

Insect Biotechnology
11:370:380

Number of credit hours: Three (3)

Semester: Spring 2020

Days and times of lectures: TBD

Days and times of lab: TBD

Location: Thompson Hall, Room TBD

Instructor: Dr. Chloe Hawkings

Office location: Thompson Hall, Room 132

Office hours: By appointment

Phone: (848) 932-0005 **Email:** c.hawkings@rutgers.edu

Course Overview: The study of the molecular mechanisms in insect systems is a useful tool in understanding biotechnology. The discovery of molecular pathways and mechanisms combined with advances in computational biology have led to advances in insect pest control strategies, food security, and addressing insecticide resistance.

Prerequisites: General Biology I and II (01:119:115/116); Insect Biology (11:370:381)

Course Description: This course will introduce students to concepts of molecular entomology and novel techniques routinely used in research to investigate the molecular mechanisms of insect systems. The course will focus on the advancements these applications have made in studies focused on insect pest control strategies, forensic entomology, plant-insect interactions, and genetic manipulation techniques particularly gene editing techniques and their broader applications such as gene drives. The course will also introduce students to the fundamental concepts of insect molecular biology, computational biology and how it pertains to arthropod genetics. The course will also cover whole insect genome projects, next generation sequencing applications, transcriptomics, and proteomics.

Learning outcomes: This course is aimed at both students with a molecular biology background and those who are unfamiliar with the field. The overall objective of this course is to ensure that all students are fully aware of the fundamental importance of molecular biology and the potential to apply molecular tools to insect systems to address problems in insect populations.

Link to Entomology Undergraduate Program Goals: <https://entomology.rutgers.edu/undergraduate/>

1. Students should be able to define and properly use key terms used in molecular entomology presented in lecture material. (*addresses program goal 1*)
2. Students should be able to describe key processes associated with gene expression and gene manipulation techniques in insects. (*addresses program goals 1 and 3*)
4. Students should be able to examine scientific literature and understand the methodologies used to evaluate current research protocols, draw conclusions on the need for specific advancements in molecular genetic studies, and communicate this to other scientists (*addresses program goals 3 and 4*)
5. Students should be able to produce original work to investigate a molecular technique that can be applied to their research interests. Emphasis is on the ability to recognize proper protocols and draw conclusions on the significance of using these tools and when to properly utilize them. (*addresses program goal 3*)

Resources:

Text: No Text is required for this course

Resources: Relevant and current literature reviews that outline the evolving applications and understanding of molecular genetic techniques will be used. Materials will be distributed weekly through Canvas.

Course Calendar:

Lecture 1: Course outline, History of Molecular Entomology

Lecture 2: Insects as Model Organisms

Lecture 3: Molecules of life; Regulation of Gene Expression in Insects *Quiz 1*

Lecture 4: Genes, Behavior, and Evolution

Lecture 5: Gene Regulation in Insect Physiology

Lecture 6: Transposable Elements and the P-element Paradigm *Quiz 2*

Lecture 7: Exam 1

Lecture 8: Insect Whole Genome Sequencing Projects; DNA sequencing

Lecture 9: RNA Sequencing; Next Generation Sequencing Methods

Lecture 10: Bioinformatics *Quiz 3*

Lecture 11: RNA Sequencing; Next Generation Sequencing Methods

Lecture 12: Analysis of Gene Expression in Insects

Lecture 13: Bioinformatic Tools *Quiz 4*

Lecture 14: Exam 2

Lecture 15: Gene Editing Systems in Insects

Lecture 16: CRISPR- Cas9 and Gene Drive Systems

Lecture 17: Sterile Insect Technique (SIT)

Lecture 18: Ethics & Implications of Gene Editing Tools; *Class discussion (reading assignment 1 due)*

Lecture 19: Molecular Mechanisms to Study Insect-Plant Interactions

Lecture 20: RNA interference and its use in Agriculture

Lecture 21: Exam 3

Lecture 22: The Future of Food and Genetically Modified Organisms

Lecture 23: Evolution of Social Insect Genes; Reproductive Ground Plan Hypothesis

Lecture 24: Molecular Applications in Forensic Entomology *Quiz 5*

Lecture 25: Insect Applications of Molecular Techniques; *Class discussion (reading assignment 2 due)*

Lecture 26: Molecular Tools for Insect Pest Management *Case Study Presentations*

Lecture 27: Molecular Tools for Insect Pest Management *Case Study Presentations*

Lecture 28: Molecular Tools for Insect Pest Management; *Case Study Presentations & Final Review*

Lecture 29: Class End

Lecture 30: Final Exam

Grading and assignment:

Exams: This course will have three midterm exams consisting of both multiple choice and essay style questions which cover material from lectures prior to the exam. One final exam is cumulative and covers all lecture material. The exams will assess the ability of the student to define key processes and terms associated with the lecture material

Reading Assignment: Students will be assigned two reading assignments, both of which will be available on canvas on the first day of class. The assignment is aimed to enhance class discussion and encourage students to understand the course content and scientific literature to increase participation. Students are expected to contribute to class discussions. Students should display the ability to both interpret and evaluate methodology used in scientific literature. The assignment will be assessed through class participation

Quizzes: Five quizzes will be assigned at the beginning of class to be completed before the lecture begins. Students will be quizzed on their ability to understand and memorize lecture material

Case Study Project: Students will propose and write a one-page, molecular-based insect control strategy describing a molecular technique that can be applied to control an insect pest to reflect the student's area of interest. Students are expected to apply the knowledge from this course to a real-world application of their choosing, correctly identifying the potential significance. Students will present their work to the class using a 5 min powerpoint. Case studies will be peer reviewed during class sessions to aid in the understanding of these techniques.

Total % contributed (course):

Exams (15% each)	60%
Case Study Presentation	20%
Quizzes (2% each)	10%
Participation/Peer reviews	10%

Attendance Policy

Attendance is expected and if you expect to miss classes, please use the University absence reporting website <https://sims.rutgers.edu/ssra/> to indicate the date and reason for your absence. An email is automatically sent to me.

Course Etiquette

Participation is required for participation points, failure to participate in discussion will result in a zero. This course requires participation in class activities, discussions, and through questions. A strict late policy is followed in this class, lateness is regarded as absence. If you miss a class you are responsible for catching up in time for assignments. classes can only be excused through university approved absences. The instructor should be provided proof of university approval no more than one week after the exam date. All assignments are expected to be submitted before the due date. Failure to submit an assignment before the deadline without a university approved absence will result in a zero on the assignment. No disturbances will be tolerated in class, this includes engaging in disruptive behavior and inappropriate cell phone or laptop use that is not related to the course. We strive to create a positive classroom climate to facilitate all students to be able to learn.

Americans with Disabilities Act (1990)

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an

accommodation, please visit the Office of Disability Services or contact their office for further information. Please follow the procedures outlined at <https://ods.rutgers.edu/students/registration-form>. Full policies and procedures are at <https://ods.rutgers.edu/>

Academic Integrity

The university's policy on Academic Integrity is available at <http://academicintegrity.rutgers.edu/academicintegrity-policy>. The principles of academic integrity require that a student: properly acknowledge and cite all use of the ideas, results, or words of others. You must acknowledge **all** contributors to a given piece of work. All work submitted for a course or other academic activity must be produced by the student turning in the assignment or task and is produced without the aid of impermissible materials or impermissible collaboration. All data or results must be obtained by ethical means and reported accurately without suppressing any results inconsistent with his or her interpretation or conclusions. Treat all other students in an ethical manner, respecting their integrity and right to pursue their educational goals without interference. This requires that a student neither facilitate academic dishonesty by others nor obstruct their academic progress. You are expected to uphold the canons of the ethical or professional code of the profession for which he or she is preparing. Adherence to these principles is necessary in order to ensure that everyone is given proper credit for his or her ideas, words, results, and other scholarly accomplishments. All student work is fairly evaluated, and no student has an inappropriate advantage over others. The reputation of the University for integrity in its teaching, research, and scholarship will be maintained and enhanced. Failure to uphold these principles of academic integrity threatens both the reputation of the University and the value of the degrees awarded to its students. Every member of the University community therefore bears a responsibility for ensuring that the highest standards of academic integrity are upheld.

Student Wellness Services

Just In Case Web App <http://codu.co/cee05e>

Access helpful mental health information and resources for yourself or a friend in a mental health crisis on your smartphone or tablet and easily contact CAPS or RUPD.

Counseling, ADAP & Psychiatric Services (CAPS)

(848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901/ www.rhscaps.rutgers.edu/

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professionals within Rutgers Health services to

support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include:

individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

Violence Prevention & Victim Assistance (VPVA)

(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 / www.vpva.rutgers.edu/

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

Disability Services

(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue,
Piscataway, NJ 08854 / <https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.

Scarlet Listeners

(732) 247-5555 / <https://rutgers.campuslabs.com/engage/organization/scarletlisteners>

Free and confidential peer counseling and referral hotline, providing a comforting and supportive safe space.

I am submitting a complete revision of the entomology curriculum to align with learning goals, to include more relevant approved courses and to provide cohesion between the department curriculum and the one



School of Environmental
and Biological Sciences

COURSE SYLLABUS

outlined in degree navigator. At this time, we currently have no way of tracking the curriculum which an individual student is following because not all curriculum's used have been previously approved through CEP. I hope this will be a more manageable way to assess students.