

# BSC4920C – Group Effort Applied Research in Biology

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**Office hours:** by appointment

**Class Meeting Times for Spring 2023:** Monday Wednesday 2-5pm

**Location:** Biology 412

**Intended Audience:** Life science majors interested in science as a career.

**Course Prerequisite:** BSC2011C (prerequisite), STA 2023 (pre or co-requisite) **and** consent of instructor

## Course Description:

This is a research-intensive course that aims to provide upper-level students with a signature experience in the science of biology. Specifically, students will (1) gain general experience in hypothesis generation, experimental design, and statistical analysis, and (2) design and implement a group research project originating from the instructor's own research program. The independent research project will reinforce both the classic scientific method (i.e. observe, hypothesize, test and conclude) and the importance of peer-reviewed communication. Peer reviewed communication will be facilitated by reviewing the draft posters of peers, as well as a final. The class will be structured as an intensive lecture / laboratory course, meeting 8 hours every week. The GEAR format substantially improves the economy of student training without sacrificing the quality of the research experience

## Intended Student Learning Outcomes:

- A deep understanding of the philosophy of science in Biology, including the types of research conducted (exploratory and confirmatory), how to construct appropriate project objectives, hypotheses, and predictions, and how to appropriately design biological studies through the three basic approaches of biological inquiry (observational, experimental, and comparative).
- How to collect and manage data and maintain a laboratory notebook
- Appropriate laboratory behavior and responsibilities
- Basic analysis of data
- How to find and read relevant primary literature.
- How to appropriately communicate a project's motivation and methodology.

## Course objectives for Spring 2023:

Agrochemical runoff pollutes nearby drainage ditches and waterways where disease-vectoring mosquitoes reproduce. Development in herbicide-rich waters is known to impact mosquito physiology including reduced survival, fecundity, and sex ratios. Previous work by GEAR students has shown the herbicides pendimethalin and glyphosate (a.k.a. Roundup) to suppress immunity of the yellow fever mosquito, *Aedes aegypti*, and the house mosquito *Culex quinquefasciatus*. Reduced immune function should lower the barrier to viral infection in the mosquito, which theoretically could increase disease prevalence among the definitive human hosts.

Interestingly, recent work shows glyphosate can chemically inhibit the phenoloxidase immune response in *Anopheles gambiae* when adults were orally fed glyphosate. Further, that mosquitoes fed glyphosate had higher pathogen loads of the malaria inducing plasmodium. However, it is unclear if this delivery method accurately reflects how glyphosate is encountered in the real world. Further, it is unknown if this delivery method affects other aspects of viral immunity.

To further assess the consequences of glyphosate on mosquito-vectoring disease dynamics, we will focus *C. quinquefasciatus* and assess a wider diversity of delivery methods and immune responses. Like *A. gambiae*, *C. quinquefasciatus* is commonly associated with agriculture, but instead vectors a variety of viral diseases such as West Nile virus, Eastern Equine Encephalitis, and Chikungunya. To this end, we will examine how larval environment, adult feeding, and adult cuticular exposure can affect phenoloxidase immunity as well as antiviral gene transcription.

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## Performance Evaluation:

Draft Poster with Intro and Methods	5%
Peer Review of Poster Draft	5%
Poster Presentation to class via PowerPoint	10%
Final Laboratory Notebook	20%
Participation	60 %

## Grading Scale

A	92.6 – 100%	C	72.6 - 77.3%
A-	90 - 92.5%	C-	70 - 72.5%
B+	87.4 - 89.9%	D+	67.4 - 69.9%
B	82.6 – 87.3%	D	62.6 – 67.3
B-	80 - 82.5%	D-	60 - 62.5%
C+	77.4 - 79.9%		

## Required Resources:

**There will be no required text. All readings will come from the primary literature.**

## Course motivation:

The new strategic plan at UCF, as well as at other research institutions nationwide, considers undergraduate research experience to be an educational priority. By gaining independent research experience, our graduates will be better trained as objective scientists. Furthermore, they will be more competitive for private / public sector employment or placement into graduate / professional school. Unfortunately, our limited faculty number has severely constrained the opportunity for undergraduates to engage in independent research. Moreover, we have no formal course in the UCF department of biology which facilitates this priority. While they are the stable of most undergraduate science curricula, structured laboratories with predetermined outcomes do not facilitate a true understanding of the process of science. The proposed course will satisfy this deficit by placing students in an immersive and intensive environment that will give them the tools to think objectively, test hypotheses and communicate their research with their peers. Such a reinforcing environment will allow students to deepen their understanding through continual communication with their peers and instructor. In order to provide an appropriate level of mentorship to the students, only 18 will be allowed to enroll in each class. Preference will be given to students who do not yet have independent research experience.

## Core course policies:

**Conduct:** Students are expected to have read and understand UCF's Rules of Conduct (<https://scai.sdes.ucf.edu/student-rules-of-conduct/>) and UCF's Golden Rule (<https://goldenrule.sdes.ucf.edu/>). Penalties for violating rules, policies, and instructions within this course can range from a zero on the exercise to an "F" letter grade in the course. In addition, an Academic Misconduct report could be filed with the Office of Student Conduct, which could lead to disciplinary warning, disciplinary probation, or deferred suspension or separation from the University through suspension, dismissal, or expulsion with the addition of a "Z" designation on one's transcript.

**Students with disabilities:** The University of Central Florida is committed to providing access and inclusion for all persons with disabilities. Students with disabilities who need access to course content due to course design limitations should contact the instructor as soon as possible. Students should also connect with Student Accessibility Services (SAS; <http://sas.sdes.ucf.edu>).

**Campus Safety:** In case of an emergency, dial 911 for assistance. Every UCF classroom contains an emergency procedure guide posted on a wall near the door. Students should make a note of the guide's physical location and review the online version at [http://emergency.ucf.edu/emergency\\_guide.html](http://emergency.ucf.edu/emergency_guide.html). Students should know the evacuation routes from each of their classrooms and have a plan for finding safety in case of an emergency. If there is a medical emergency during class, students may need to access a first-aid kit or AED (Automated External Defibrillator). To learn where those are located, see <https://ehs.ucf.edu/automated-external-defibrillator-aed-locations>. To stay informed about emergency situations, students can sign up to receive UCF text alerts by going to <https://my.ucf.edu> and logging in. Students with special needs related to emergency situations should speak with their instructors outside of class. To learn about how to manage an active-shooter situation on campus or elsewhere, consider viewing this video (<https://youtu.be/NIKYajEx4pk>).

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Deployed Active Duty Military Students: Students who are deployed active duty military and/or National Guard personnel and require accommodation should contact their instructors as soon as possible after the semester begins and/or after they receive notification of deployment to make related arrangements.

Make-Up Assignments for Authorized University Events or Co-curricular Activities: Students who represent the university in an authorized event or activity (for example, student-athletes) and who are unable to meet a course deadline due to a conflict with that event must provide the instructor with documentation in advance to arrange a make-up. No penalty will be applied. For more information, see the UCF policy at <https://policies.ucf.edu/documents/4-401.pdf>.

Religious Observances: Students must notify their instructor in advance if they intend to miss class for a religious observance. For more information, see the UCF policy at <http://regulations.ucf.edu/chapter5/documents/5.020ReligiousObservancesFINALJan19.pdf>

## Tentative Class Schedule next page:

	Monday-Lec	Monday - lab	Tuesday	Wednesday	Wednesday - Lab	Thursday	Friday
1/9/2023	Project Overview	Training: pipettes		Experimental Design	Training: PO Assays		
1/16/2023	No class			Lecture: Vector competence	Notebooks & Data		
1/23/2023	Discuss: Kibuthu	Start Experiment		Discuss: Klinkenberg	EXPERIMENT		
1/30/2023	Discuss: Muturi	EXPERIMENT		Discuss: Smith	EXPERIMENT		
2/6/2023	Lecture: Insect Immunity	EXPERIMENT		Discuss: Cheng	EXPERIMENT		
2/13/2023	Discuss: Adamo	EXPERIMENT			EXPERIMENT		
2/20/2023		EXPERIMENT			EXPERIMENT		
2/27/2023		Training: mRNA extraction			Training: Reverse transcription		
3/6/2023	Spring Break						
3/13/2023							
3/20/2023		Training: qPCR					
3/27/2023							
4/3/2023	Lecture: Poster Layout						
4/10/2023	Computer lab: Analyze results			Computer lab: Analyze results			
4/17/2023	Computer lab: Analyze results			Computer lab: Analyze results			
4/24/2023	Present Results						