Biology 3451: Cell and Molecular Biology Laboratory
Spring 2016 Syllabus and Schedule
Room 330 Cherry Emerson
Section A – Wednesday 12:05-2:55 pm; Section B – Wednesday 3:05-5:55 pm

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Note: This Syllabus and Schedule are subject to change.

Overview and objectives: You will explore fundamental aspects of cell biology and current methods used in cell biology by using the mouse macrophage cell line, RAW264.7, as a model system. We will perform a series experiments to examine changes in cell morphology, viability and metabolic activity, and gene expression in these cells in response to treatment with a bacterial endotoxin and ragweed pollen extract in support of the Georgia Tech Urban Honey Bee Project (http://bees.gatech.edu/).

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
- Work effectively in a team to investigate scientific questions

Lab safety: Safety policies are mandated by federal, state, and institutional rules. The following policies are **non-negotiable during experimental weeks**:

- **Attire**
    - Shoes that cover your feet entirely (no sandals, e.t.c.)
    - Long pants to the ankle
    - Long hair tied back
    - Lab coat (purchased by student)
    - Goggles and gloves (provided)
- **Behavior**
    - No food or drinks, including water bottles.
    - No cell phone use, including texting.
    - Clean up your bench at the end of lab and report any mess left from previous lab section.
    - Properly dispose of trash, glassware, and biohazard waste.
    - Follow additional safety procedures for specific lab activities as indicated by your TA/instructor.

- **Improper attire or behavior will result in removal from lab and an unexcused absence for the day.**
- **Report all injuries or accidents to the TAs or instructor immediately.**

Course components:

Attendance and participation: 100% attendance is expected for each lab, and for the entire lab period. *This expectation includes arriving on time*. Since you are working in teams to perform experiments, there is no mechanism to make up a lab. Each unexcused absence will lower your final grade by half a letter grade. Excused absences require appropriate documentation within 24 hours of missing class. If you miss a lab, you are still responsible for completing assignments and getting data from your lab partner. Requests for extensions on assignments must be made ahead of time and require appropriate documentation as described above for excused absences.

All students are expected to actively participate in bench-work and class/group discussions, and will be assessed by the extent to which they participate in class discussions (by asking questions, answering questions, and offering ideas) and group work evaluations. You are expected to ask a question or offer a comment at least once every class.

Laptops will be frequently required for this course, and you are encouraged to bring them every day. Computer use is not permitted during class for any purpose other than course-related activities as directed by the TAs/instructor.

Protocol quizzes and 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 T-square. Pre-lab assignments are due online via T-square, and quizzes will be administered in the first 10 minutes of class.

Lab notebooks will be maintained in spiral-bound composition notebooks. Prior to each experiment, you must complete an **Experimental Design** 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. Lab notebooks will be checked each experimental week, prior to beginning the experiment.

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. Projects Updates are individual assignments, and every aspect of the analysis should be generated by the author *with the exception of figures and figure legends.* The data analysis should convincingly and accurately communicate your hypothesis, experimental tests of that hypothesis, analysis of the results, and interpretations of those results. Project updates will be subject to peer review during class.

Research Paper: 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, similar to a peer-reviewed research article.

- **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 use 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 will 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 will be peer-reviewed in class (required for full credit)

Team evaluations: After each experiment, you will evaluate yourself and your team member(s) participation in the group work, including conducting the experiment, analyzing the results, and providing helpful peer feedback. Thoughtful completion of these evaluations and feedback in the evaluations is part of your participation grade.

Detailed information for all assignments will be posted to T-Square.

Late assignments: Unless otherwise specified, all assignments are due by 10am the day of lab and must be submitted through T-square. Late assignments will be subject to a one-letter grade penalty per 24-hour period that it is late, and will not be accepted more than 3 days after the due date. *You are responsible for ensuring that your assignment was properly uploaded to T-square; any assignment emailed directly to the instructor or TAs will be considered late.*

Re-grade policy: Requests for re-grading must be made in writing, explain the rationale for the re-grade request, and be made within one week of the assignment's return.

Academic integrity: 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. Plagiarism includes representing the words or ideas of others as your own. **Sharing and discussing information is permitted and encouraged (this is how science is really done!), but *submission of someone else's work as your own is not permitted*. This includes *any* other form of student work. *When in doubt, ask your TAs or instructor for help.***

Grading:

- Attendance, participation, team evaluations 10%
- Quizzes and pre-lab assignments 15%
- Lab Notebooks 10%
- Project Updates 15%
- Annotated bibliography 10%
- Literature review 15%
- Research Paper 25%

Final scores will be rounded to the nearest whole number, and grades will be assigned according to the following scale: 90.0-100% A; 80.0-89% B; 70.0-79% C; 60.0-69% D; <60% F

LAB SCHEDULE (subject to change) **Unless otherwise specified, all assignments are due online by 10am the day of lab**

Date	Assignments Due (by 10 am unless otherwise noted)	Discussion Topics and Class Activities	Notes
1/13		Course overview Introduction to Macrophage Biology Lab/cell culture safety; sign safety forms	*Bring laptops*
1/20	Pre-lab 1: Macrophage Biology Background Read assigned research article	Student-led discussion of research article Workshop: Hypotheses, predictions, & experimental design Discussion: How and why we cite	*Bring laptops*
1/27	Pre-lab 2: Statistics, pipettes, and citations Citation and plagiarism online quiz/certificate Confirm access to mydesk.gatech.edu	Protocol Quiz 1: Statistics and pipettes Pipetting and statistics exercise Workshop: Using JMP for statistical analysis	*Bring laptops* *Lab coats required*
2/3	Pre-lab 3: Measuring cell viability and macrophage activation Statistics exercise analysis	Discussion: Broad question vs focused hypotheses/experiments HPED Workshop: Cell viability Annotated Bibliographies	*Bring laptops*
2/10	Experimental Design 1 & 2: WST-1/AlamarBlue and Griess	Protocol Quiz 2: WST-1/AlamarBlue and Griess Experiment: WST-1/AlamarBlue and Griess	*Lab coats required*
2/17	Pre lab 4: Principles of fluorescence microscopy & flow cytometry Annotated Bibliography	HPED Workshop: Phagocytic activity Workshop: Figure legends Data analysis: Cell viability and macrophage activation experiments	*Bring laptops*
2/24	Experimental Design 3: Fluorescent microscopy Project Update 1: Cell viability (submit online and bring printed copy for peer feedback)	Protocol Quiz 3: Fluorescence microscopy Experiment: Fluorescence microscopy Peer feedback: Project Update 1	*Lab coats required*
3/2	Team evaluation 1 Experimental Design 4: Flow cytometry	Protocol Quiz 4: Flow cytometry Experiment: Flow cytometry	*Lab coats required*
3/9	Pre-lab 5: Changes in gene expression Literature Review outline	HPED Workshop: Gene expression Data analysis: Phagocytic activity experiments	*Bring laptops*
3/16	Experimental Design 5: qPCR Project Update 2: Phagocytosis (submit online and bring printed copy for peer feedback)	Protocol quiz 5: qPCR Experiment: RNA isolation & cDNA synthesis Peer feedback: Project Update 2	*Lab coats required*
3/23		***Spring Break – no lab***	
3/30	Team evaluation 2 Review Ethical Summary Protocol Review Article draft (submit online and bring printed copy for peer feedback	Discussion: How and why we cite review Data analysis: Gene expression experiments Peer feedback: Literature Review Drafts	*Bring laptops*
4/6	Review Article Project Update 3: Gene expression (submit online and bring printed copy for peer feedback)	Discussion: Broad question vs focuses hypotheses/experiments Peer feedback: Project Update 3	*Bring laptops*
4/13	Team evaluation 3 Final Research Paper draft (submit online and bring printed copy for peer feedback)	Discussion: Project future directions	*Bring laptops*
4/20	Final Research Paper	3451 End of Semester Survey and CIOS	*Bring laptops*