPS is a great resource for counseling and support: https://caps.unl.edu/appointments

FACE COVERINGS

At this time University and county health policies require face coverings indoors including in the classroom. This policy is subject to change depending on University and local guidance. See https://covid19.unl.edu/ for up to date information.

ATTENDANCE

The course has been designed to give you many opportunities to meaningfully engage with the instructor, peers, and the material beyond in-person attendance. Attendance will be taken for record-keeping and safety reasons. Let me know before class if you are not able to attend.
If you do not feel well DO NOT come to class in person. Students who are sick or who are engaging in self-quarantine in accordance with guidance from the Lincoln-Lancaster County Health Department or their health care professional should not physically attend in-person classes.

FLEXIBILITY & DUE DATES

Assignment due dates are designed to help you progress through the course while engaging in deep learning. It is important to turn in assignments on time to keep up with course material and engage in productive discussion in class. Deadline extensions may be permitted on a case-by-case basis. Please contact the instructor as soon as possible if you anticipate missing critical deadlines.
Late policy: You may receive up to 90% credit for homework assignments turned up to 2 days late, and up to 80% for assignments turned in up to 5 days late. Exceptions to this policy may be granted on a case by case basis.

ASSIGNMENTS & GRADING

HOMEWORK 300 POINTS

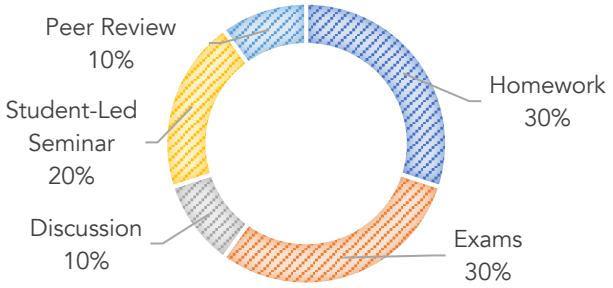
Homework gives you the opportunity to evaluate your understanding of the material before and after class. Homework will take the form of pre- or post-class assignments. Complete the assigned reading before beginning the pre-class assignment. Pre-class assignments will assess understanding of the assigned reading and build your reasoning/critical thinking skills when reading research articles. Post-class assignments will assess theoretical and practical understanding of the material and develop problem-solving skills on methods covered.

EXAMS 300 POINTS

Exams assess your summative understanding of concepts and methods. Exams will be 'take home' format and will be posted on Canvas by Friday 5 pm and due Sunday midnight. Exams will be worth 150 points each. Any resource can be used, but you must cite all resources used. Exams must be completed individually – do not work with anyone on the exam. Exams will take place on the following dates:

- Midterm exam March 4-6
- Final exam May 13-15

If you have a conflict or anticipate missing an exam, you **must** notify me before the exam start date. Class and exam policies and procedures are subject to change depending on national, state, or University issued guidance.



POINTS	PERCENT	GRADE
970-1000	97.0+	A+
930-969	93.0+	A
900-929	90.0+	A-
870-899	87.0+	B+
830-869	83.0+	B
800-829	80.0+	B-
770-799	77.0+	C+
730-769	73.0+	C
700-729	70.0+	C-
670-699	67.0+	D+
630-669	63.0+	D
600-629	60.0+	D-
<600	<60.0+	F

DISCUSSION 100 POINTS

In-class discussions and activities give you the opportunity to evaluate your understanding and receive feedback in real time to build critical thinking and problem solving skills.

PEER REVIEW 100 POINTS

You will provide constructive, productive feedback for your peers after each student-led seminar. Peer review evaluations will be due at the beginning of the next class following the student-led seminar. This feedback will be returned to your peers and is critical to assisting both your and your peer's critical thinking and professional development skills.

STUDENT-LED SEMINAR 200 POINTS

You will work in a team of 2-3 students to lead the class in discussion of a topic related to the module. Your team will select a topic and reading material, design a short assignment to assess student understanding, and present on the topic in class. Each member of the team will be responsible for presenting 15-20 minutes during the class period. Your grade will be based on individual and group contributions. Seminar and assignment due-dates are as follows:

IMPORTANT DATES

STUDENT-LED SEMINAR	DATES
NUCLEIC ACID METHODS	FEB 17
PROTEIN EXPRESSION	MAR 3
GENOME MANIPULATION	MAR 31
BIOINFORMATICS	APR 21
APPLICATIONS	MAY 12

YOUR SEMINAR	DUE DATES (MIDNIGHT)
TOPIC & READING SELECTION	2 WEEKS BEFORE
ASSIGNMENT DRAFT	1 WEEK BEFORE
OUTLINE & SLIDES	MONDAY BEFORE

LET ME KNOW IF YOU HAVE ANY QUESTIONS!

COURSE SCHEDULE

JAN 18
INTRODUCTION

JAN 20
GENE EXPRESSION MACHINERY & MECHANISM:
DNA ARCHITECTURE & REPLICATION

JAN 25
GENE EXPRESSION MACHINERY & MECHANISM:
TRANSCRIPTION

JAN 27
GENE EXPRESSION MACHINERY & MECHANISM:
TRANSLATION

FEB 1
GENE EXPRESSION MACHINERY & MECHANISM:
EPIGENETICS

FEB 3
GENE EXPRESSION MACHINERY & MECHANISM:
PRACTICAL ASPECTS

FEB 8
NUCLEIC ACID-BASED METHODS:
GENES & PLASMIDS

FEB 10
NUCLEIC ACID-BASED METHODS:
PCR, PRIMERS, & SEQUENCING

FEB 15
NUCLEIC ACID-BASED METHODS:
BIOMOLECULAR INTERACTIONS

FEB 17
STUDENT-LED SEMINAR

FEB 22
RECOMBINANT PROTEIN EXPRESSION:
STRAINS & CELL CULTURE

FEB 24
RECOMBINANT PROTEIN EXPRESSION:
PROTEIN PURIFICATION

MAR 1
RECOMBINANT PROTEIN EXPRESSION:
DETECTION & VALIDATION

MAR 3
STUDENT-LED SEMINAR

------ MIDTERM EXAM MAR 4-6 ------

MAR 8
GENOME MANIPULATION:
RNA DEGRADATION DISCOVERY

MAR 10
GENOME MANIPULATION:
RNA DEGRADATION TOOLS

MAR 13-20
SPRING BREAK, NO CLASS

MAR 22
GENOME MANIPULATION:
CRISPR/CAS9 DISCOVERY

MAR 24
GENOME MANIPULATION:
CRISPR/CAS9 TOOLS

MAR 29
GENOME MANIPULATION:
PROTACS & PROTEOLYSIS

MAR 31
STUDENT-LED SEMINAR

APR 5
BIOINFORMATICS:
INTRODUCTION

APR 7
BIOINFORMATICS:
STRUCTURE PREDICTION

APR 12
BIOINFORMATICS:
STRUCTURE PREDICTION, PRACTICAL ASPECTS

APR 14
BIOINFORMATICS:
SEQUENCE ALIGNMENT & CONSERVATION

APR 19
BIOINFORMATICS:
DATABASES

APR 21
STUDENT-LED SEMINAR

APR 26
APPLICATIONS:
IMAGING & MOLECULAR DIAGNOSTICS

APR 28
APPLICATIONS: THERAPEUTICS

MAY 3 LAST WEEK OF CLASS
APPLICATIONS: DIRECTED EVOLUTION

MAY 12 LAST CLASS
STUDENT-LED SEMINAR

------ FINAL EXAM MAY 13-15 ------