

ENTO-496/896-004.1208 – Independent Study (temporary #)

Molecular tools for aspiring entomologists

3 credits

Instructor: Leslie Rault, PhD

Office: ENTO Hall 312F

Email: lrault2@unl.edu

No office phone, Google Voice phone # 402-783-1322 only between 8:30 AM and 5 PM weekdays (texts and calls).

Zoom meetings or in person meetings upon request.

[Guest lecturers: Drs Lise Pingault (senior research associate) and Ellis Johnson (postdoc).

Teaching assistant: Xi Xian Ng]

Online lecture videos to watch before the lab, Thursday 3 hour-laboratory session 9 am to 12 pm

Textbooks: none required, suggestions: Insect Molecular Genetics, An Introduction to Principles and Applications. 4th Edition. Marjorie A. Hoy, available for purchase at the bookstore and online.

Prerequisite: high school biology.

Undergraduate and graduate level introductory course.

Course statement:

This class is an introduction to topics that are necessary to understand general biology, using insects and issues associated with them as a model. This class includes a lecture section (online) as well as a laboratory section (on campus). It will provide an understanding of the principles, concepts and techniques of molecular biology applied to entomology. The specific objectives of this course are to provide an understanding and discuss ramifications of cell structure and genetic material, the Central Dogma, inheritance, gene function, gene mutation and implications for entomology, and ethical issues related to genetic research and its applications (Gene editing, sterile technique, GMO plants). This course is geared towards undergraduate/graduate students who are interested in laboratory-based research in entomology but may lack hands-on experience.

Learning objectives:

- Gain an understanding or remember the basic structure of the cell, cell diversity and universal aspects across life forms
- Be able to explain what the central dogma is and why it is important in entomology by making a link between the observable traits and the underlying molecular mechanisms

- Understand that scientific knowledge progresses through confirmation or rejection of background-based hypotheses, decisions that are based on empirical evidence and logical interpretation using the basic structure “CEDRIC: Context, Experimental Design, Results, Interpretation, Conclusion”
- Gain the ability to apply basic concepts of genetics to current problematics of entomology from pest control to insect conservation and genetic engineering
- Demonstrate enhanced critical inquiry skills through writing, development of synthesis and reviewing skills by becoming familiar with publications relevant to the class
- Be proficient in basic laboratory procedures such as pipetting, setting up an assay, and be able to analyze and interpret the results obtained

Tentative schedule and topics covered:

Please refer to UNL registrar calendar for the semester for holidays and academic deadlines:

<https://registrar.unl.edu/academic-calendar/>

August 21 to December 9, 2023

Lecture/lab sequence	Topic covered	Date
Chapters 1-3 Unit I	Cell Biology and introduction to genetics	
Chapter 1	Introduction - Cell biology, diversity and universality in life forms	
Chapter 2	Central Dogma, DNA/RNA Structure	
Chapter 3	Genetic Code, Transcription and Translation	August 24 /
	Introduction to Polymerase Chain Reaction	September 7
	Graded assignment: summary of a research article (all)	
Lab#1:	Introduction to laboratory methods	
A.	Safety; Notebooks; Scientific Method; Micropipetting.	
B.	Design of experiments; statistical analysis.	
Lab#2:	Application around the Central Dogma and introduction to mutations	
A.	Virtual biology (computer lab) - Summary activity for the Central Dogma	September 7
B.	Designing primers	
	graded assignment: answer questions relative to the activity (all)	
Chapters 4-6 Unit II	Cell cycle, DNA modifications and heredity	
Chapter 4	Mitosis and Meiosis	
Chapter 5	DNA Replication and Recombination and Mechanisms of DNA Repair: Mutations	September 14
Chapter 6	Mutations in translation: examples from journal articles	
	(Graduate) First paper review –	
	(UG) First presentation/poster/infographics	

Lab#3-5:	Application of the detection and understanding of gene function in insect physiology	
A.	RNA extraction (September 14)	
B.	cDNA synthesis and DNA amplification by PCR: Optimizing and using the designed primers	September 21
C.	Gel electrophoresis	September 28
	Assignment: laboratory report	Due October 5
	Exam #1: Basic knowledge, definitions and description of processes. Mix of different types of questions (MCQ, essay questions)	Due October 12
	Mid-semester evaluation as a group	Survey due October 13 discussion on October 19
Lab#6:	Progress in the development of the laboratory project, questions	October 19
Chapters 7-9	Unit III Genetic Organization, Expression and Regulation	
Chapter 7	Mendelian Genetics and Evolution: Natural and Artificial selection	
Chapter 8	Gene Mutation and Gene expression and their role in resistance	
Chapter 9	Epigenetics and post-translational regulation	October 26- November 2
	Discussion of a case study	
Lab#7-8:	Genotypic vs. Phenotypic analysis	
	Gene expression vs Toxicity assay: perform a toxicity assay	
	Assignment: laboratory report in group	
	Exam #2: Basic knowledge, definitions and description of processes. Mix of different types of questions (MCQ, essay questions)	due Nov 9
Chapters 10-13	Unit IV Biotechnologies in entomology	
Chapter 10	Evolution of the -omics - Biotechnologies for Understanding Insect Physiology	
Chapter 11	Biotechnologies for Insect Control and Conservation - Genetic modifications	
Chapter 12	Phylogenetic analyses using molecular traits (Molecular systematics)	November 9- 16
Lab#9-10:	Detecting resistance	
	gDNA extraction	
	DNA Fingerprinting analysis/ DNA digestion (restriction enzyme and gel electrophoresis)	
	(Graduate) – Review 2 (UG)- Poster 2	Due on Nov 16

Group work in class: Statistical analysis of results and comparison of the information obtained from the three experiments (you will need this for the report)	
Final lab report/lab project due	Due Nov 30
Final lab: lab exam (random method to run, with protocol)	
Self-reflective assessment	Due December 8th
Exam #3: Comprehensive exam, Lecture and Lab material over the semester, combination of closed and open questions	Due Dec 6

Grading:

First Exam: 100 pts

Second Exam: 100 pts

Third Exam: 100 pts

Homework and class assignments: 100 points

Undergraduate presentation and poster: 100 points (50 each)

Graduate student article reviews: 100 points (50 each)

Participation, contributions to surveys, punctuality, and attendance: 100 points

Laboratory: 400 pts (notebook checks, questions and reports, lab project, lab exam)

Total: 1000 pts

Grading: ≥ 95 : A+ 90-94.9: A 85-89.9: A- 80-84.9: B+ 75-79.9: B 70-74.9:
B- 65-69.9: C+ 60-64.9: C 55-59.9: C- ≤ 54.9 : D

Exams:

The 3 exams will be at the end of each unit, which includes lectures and labs. The 3rd exam is a comprehensive exam. Stay tuned on Canvas and consult your emails regularly for updates on exam dates.

Barring **documented** illness or family emergency, failure to take the exam at the scheduled time will result in a grade of ZERO for that exam. Please contact me prior to the scheduled exam period. The exams will be offered on Canvas (online) or as take-home exams. Exams will consist of short answers, essay questions, matching, and multiple-choice problems. Questions will be based on material covered in lectures AND lab and assigned reading/videos. Doing your homework and practice quizzes will contribute to make you a successful student in this class.

Each exam includes material from all the lectures preceding the exam date as well as laboratory material.

Formal assignments:

Lab Notebooks: All students must keep a laboratory notebook. This book is a written account of all the experiments conducted by the student. It should contain date on which the experiment was conducted, colleagues involved, experimental design including objectives and description of the protocol and changes to the protocol, results in the form of raw data and analyzed data as graphical or tabular format, a short summary and conclusion to the experiment, which is an interpretation of all the collected data (what it means). We will go over the rules of maintaining a notebook during the first lab. I will periodically check notebooks and assign a grade counting towards your “laboratory” grade.

Lab Reports: You will have to turn in lab reports and response to questions asked during the lab as part of the report. A complete lab report will contain the following sections: Abstract, Introduction, Materials and Methods, Results including Figures and Tables with captions (referenced in the text), Discussion, and References (literature cited) if necessary. The outlined report is based on computer-generated data. **Reports are to be submitted electronically. No hand-written report will be accepted.** These will be collected by the beginning of the next lab period (1 week).

Graduate students will be given two reading assignments as material for papers (one for each article). A summary of the article is expected as well as a reflective piece about the conclusions, the methods used, the description of the methods and what they would have done differently or not.

Undergraduate students will be asked to pick a topic to cover by a virtual poster/infographics accompanied by a 1-3 minute(s) talk, to work on understanding of a complex topic through a simple representation. It needs to be well presented, not have jargon or have a glossary if scientific terms are used. This work may be presented at an outreach symposium at a scientific conference and/or at an extension event and must be understandable by a non-scientific audience. This assignment is also individual.

Final projects: All students will work on a manuscript-type report that relates to what we covered in class. This assignment is individual. We will cover what is expected of you in class, but the idea is to put all the techniques back into the context of resolving a research question.

Participation:

Questions relative to a lecture or reading material are encouraged and show your interest in the topic, they can even lead to discussion in class, hence, they are considered toward your participation points. I want to make sure you understand the material so do not hesitate to stop me when you need help. Other participation points include

Laboratory set up and clean up:

Showing up in advance to set up the lab and cleaning after the lab session will count in your participation points.

Evaluations:

A survey at the beginning of the course will be used to assess the level of students and reflect accomplishments when compared to the end of course survey.

There will be a mid-semester evaluation aiming at improving the content of the class according to your expectations.

Another survey will follow at the end of the class and will be used to improve my teaching methods and materials for future students. There are also self-evaluations there for you to follow your own progress, your expectations at the beginning and end of the course. You are strongly encouraged to return these surveys as they are counting toward your participation grade.

Attendance:

All students are expected to attend all scheduled classes. I will record attendance at all sessions. Chronic tardiness is very disruptive to the class. Please be on time.

Grades will NOT be rounded in the student's favor if the student is chronically late or absent without a valid excuse.

Attendance is mandatory as it counts for your final grade.

Discussions:

Almost all laboratory experiments include waiting! To make our wait more productive, we will go over questions and discuss related themes. This also includes reading, summarizing, and applying critical thinking about journal articles relevant to the class. The assignments will be written but the discussion will be in person.

Course-specific policies

Class cancellation: If in-person classes are cancelled, you will be notified of the instructional continuity plan for this class by Canvas.

Late Work: All assignments are due within the first 10 minutes of class on the date indicated. Grades on late assignments will reflect a 10% deduction per day late unless prior arrangements have been made with the instructor. After one week, the assignment will be considered as not completed and will result in a ZERO.

Regrading Policy: If you think that an error was made on your exam or lab report, **you may return it for re-grading within one week of the return of the exam/report. No**

exceptions. You must clip to the graded item a **typed** explanation of what you think the error is. Late regrade requests and requests that are not typed will not be regarded. The exams and letters will be stored in the course folder as material for evaluation. Papers asked to be reexamined will be regraded in their entirety.

Makeup examination policy: In case of **documented** illness, family emergency, or other **documented** important circumstance preventing you from taking an exam or graded assignment, a take-home assignment will be arranged. Without a valid excuse, the assigned grade for the assignment will be ZERO.

Standards:

Dress code and laboratory safety requirements: For your own safety, you are required to come to laboratory sessions with long pants and close-toed shoes. You are expected to wear a lab coat and gloves as well as other necessary personal protective equipment (PPE) such as glasses/goggles when required. Gloves stay in the lab to avoid contamination.

No food or drinks in the lab.

Due to remaining COVID-19 safety issues, all students and faculty are required to wear a face mask during peak transmission and practice social distancing when required by UNL. Stay up to date with requirements by visiting: <https://covid19.unl.edu/face-covering-policy> and <https://covid19.unl.edu/>

Writing standards: You are expected to use proper English grammar and spelling on all written material submitted for this course. Content of your writing will be my main focus during grading, but the way you are conveying the message will also be reflected in your overall grade. Proofreading is a good habit, so it is strongly encouraged.

Cell phones and laptops: Cell phones are not tolerated in class, whereas laptops are tolerated but not necessary. However, I encourage you to read the following article that showed handwriting to be a more efficient learning tool than laptop typing: <https://journals.sagepub.com/doi/full/10.1177/0956797614524581>

Additionally, a lot of the reagents used in the laboratory are toxic, thus, using a laptop, tablet or a phone to take notes is not recommended due to the risks of contamination.

Writing Support: The Writing Center can provide you with meaningful support as you write for this class as well as every course in which you enroll. Trained undergraduate and graduate peer consultants are available to talk with you about all forms of communication. You are welcome to bring in everything from lab reports, presentations, and research papers to cover letters, application essays, and graduate theses and dissertations. Writing Center Consultants can work with you at any stage of the writing process, from brainstorming and organizing your ideas through polishing a final draft. There are three ways you can connect with a Consultant: Online (a real-time, video conversation), eTutoring (email feedback), In person in Andrews 102. To learn more about online options and view video tutorials, visit <https://www.unl.edu/writing/online-writing-center-services>

University-wide course policies: <http://go.unl.edu/coursepolicies>

Diversity and inclusion: The University of Nebraska-Lincoln does not discriminate on the basis of race, ethnicity, color, national origin, sex (including pregnancy), religion, age, disability, sexual orientation, gender identity, genetic information, veteran status, marital status, and/or political affiliation.

If you have any specific pronoun preference, please let me know before the start of the class, or at any point during the semester, in person or by email.

Academic Dishonesty: Cheating and plagiarism will not be tolerated. The University of Nebraska-Lincoln has a policy about Academic Dishonesty (see Article II, section B about Proscribed Conduct in the Student Code of Conduct <https://studentconduct.unl.edu/student-code-conduct>). For grade appeal guidelines in the Department of Entomology, please view: <https://entomology.unl.edu/dishonesty>

As the Student Code of Conduct indicates, academic sanctions for misconduct (subject to appeal) are at the discretion of the instructor and may include giving the student a failing grade for the course. In this course, the least penalty we will impose for misconduct is a one letter grade reduction in the course grade, however, in most instances, the penalty for cheating in this class will be a failing grade in the course.

Students with disabilities: The University strives to make all learning experiences as accessible as possible. If you anticipate or experience barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can discuss options privately. To establish reasonable accommodations, I may request that you register with Services for Students with Disabilities (SSD). If you are eligible for services and register with their office, make arrangements with me as soon as possible to discuss your accommodations so they can be implemented in a timely manner. SSD contact information: 117 Louise Pound Hall.; 402-472-3787

Mental Health and Well-being Resources: UNL offers a variety of options to students to aid them in dealing with stress and adversity. Counseling and Psychological & Services (CAPS) is a multidisciplinary team of psychologists and counselors that works collaboratively with Nebraska students to help them explore their feelings and thoughts and learn helpful ways to improve their mental, psychological and emotional well-being when issues arise. CAPS can be reached by calling 402-472-7450. Big Red Resilience & Well-Being provides one-on-one well-being coaching to any student who wants to enhance their well-being. Trained well-being coaches help students create and be grateful for positive experiences, practice resilience and self-compassion, and find support as they need it. BRRWB can be reached by calling 402-472-8770.

Title IX Policy

Any unwanted conduct of a sexual nature, whether verbal, physical, written, or pictorial, which has the purpose or effect of creating a hostile environment for the person subjected to the conduct, or any solicitation of sexual conduct of any nature when submission to or rejection of such contact is used as the basis for either implicitly or explicitly imposing favorable or adverse terms and conditions of academic standing constitutes sexual harassment and will not be

condoned or tolerated. Moreover, sexual misconduct including stalking, dating or domestic violence and sexual assault is prohibited.

Appropriate corrective action will be taken toward any student or employee who is found to have violated UNL's non-discrimination, sexual harassment and/or sexual misconduct policies. Further, UNL commits itself toward the assurance of non-retaliation toward any person who reports harassment, sexual misconduct or discrimination or who participates in an investigation of such conduct.

If you suspect or experience discrimination, sexual harassment, or retaliation toward yourself or others, please keep records or other evidence of specifics and report the conduct. If you do not feel comfortable telling a person to stop inappropriate behavior, or if the behavior does not cease once you have made the request that it do so, you may seek assistance from an administrator, professor or counselor. Persons designated by the University as Responsible Employees are required to report sexual discrimination, harassment and misconduct reported to them. Other employees are encouraged to provide assistance and/or report.

Detailed information about support and resources, and how to report an incident of sexual discrimination, harassment or misconduct, is available on the Institutional Equity and Compliance Title IX website. You can contact the office directly at 402-472-3417.