ENTM 201L: Core Laboratory Techniques in Molecular Biology & Insect Morphology

Fall 2025, Thursday from 2 PM to 4:50 PM

Section 1	Section 2
Instructor: Dr. Amy Murillo Chapman Hall 109 Office hours: Friday 10 to 11 AM or by appointment Office: ENTM 239	Instructor: Luciano Cosme ENTM 326 Office hours: Monday 10 to 11 AM appointment Office: ENTM 325

Course Overview

This course is divided into two distinct sections. **Section I** (Murillo) provides hands-on training in techniques for studying the internal and external anatomy of insects. Students will learn key features of external anatomy, dissection techniques for exploring internal anatomy, and structure-function relationships in the context of insect life histories and evolution.

Section II (Cosme) provides hands-on training in molecular biology methods using mosquito specimens. Students work in collaborative teams (Team Spin and Team Magnet) to compare DNA extraction methods, identify species through sequencing, and detect endosymbiont bacteria. The course emphasizes real research experience where students generate publication-quality data comparing preservation methods and extraction techniques.

Learning Outcomes

Section I (Murillo)

- Define key concepts relating to insect morphology and physiology
- Distinguish internal and external morphological structures
- Explain the significance of insect structural features and how this relates to their functions
- Demonstrate proficiency in handling and dissecting insects to reveal key features of morphology and internal anatomy

Section II (Cosme)

- Understand and explain considerations for sample preservation and DNA extraction
- Extract DNA using column-based and magnetic bead methods
- Understand primer design principles for PCR amplification
- Set up PCR reactions with positive and negative controls

- Analyze DNA quality and PCR success using gel electrophoresis
- Quantify DNA concentrations using fluorometry (Qubit)
- Prepare PCR products for Sanger sequencing
- Use BLAST to identify mosquito species from DNA sequences
- Build phylogenetic trees using IQ-TREE to analyze evolutionary relationships
- Analyze evolutionary relationships between mosquito samples and reference sequences
- Detect endosymbiont bacteria (Wolbachia) using diagnostic PCR

Required Texts & Materials

Section I (Murillo)

- Beutel, R.G., Friedrich, F., Yang, X.K., Ge, S.Q. *Insect Morphology and Phylogeny: A textbook for students of entomology*. De Gruyter, 2014. (Available online through the UCR library)

Section II (Cosme)

- Lab protocols and handouts (provided on Canvas)
- Calculator and lab notebook
- Personal protective equipment (provided)

Course Schedule

Section I: Insect Morphology (Murillo)

- **Week 0 (Sep 25)**: Introduction to morphology, mouthparts & head structures, basic microscopy
  Reading: Beutel, Ch. 4 – Traditional and modern techniques in insect morphology
  Lab activity: Fly PER, honey bee dissection
- **Week 1 (Oct 2)**: Integument and sclerotization, thorax & flight, SEM techniques
  Reading: Beutel Ch. 1 – Morphology
  Lab activity: SEM imaging, grasshopper dissection
- **Week 2 (Oct 9)**: Overview of insect internal anatomy
  Reading: Beutel, Ch. 6 – The orders of Hexapoda
  Lab activity: EPG demo
- **Week 3 (Oct 16)**: Insect reproduction
  Reading: TBD
  Lab activity: dissection
- **Week 4 (Oct 23)**: Lab practicum and exam

Section II: Molecular Biology (Cosme)

- **Week 5 (Oct 30)**: Molecular Lab Basics & Column-based DNA Extraction
- **Week 6 (Nov 6)**: Magnetic Bead-based DNA Extraction + PCR Setup
- **Week 7 (Nov 13)**: Gel Analysis & Sequencing Preparation
- **Week 8 (Nov 20)**: Wolbachia Detection & Phylogenetic Analysis
- **Week 9 (Nov 27)**: Thanksgiving Break
- **Week 10 (Dec 4)**: Assessment & Student Presentations

Grading Structure

Overall Course Breakdown

- **Section I (Murillo)**: 50%
  - Participation: 5% (Weeks 0-4)
  - Lab activities: 20%
  - Lab practicum: 15%
  - Practicum exam: 10%
- **Section II (Cosme)**: 50%
  - Pre-lab quizzes (Weeks 5-8): 5%
  - Week 5: Column extraction completion & Qubit data: 5%
  - Week 6: Bead extraction & PCR completion: 5%
  - Week 7: Gel analysis & sequencing submission: 5%
  - Week 8: Species ID & Wolbachia detection: 5%
  - Week 10: Final quiz & practical exam: 10%
  - Week 10: Individual presentation (5 min): 10%
  - Team collaboration & peer review: 5%

Grading Scale

Grade	Percentage	Grade	Percentage
A	93-100	C	73-76.9
A-	90-92.9	C-	70-72.9
B+	87-89.9	D+	67-69.9
B	83-86.9	D	60-66.9
B-	80-82.9	F	<60
C+	77-79.9		

Course Policies

Shared Policies (Both Sections)

Lab Safety

- Closed-toe shoes and long pants are required
- Lab coats and gloves are provided and must be worn
- No food or drinks in the laboratory
- Follow all safety protocols and disposal procedures
- Report all accidents immediately

Data Integrity

- Never fabricate or falsify data
- Document all procedures accurately
- Report unexpected results honestly

Academic Integrity

Plagiarism is the most common form of academic misconduct at UCR. ANY documented instance of plagiarism from a published article or source that is not yourself will result in automatic failure on that assignment. Repeated cases of plagiarism will fail of the course and/or reporting to Student Conduct & Academic Integrity Programs.

Section I Policies (Murillo)

Attendance

- Attendance is mandatory for all lab sessions
- Missing more than one lab session may result in course failure
- Notify the instructor in advance if you must miss class
- Make-up work is at the instructor's discretion

Specific examples of plagiarism include, but are not limited to, **using ChatGPT or other generation artificial intelligence apps, plug-ins, or programs to generate text or ideas**; copying text from any source without attribution (including non-traditional sources such as Google search results, chat bots, and the like); turning in a paper you wrote for one class in another; copying from a fellow student's paper (including their rough draft); using a paper belonging to another student; paraphrasing improperly; representing other people's ideas as your own; representing ideas generated by artificial intelligence apps, plug-ins, or programs as your own; and using or buying papers from online "paper mills" or from human writers.

Section II Policies (Cosme)

Team Responsibility Policy

The class will be divided into two teams: Team Spin and Team Magnet. Teams are research units. In research, if your labmate doesn't run their PCR, the whole project suffers. Teams must ensure all members complete all techniques. How you accomplish this is your responsibility. Document your solution.

- No individual make-up labs are available (3-hour hands-on sessions cannot be replicated). Students can come to the lab if they want to do DNA extraction with a team member, provided they have a reasonable excuse for missing a session.
- Teams are responsible for ensuring that absent members obtain data
- Document solutions in lab notebooks
- Week 10 assessment requires mandatory attendance

AI Use Policy

AI tools are encouraged as learning aids in Section II. You may use AI tools to calculate dilutions and concentrations, to understand complex concepts, to troubleshoot protocols, and to generate ideas for data analysis.

Be aware of AI hallucinations. Always verify critical information. Cite AI use when appropriate (e.g., "Calculation verified using ChatGPT"). AI cannot replace hands-on lab work or data collection. Ask a team member if you have questions. You must understand what you're doing, not just copy AI outputs.

Accommodations

Students with documented disabilities should contact the Student Disability Resource Center (SDRC) and notify instructors by Week 1. Religious observances must be communicated at least one week in advance.

Resources

- **Canvas**: All protocols, readings, and assignments
- **Office Hours**: Both instructors available weekly or by appointment
- **UCR Library**: Access to scientific literature and databases
- **ITS Support**: Equipment loans and technical assistance

Communication

- Check Canvas and UCR email regularly
- Response time: 24-48 hours on weekdays
- For urgent matters, visit during office hours

Last updated: September 15, 2025