BIOS 3451: Cell and Molecular Biology Laboratory   **Fall 2023**

Essential Course information

Section A1: **Thursdays 12:30-3:15pm**; Boggs 1-59
Section A2: **Thursdays 3:30-6:15pm**; Boggs 1-59

Instructor	Email	Drop-in hours	Location
Shana Kerr, PhD	shana.kerr@biosci.gatech.edu	Tuesdays 1-2pm	Zoom

TA	Section	Email	Drop-in hours	Location
Noah Campbell	A1, A2	ncampbell40@gatech.edu	Thursdays 11:15-12:15pm	Boggs 1-59 or Zoom
Martin Griffin	A1, A2	mgriffin73@gatech.edu	Wednesdays 9:30-10:30am	Zoom

This syllabus and schedule are subject to change.

Covid-19 Information: This course meets in person and has required attendance. While we expect each student to attend every class and be present for the entire class session, we also want to prevent infectious disease spread. If you are sick or in isolation for covid, flu, or similar, then we ask that you not come to class. Instead, email the TAs and Dr. Kerr immediately to communicate that you will not be in class and plan to participate remotely in a virtual session unless you are not well enough to do so. *Virtual sessions are intended only as a short-term solution for students who are ill or are otherwise unable to attend in person, and approval via email is required in order to attend virtually. Students attending virtually are expected to participate fully in the virtual session.*

Overview and objectives: You will use current methods in cell and molecular biology to explore fundamental aspects of cell biology with the mouse macrophage cell line, J774, as a model system. We will perform a series of experiments to examine changes in cell morphology, viability, and gene expression in these cells in response to treatment with an immunomodulatory compound.

By the end of this course, you should be able to:
- Perform specific modern cell and molecular biological techniques
- Differentiate between scientific hypotheses and predictions
- Recognize and apply elements of experimental design
- Graphically and statistically analyze and represent data to support or reject a hypothesis
- Convincingly and accurately communicate your hypothesis, experimental tests of that hypothesis, and analysis and interpretations of results

Lab safety: Safety policies are mandated by federal, state, and institutional rules. For every wet (experimental) lab, you must wear your lab coat, long pants, close-toed shoes, and tie back long hair. Safety policies are mandated by Georgia Tech institutional rules to keep everyone safe. At the beginning of each lab, your TA will alert you to all of the potential hazards. You will lose all of your participation points for that lab if you violate any safety policies. The following safety policies are non-negotiable:
- You must wear shoes that cover your feet entirely (i.e., no flip flops, ballet slippers, or sandals). You will not be allowed to enter the lab without appropriate footwear.
- No food or drinks, including water bottles.
- No cell phone use, including texting (phones must be silenced and off the lab bench).
- Clean up your lab station at the end of lab and report any mess left behind from previous lab sections to your TA.
- Properly dispose of trash, glassware, and biohazard waste. Other people's safety may be compromised by your negligence.
- During "wet labs" (experimental labs) you must wear long pants to the ankle, your lab coat and safety glasses, and long hair should be tied back. Your TAs will indicate when gloves are necessary. **Students must provide their own lab coats and safety classes**. Safety glasses or goggles must offer side splash protection in order to comply with lab safety requirements; regular eye-glasses are NOT sufficient, and safety glasses or goggles must be worn over

      regular prescription glasses. Compliant safety glasses or goggles can be purchased from the Georgia Tech Bookstore. Disposable nitrile gloves are provided in lab.
- Follow additional safety procedures for specific lab activities as indicated by your TA.
- **Report all injuries or accidents to your TA immediately.**

Failure to bring the required PPE for in-person labs will result in denial of admission to labs with grade penalties associated with an unexcused absence for missing lab. Refusal to comply with proper PPE usage or any direct safety-related instructions from the TAs will result in an unexcused absence and grade penalty.

Attendance and participation: This course meets in person and has required attendance; 100% attendance is expected for each lab for the entire lab period. Participation in each laboratory session is worth 3 points per lab, and full credit will be assigned to students who arrive on time and are fully prepared for class and to actively participate in bench-work and class/group discussions. Arriving late and/or failing to fully participate in class may result in a participation point penalty. Attendance scores will be available in Canvas via the PostEm tool.

Absences: Absences from lab may be considered excused or unexcused as outlined below. You should notify the instructor and your section TAs as soon as you are aware of any potential absence, and preferably before the missed lab. If you miss a lab, you are still responsible for completing any associated assignments.
- **Excused absences:** Excused absence requests will be evaluated on a case-by-case basis and require appropriate documentation supporting the absence request. *Please note that any medical documentation should be submitted to the Dean of Students (*https://studentlife.gatech.edu/request-assistance*) and not to your course instructors*. Examples of potential excused absences include illness, illness or death in your immediate family, and participation in official university activities. For excused absences, missed assignments and makeup lab assignments will typically be due within one week of the original due date.
- **Unexcused absences:** There are no make-up opportunities for unexcused absences. Vacation, work commitments, social events are not considered acceptable reasons to miss lab. *Each unexcused absence will lower your final grade by half a letter grade*.

Pre-lab assignments cover the necessary background for you to perform and understand each experiment, and will be based on both material discussed in class as well as material posted on our Canvas site. Pre-labs are based on participation, not accuracy; you will not be penalized for an incorrect answer as long as it is clear you have thoughtfully considered your answer and your words and ideas are your own (not plagiarized). These assignments are due online via Canvas.

Protocol quizzes assess your preparedness to carry out each in-person experiments independently. Protocol quizzes are timed and are open-note based on any information you include in your *lab notebook*.

Lab notebooks will be maintained in spiral-bound composition notebooks. Prior to each experiment, you must complete a lab notebook entry describing the general *experimental question*, *specific hypothesis/es*, *experimental design*, *data analysis plan*, and *experimental predictions* in your lab notebook. Your notebook must also include either printed or hand-written copies of *experimental protocols* that will be used for the experiment. Printed protocols should be taped into your notebook. You will need to have your up-to-date lab notebook with you for each experimental week, and lab notebooks will be checked each experimental week.

Project Updates: After each experiment, you will prepare a Project Update that describes the results and interpretations from the experiment. Project Updates are informal reports for communicating the results of your experiment to another researcher in the same field (*it is NOT a formal lab report*). Projects Updates are individual assignments, and every aspect of the analysis should be generated individually *with the exception that you are encouraged to discuss how to construct your figures and figure legends with your peers.* The data analysis should convincingly and accurately communicate your hypothesis, experimental tests of that hypothesis, analysis of the results, and interpretations of those results.

Research Project: Each individual experiment conducted over the course of the experiment is related to larger overall research question. You will synthesize these individual experiments into a final research paper.

- **Annotated Bibliography:** You will conduct a search of the scientific literature and create an annotated bibliography of resources related to the overall, semester-long research question. This assignment is to help you become familiar with the background information on the lab research.
- **Review Article:** After completing the annotated bibliography, you will compose a one-to-three page summary, synthesis, and review of the information based on the annotated bibliography and other sources. This review paper will ultimately form the background and introduction for your final research paper. Drafts may be peer-reviewed in class (required for full credit).
- **Final Research Paper**: At the end of the semester, you will synthesize the **literature review** and **data analyses** for each of individual experiments into a coherent research article. Drafts may be peer-reviewed during class (required for full credit)

Detailed information and rubrics for all assignments will be posted to Canvas.

Late/Missed Assignments: Keeping up with writing and other assignments is a critical part of staying on track in this course; late assignments are accepted with a 5% late penalty per day late. However, we recognize that sometimes things happen in life that are outside of your control. With this in mind, we offer the following options to every student. *Instructions for how to use these opportunities are indicated below each bullet point:*

- **Writing assignments** (Lab Notebooks, Research Updates, other Research Project assignments): Every student has the option to turn in **two** writing assignments late within 3 days or the original due date, with no late penalty and without documentation required. *To utilize one of the two allowed 3-day extensions on writing assignments, use the "comment" option in the assignment submission in Canvas to notify the instructor and TAs of the request.*
- **Pre-labs**: Every student has the option to turn in **one** pre-lab assignment late within 3 days of the original due date with no late penalty and without documentation required. *To utilize the allowed 3-day extension for a pre-lab assignment, send an email request to the course instructor and cc your TAs.*

Requests to waive the late penalty for additional late submissions and/or for extensions beyond 3 days will require appropriate documentation that warrants an extension (e.g., documented illness). In order to protect your privacy, documentation of personal or family illness should NOT be shared with the instructor but should instead be sent to the Dean of Students.

Re-grade policy: Requests for re-grading must be made in writing (email), explain the rationale for the re-grade request, and be made within one week of the assignment's return. If you request a re-grade and the re-graded assignment's score is lower than the previous score you must accept the updated lower score.

Honor Code: Academic dishonesty in any form will not be tolerated. Be aware of your obligations and expectations associated with the Georgia Tech Academic Honor Code and Student Code of Conduct (http://www.honor.gatech.edu). Academic dishonesty includes cheating, lying about course matters, plagiarism, submitting someone else's work as your own, stealing classroom materials, or helping others commit a violation of the Honor Code. Consistent with the), refusal to comply with any safety requirements, including wearing masks, wearing safety glasses, and/or maintaining social distancing, will be considered a violation of the Non-Academic Misconduct Policy. Plagiarism includes representing the words or ideas of others as your own. **Written assignments in this class will be reviewed by Turnitin**. **Sharing and discussing information is permitted and encouraged (this is how science is really done!), but** *submission of someone else's WORK or IDEAS as your own is* *not* *permitted*. **This includes** *any* **form of student work.** *When in doubt, ask your instructors for help.*

AI Policy: Machine learning language processing and artificial intelligence are becoming common in the generation of text. These tools are sophisticated enough that they can now generate answers to some basic questions (which does not mean they are necessarily correct answers). **The use of AI/ML-generated text is not allowed to generate your response to any assignment in this class**. However, this AI tools can be useful in the process of **editing and refining** a written response. AI tools should be used as you would a trip to the Writing Center, where the AI or a writing tutor can help provide outlines,

feedback, and editing to a written response. *If you utilize AI in your response, you should submit the input you provided to the AI, cite the AI you used, and explain how the AI was utilized.*

Grading:

• Attendance and participation and in-class assignments	10%
• Lab notebooks (approximately 5% each; see #1 below)	15%
• Pre-lab assignments & protocol quizzes (equally weighted)	10%
• Project updates (approximately 10% each; see #2 below)	30%
• Annotated bibliography	5%
• Literature review	10%
• Final Research Paper	20%

1. Lab notebooks will be weighted as 3%, 5%, 7%; where your lowest lab notebook score will count 3% and your highest lab notebook score will count 7% of your final grade
2. Project updates will be weighted as 8%, 10%, 12%; where your lowest project update score will count 8% and your highest project update score will count 12% of your final grade

Final letter grades will be assigned according to the following scale:

A: ≥ 90.0%
B: ≥ 80.0% and < 90.0%
C: ≥ 70.0% and < 80.0%
D: ≥ 60.0% and < 70.0%
F: < 60.0%

The above scale is the most stringent we will use, and you are not competing with anyone for your grade.
We are here to help you succeed!

BIOS 3451: Cell and Molecular Biology Laboratory   Fall 2023

LAB SCHEDULE (subject to change)   **Unless otherwise specified, all assignments are due by the start of class time**

Week	Date	Assignments Due by the start of class time unless otherwise noted	Discussion Topics and Class Activities	Notes
	8/24		*No lab during first week of classes*	
1	8/31	Pre-lab 1: Macrophage Biology Background, including research article, figure analysis assignment, and pre-lab questions	Course overview and structure Introduction to Macrophage Biology Lab/cell culture safety; *sign safety forms (Canvas)* Discuss assigned research paper using Figure Analysis	*Bring laptops*
2	9/7	Pre-lab 2: Statistics, pipettes, and citations; including citation and plagiarism online tutorial Confirm access to virtual machine on mycloud.gatech.edu or download JMP to personal computer	Discussion: How and why we cite Discussion: Annotated Bibliography expectations Workshop: Hypotheses, predictions, & experimental design Pipetting and statistics activity Workshop: using JMP for graphing and statistical analysis	*Bring laptops, Lab coats required.*
3	9/14	Pre-lab 3: Measuring cell viability and macrophage activation, and safe use of BSCs Pipetting & statistics analysis (if not completed in previous class)	HPED Workshop: Cell viability and macrophage activation Discussion: Broad question vs focused hypotheses/experiments Practice using BSCs & visualizing cells	*Bring laptops; Lab coats required.*
4	9/21	Review Biosafety and Safe Use of BSCs Lab Notebook 1: Activation and Viability: Griess, propidium iodide assays, and visual assessment by light microscopy	Protocol quiz 1: Griess (open notebook) Experiment: Griess & Visual observation	*Bring laptops; Lab coats required.*
5	9/28	Annotated Bibliography (5 research articles) – *due Monday 10/2 at 11:59pm*	Protocol quiz 2: Propidium iodide (open notebook) Experiment: Propidium Iodide Data analysis *preview:* Cell viability and activation experiments	*Bring laptops; Lab coats required.*
6	10/5	Pre-lab 4: Principles of microscopy & flow cytometry	HPED Workshop: Morphological assays for activity Workshop: Scientific Writing (Figure Legends and Methods) Discussion: Project Update expectations Data analysis *review:* Cell viability and activation experiments Work on Project Update during class Discussion: Review Article expectations	*Bring laptops*
7	10/12	Lab Notebook 2: Morphology and activation: microscopy and flow cytometry assay Project Update 1: Cell viability and activation – *due Monday 10/16 at 11:59pm*	Protocol quiz 3: Microscopy (open notebook) Practice cell collection practice Experiment: Microscopy Data analysis *preview:* microscopy	*Bring laptops; Lab coats required.*
8	10/19	Review Article – *due Monday 10/23 at 11:59pm*	Protocol quiz 4: Flow cytometry (open notebook) Experiment: Flow cytometry Data analysis *preview:* flow cytometry Work on Project Update during class	*Bring laptops; Lab coats required.*
9	10/26	Pre-lab 5: Changes in gene expression during macrophage activation	HPED Workshop: Gene expression Data analysis *review:* Phagocytic activity experiments Work on Project Update during class	*Bring laptops*
10	11/2	Lab notebook 3: Gene expression: RNA Isolation, cDNA Synthesis, and qPCR Project Update 2: Morphology and activation – *due Monday 11/6 at 11:59pm*	Protocol quiz 5: RNA isolation, cDNA synthesis, and qPCR (open notebook) Experiment: RNA isolation & cDNA synthesis Data analysis *preview:* qPCR and gene expression	*Bring laptops; Lab coats required.*
11	11/9		Data analysis *review:* Gene expression/activation experiment Discussion: Final Research Paper expectations Work on Project Update during class	*Bring laptops*
12	11/16	Project Update 3: Gene expression – *due Monday 11/20 at 11:59pm*	Discussion: Broad question vs focused hypotheses/experiments Work on Final Research Paper during class	*Bring laptops*
	11/23		*No lab - Thanksgiving Break*	
13	11/30	Final Research Paper DRAFT (paper copy) and peer review	3451 End of Semester Survey and CIOS Peer review (due during class): Final Research Paper	*Bring laptops*
		Final Research Paper due 12/5 at 11:59pm via Canvas; the two allowed 3-day extensions may NOT be used for this assignment	*No class*	