**BIOS 1208L: Organismal Biology Laboratory Spring 2018**

***Laboratory Syllabus***

Biological Sciences 1208L labs are held in room CULC 475.

**Faculty Instructor:** Colin Harrison charrison47@biosci.gatech.edu

**TAs:** TA information is available on the T-Square Homepage for the Lab

# BIOS 1208L Laboratory Policies

Note: This syllabus is subject to change.

1. **Lab structure & learning objectives.**

This course, designed for Biology majors, introduces students to organismal biology. This course is designed as a research service-learning lab, which means you will be immersed in a research experience from day one. Service-learning is a way of integrating relevant community service with academic coursework in order to enhance learning, teach civic responsibility, and strengthen communities. The lab class is partnering with Piedmont Park Conservancy to conduct research that will benefit our learning in biology and the greater Atlanta community. You will work in teams with the support of the entire class to brainstorm and critique ideas to design a semester-long research project to explore a question related to water monitoring in Piedmont Park. Piedmont Park Conservancy will use our data for long-term ecological monitoring and other initiatives. Your instructor and TAs are available to guide you in figuring out which techniques are applicable to the biological questions you are addressing, as well as to help you to understand and use these techniques. This course is meant for you to explore what it means to do applied biological research, foster scientific thinking, develop effective communication skills, and develop your ability to work effectively with others. Most importantly, this course will be exciting, and you will make your own discoveries, and we expect that you will develop knowledge and skills that extend beyond the classroom! Please bear in mind that the 1208LL schedule may change as the semester progresses to accommodate for your projects. After participating in Biological Sciences 1208L Lab, we expect that you will be able to do the following:

1. Interpret and summarize primary biological literature.
2. Work with a Community Partner to create testable scientific hypotheses regarding real world scientific issues.
3. Work in groups to design experiments and gather data to test your hypothesis.
4. Apply qualitative and quantitative methods including basic statistics and visualizations to their data to evaluate your hypotheses.
5. Communicate their research findings in both written and short presentation formats.
6. Acquire basic biological laboratory skills and ecological sampling techniques.
7. **Lab materials.** There is no lab manual for this course. You will need a spiral bound carbonless lab notebook and a 100% cotton lab coat.
8. **Safety.** Safety policies are mandated by federal, state, and institutional rules to keep everyone safe. During lab (in the lab & in the field) it is important to be aware of your surroundings. Depending on the types of protocols involved in your project, you may be required to wear gloves and/or your safety goggles (both provided), and we’ll inform you of potential hazards as needed. **Report** **all injuries or accidents immediately**. The following are non-negotiable policies:

* You must wear shoes that cover your feet entirely (i.e., no flip flops, ballet slippers, or sandals).
* No food or drinks, including water bottles, in the lab. You may bring water and a snack for the field.
* 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.
* During wet labs, required attire includes: long pants to the ankle, lab coat & goggles and hair tied back.
* Properly dispose of trash, glassware, and biohazard waste.

1. **Absences & Tardiness.** It is essential that you attend lab and are on time; your group is counting on you. There are no make-up labs for unexcused absences as this is a project-based lab. An unexcused lab will cost you 5% reduction of your grade and your participation points for that lab. There is no penalty for an excused absence.In the event that you miss a lab, or know in advance that you will need to be excused from a lab, contact Dr. Harrison and your group members since they are counting on your contributions. Documented excused absences may include: an illness of your own or within your family (physician’s note required), schedule conflict with an obligation to an official organization (letter from Dean of Students or head of organization is required), car accident (copy of police report required), etc. [FYI: Full-time students can be exempt from/rescheduled for jury duty with proof of full-time enrollment.] Contact your TA and Dr. Harrison by the time your lab meets for the week (unless it is an emergency) to confirm your absence to either attend another lab section or complete a make-up assignment. Your makeup assignment is due within one week. **Note**: **if you miss a lab you are still responsible for completing assignments and getting data from your group members.**
2. **Plagiarism will not be tolerated**. On the first day of class, we will discuss what plagiarism is, particularly in the context of group work. Most of the work you do in lab will be with your group. Though your project is designed as a group, your notes in your notebook must be in your own words, not copied from a group member’s notes. However, you’ll be turning in several written assignments and presentations that will be created as a group. Since your name is on this work, you’re responsible for being completely certain that the *entire work* meets the standards of the honor code. Anything written that is not an original idea of yours must be referenced. Direct copying from other students’ work will result in a grade of "0" for that assignment. Your conduct is expected to conform to the Georgia Tech Honor Code (<http://www.honor.gatech.edu>). Please familiarize yourself with its expectations and responsibilities.
3. **Grades.** Your lab grade is comprised of the components described below, all assignments are due by the time your lab meets unless stated in the syllabus:

* Group project components are worth 40% of your lab grade:
  + Annotated bibliographies (two, each worth 5%) are worth 10%.
  + Completing 5 weekly Experiment Notes (Due 24 hours after your lab meets) 5%
  + Written proposal is worth 15%.
  + Final presentation is worth 10%
* Class individual participation components are worth 60% of your lab grade:
  + Group evaluations (two, each worth 2.5%) are worth 5%.
  + Reflection statements (two, each worth 5%) are worth 10%.
  + Lab notebook (two unannounced checks, each worth 5%) is worth 10%.
  + Lab Report drafts (4, each worth 1.25% graded only on completeness) are worth 5%
  + Final Lab Reports are worth 25%
  + Lab participation is worth 5%. Participation includes weekly readings which will be assessed through conversation and any pre-lab activities. Tardiness to lab without excuse will result in a deduction of 1% for each 10 minutes. Tardiness to labs requiring site visits may cause unexcused absences, as we will not hold the van more than 10 minutes and you will then be responsible for your own travel to the site.
* **Assignments turned in late will receive a 10% penalty per day late up to 5 days. Notebook checks are not accepted late.**
* Final letter grades will be assigned as follows:
  + A: ≥ 90.0%
  + B: ≥ 80.0% and < 90.0%
  + C: ≥ 70.0% and < 80.0%
  + D: ≥ 60.0% and < 70.0%
  + F: < 60.0%

1. **Class discussions about journal articles and experimental design.**

Reading, understanding, discussing and critiquing research papers and thinking through experimental design is crucial to doing science. Since we’re working together to learn about new ideas together, I expect that you will contribute to our class discussions about experimental design and journal articles. This means sharing at least one specific question or comment to each discussion.

**Advice from former 2107 and 1208L students to aid in your success:**

*Literature searches:*

* Don’t underestimate the value of the annotated bibliographies. Although they may seem like a waste of time, the ability to understand and utilize others’ writing is so useful in research.
* Do tons of research on your topic. Don’t be afraid to investigate something different.
* Be creative and read many research papers for ideas on project topics.
* Find as much literature on your topic as you can. It will save you a lot of time in the end.
* Endnote is your BFF.

*Organization and group work:*

* Pick group members who have similar interests in research topics. Don’t just work with people you like.
* More than anything else, develop a good relationship with your groupmates. It will help you to communicate more effectively with them and also to get work done better. Also, it will be a more enjoyable experience because you will be spending a lot of time in lab with them and outside too.
* Keep communication open and honest with group members. Be sure to plan meetings ahead of schedule and clearly distribute work.
* Make sure you and your group fully think through your procedure step by step to make sure you know what you’re doing.
* Create a regular timeline listing goals and coursework over time, and update them if plans change. It can get overwhelming when you realize you have a lot due the next week and not much time to do it.
* Write your methods section as you go, and then revise it at the end.

*General advice:*

* Don’t be frustrated when you aren’t given instructions. Be confident in trying things and be ready to problem solve to fix mistakes.
* Understand that all the hard work you will put in will teach you about science and it all has a point.

**Most of all…Have fun & have a terrific semester!**

**Tentative Lab Schedule (subject to change)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Date** | **Week** | **Activity** | **Assignments due\*** |
| Jan 7 | **1** | *No Lab: First Week of Classes* |  |
| Jan 14 | **2** | *No Lab: MLK Day* |  |
| Jan 21 | **3** | *At lab*: in-class reflection about prior experiences doing science; overview of class and project; syllabus discussion; how to keep a lab notebook: reading scientific papers: accessing primary literature and Endnote workshop | Read last year’s papers |
| Jan 28 | **4** | *At site*: Project Introduction/Info | Discussion of park, last year’s papers |
| Feb 4 | **5** | *At lab:* Work on proposals | Annotated bibliography 1 due  Reflection statement #1 |
| Feb 11 | **6** | *At lab:* Revising Proposals | Proposal Draft Due/Final Proposal Due at End of Lab |
| Feb 18 | **7** | *At site:* Sampling/Observations | Group Evaluation 1 |
| Feb 25 | **8** | *At lab:* Testing Samples and Statistics | Experiment Notes 1 |
| Mar 4 | **9** | *At lab:* Revised Testing Samples | Experiment Notes 2  Intro Draft Due |
| Mar 11 | **10** | *At lab:* Experiments and Collecting Data | Experiment Notes 3  Annotated Bibliography 2 |
| Mar 18 | **11** | *No Lab: Spring Break* |  |
| Mar 25 | **12** | *At lab:* Revised Experiments and Collecting Data | Experiment Notes 4  Methods Draft Due |
| April 1 | **13** | *At lab:* Revised Experiments and Collecting Data | Experiment Notes 5  Reflection Statement 2 |
| April 8 | **14** | *At lab:* Presentation Preparation | Group Evaluation 2 |
| April 15 | **15** | *At lab:* Group Presentations | Abstract Draft Due  Results/Discussion Draft Due  Post-Lab Free Response |
| April 22 | **16** | *No Lab Last Week of classes* | Final Lab Report Due Tues 4/24 at NOON |

Please bear in mind that the 1208LL schedule may change as the semester progresses to accommodate specific project needs.

\*Unless otherwise specified, all assignments are due at the start of lab through T-square. This due date/time applies to both lab sections.

**Lab Paper**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Criteria** | **Specific objectives** | **Level of achievement** | | |
| ***Scientific approach*** | Excellent (2) | Needs work (1) | Absent (0) |
| (1) *Abstract:* The abstract helps the reader to understand the larger document by acting as a summary or “pre-reading” of the key points. Abstract is concise yet complete: a 100-150 word paragraph summary. 1-2 well-developed sentences articulate each objective listed. | 1. Purpose or motivation for experiment is linked to concepts and “big picture,” in light of Piedmont Park & the greater Atlanta region. 2. Particular question and hypothesis addressed in experiment are stated. 3. Experimental approach taken to address the question is described. 4. Major findings and interpretations are described. 5. Judgment about the hypothesis is linked to findings. 6. Conclusions are stated: why this matters and significant implications, again in relation to Piedmont Park and the larger community. |  |  |  |
| (2) *Introduction:* What question is your experiment designed to address? What do you expect to find and what evidence would be needed to support this claim? How are these hypotheses grounded in scientific concepts? What is the relevant background information and previous research that sets up your question? | 1. The question or objective is well-defined. 2. Alternate hypothesis(es) is stated. Null hypothesis is not stated. 3. Reasoning for hypothesis(es), based on scientific concepts and logic, is explained. 4. Evidence needed to support/reject hypotheses is described. 5. Relevant background and previous research findings are cited |  |  |  |
| (3) *Methods:* How will you address your question? What data will you collect and how? How will you analyze and interpret this data? | 1. Pertinent details are described (e.g., controls) 2. Specific data collection is described in enough detail so the experiment could be replicated. 3. Analysis and interpretation procedures are described in enough detail so the experiment could be replicated. |  |  |  |
| (4) *Results:* What did you find? | 1. Begins with 1-2 sentences describing the overall findings of the lab. 2. Findings from the data analysis are reported only, without making explanations or conclusions about the data. |  |  |  |
| (5) *Discussion:* What do your findings mean? Interpret your results with regard to your hypothesis. | 1. Begins with a statement relating the overall results to the hypothesis. 2. Specific data is used as evidence to decide whether the hypothesis is supported, in conjunction with the appropriate scientific concepts. 3. Findings are compared to other published research and differences between study findings are discussed. 4. Other issues are addressed as appropriate, e.g., problems that occurred; sources of uncertainty in the lab procedure or findings; improvements or extensions of the experiment. |  |  |  |
| ***Presentation*** | 1. There are no grammatical or spelling errors and italics are used as needed. 2. Sentences are clear and to the point. 3. Flow of ideas is cohesive and logical. 4. Use of technical terminology is appropriate. 5. Writing is understandable to non-scientist professionals. |  |  |  |
| (6) *Writing:* Grammar; spelling; clarity and conciseness of sentences; flow of ideas; use of technical terminology. |  |  |  |
| (7) *Figures & tables:* Graphs; drawings, diagrams, tables. | 1. Correct format is used (titles, captions, graph components) and visuals are well-suited to the data. 2. Visuals are discussed and clearly referred to in text and arranged in an order that effectively conveys the data’s “story.” |  |  |  |
| (8) *Formatting* | 1. Word document: 12 pt Times New Roman, 1 inch margins, single-spaced with a space between paragraphs 2. Title of paper is relevant and interesting; conveys findings 3. 10 peer-reviewed references are included and formatted according to *Ecology*. |  |  |  |

**Grade**= (Scientific approach points *x* 2) + (Presentation points)= 100 points possible to earn for final lab paper

**Presentation Rubric**

* Accomplished =3 pts
* Average = 2pts
* Developing = 1pt
* All points doubled except style.
* Presentation should be 8-10 mins long

**Group Evaluations**

**Your name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Please fill in the chart to rate each of your group members, using the following scale:**

Always (3) Often (2) Sometimes (1) Never (0)

Your evaluation score is 5 points for completing your peers’ evaluations + the average score your group members award you. A total of 20 points may be earned.

|  |  |  |  |
| --- | --- | --- | --- |
| **Please rate the following items.** | **Group member:** | **Group member:** | **Group member:** |
| *Contribution:* He/she actively, equally, and productively contributed to all group efforts, including group discussions, work, written assignments, and presentations, both within and outside of lab? |  |  |  |
| *Creativity:* He/she exhibited creativity when designing experiments and solving problems. |  |  |  |
| *Logical thinking:* He/she showed logical thinking during the design of the experiment and in solving problems. |  |  |  |
| *Group dynamics:* He/she demonstrated aspects of teamwork (e.g., listening, sharing knowledge, asking useful questions, working together, encouraging others, flexibility) that helped the group succeed, and contributed to resolving issues arising between group members. |  |  |  |
| *Feedback:* He/she used constructive criticism positively to further improve the quality of group products. |  |  |  |

**For each group member, in at least 1 sentence but no more than 3 sentences, please address the following questions:**

1. What is the single most valuable contribution this person makes to your group?
2. What is the single most important thing this person could do to more effectively help your group?

**Lab Notebook Guidelines**

Scientists keep lab notebooks so that they have a record of thoughts and ideas related to their research. Lab notebooks are a record of observations, methods, protocols, results, conclusions, and plans for future work. As a working scientist, looking through your lab notebook can help you to figure out what’s worked and what hasn’t when you are troubleshooting a protocol. It is more reliable your memory when you’re trying to describe something that you found to a collaborator. Lab notebooks usually become the property of the lab when you leave, so that if someone else continues to work on the project or a related project, there is a written record. Since you will be designing and carrying out a research project with your group, you will keep a lab notebook. There is no one right way to keep a lab notebook, but there are general guidelines that you can adapt so that the notebook is useful for your purposes. There will be two unannounced lab notebook checks during the semester, each worth 10pt (5% each check, 10% total). Points will be allocated in the following way: 2pt legibility; 2pt organization; 3pt sufficient content; 3pt up to date (to the prior lab class).

1. **Keep it up to date:** Keeping your notebook up to date also ensures you have a record of what’s going on with your research at each step, rather than trying to remember what you did at the end of the semester. It’s very likely you will not remember!

2.  **What should be included:** The more detailed your lab notebook the easier it will be to write your proposal

and final report. Including the following may be helpful, but you may find that some items are not applicable for each lab. Your lab notebook should help you to keep track of what you have done and the progress you have made toward answering your questions.

**Title/ date/ name**

**Observations and background information**: Be clear and concise. You may need to refer to your observations in order to design the appropriate experiment(s). What are your questions? What are you basing these questions on? This section will become part of your background information in your lab report.

**Questions and goals:** What are the main questions you are investigating in your experiment? What is your focus for lab that day? There can be more than one. Be clear about which question(s) you choose to answer and explore. These questions will directly drive your hypotheses and therefore your experimental design.

**Hypotheses:** Your hypotheses are based on your original observations. What are your null and alternative hypotheses? Clearly state the objectives of your proposed study. Outline your *a priori* expected outcomes.

**Experimental Design:** Include variables, what exactly did you measure, and how did you measure it? How does measuring this allow you to address your hypotheses? How many replicates did you do? Where might error creep into your design? Did you change any methodologies during your experiments? Why? Be detailed so that others can replicate or repeat your experiments. This should be a good resource for you to refer from week to week. Do you need to re-evaluate your research plans or methods?

**Results & Data Analysis:** This will include your raw data and data collection notes as well as statistical analyses and logical, informative graphs. This may also include diagrams and drawings (especially important when identifying organisms). When using statistics, explain what those statistics are, why you’re using them, and what they are telling you.

**Plans for the following week:** your to-do list.