## BIOS 4690 Independent Research Project | Syllabus

**Course description:**Independent research with proposal and manuscript writing, conducted with the guidance of a faculty member.

**School of Biological Sciences Instructor of Record:**

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**Overview:** BIOS 4690 is a 3-credit research-based course to fulfill the senior research requirement. Students will gain experience in designing, implementing, and communicating a biology research project, and practical training in modern approaches for biological research. The research project will be designed, implemented, and analyzed in collaboration with the faculty mentor you have identified. Students cannot receive course credit for BIOS 4690 and also be paid for the same research hours.

**Prerequisites and Corequisites:**

* Students are required to have a minimum of 1 credit of BIOS 2698/2699/4698/4699 prior to enrolling in BIOS 4690.
* BIOS 4460 (Communicating Biological Research) can be taken concurrently or in the subsequent semester; students present their research from BIOS 4690 in 4460.
* If a student is completing BIOS 4690 to complete the Research Option through the Undergraduate Research Opportunities Program, they will need to complete the LCC 4701 pre-requisite and LCC 4702 co-requisite.

**Class Administration:** BIOS 4690 students technically have two supervisors, the ‘research supervisor’ and the ‘School of Biological Sciences supervisor/Instructor of Record’.

* The **research supervisor** will be the Principal Investigator who oversees the student in their research throughout the semester (practically, students may work with graduate students or postdocs on a day-to-day basis). The research supervisor will serve as the primary director and assessor of the student during the research. The student is expected to work closely with the research supervisor regarding all course activities. In addition, the research supervisor will work with the student to develop the reports, to assess the quality of those reports, and to assign an overall grade at the end of the semester.
* In contrast, the **Biological Sciences supervisor** will act as the administrative manager of the course. In most cases, student contact with the Biological Sciences supervisor will likely be limited to emails and contacts through Canvas. However, when needed, students are encouraged to contact the Biological Sciences supervisor at any time to address concerns, issues, questions, or problems regarding the research. It is important to address concerns as they arise rather than try to resolve the outcome of a longer term underlying issue. The Biological Sciences supervisor will help to ensure that the research proceeds properly for all parties involved.

**Learning outcomes:** By the end of this class, students will be able to:

1. Design and implement experiments to test scientific hypotheses
2. Implement appropriate techniques and methods to conduct scientific research
3. Write a complete scientific manuscript

**Course Timeline and Assessments**

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| **Assessment** | **Description** | **Due on** |
| Syllabus and PI confirmation | Complete the Canvas Quiz to confirm you have read this syllabus and provide final contact information for your research supervisor (PI) | Due on Canvas by Tuesday of the first week of classes. |
| Research Proposal | The research proposal consists of a short plan of the project to be conducted. The proposal should be 500-1000 words and should include: a title, introductory background and justification, hypotheses (if applicable), experimental design, expected data analysis, statement of expected results, and how the results relate to the introduction. In addition, the proposal should contain at least five citations in-text, and it should include a journal-style literature cited section (not included in the word limit) in a citation style appropriate for your field of research (consult with your PI on preferred citation styles). | Due to your PI and as a submission on Canvas by midnight Friday of the 3rd full week of classes. *In summer session, this assignment is typically due in the 2nd week of classes.* |
| Research activity | The student works throughout the semester on their project for ~9 hr per week for regular Fall and Spring semesters, ~12.6 hr per week in the Full Summer semester, and ~27 hr-week for the Short Summer semester. This weekly research timing allows the student to complete 135 hours of research in a balanced way across the semester. The student may receive help from others in the lab group when needed, but the project should be run by the undergraduate student. | Weekly throughout the semester, in agreement with your research supervisor |
| Second Reader selection | The student and faculty mentor agree on another faculty member who can provide appropriate feedback on your research work; this person is known as the **second reader**. To select a second reader, the student and faculty mentor should consult and agree on someone who is a faculty member and who has appropriate content expertise to provide a sound review of the science. Faculty who are already serving as second readers for other student’s projects are likely to decline; asking earlier can help secure a second reader.  For students with research supervisors outside of the School of Biological Sciences, the second reader should be selected from the School of Biological Sciences [faculty](https://biosciences.gatech.edu/people?field_last_name_value=&field_job_category_tid=19), unless otherwise approved by the 4690 Biological Sciences supervisor.  More information about the second reader’s role can be found below under “Final manuscript.” | Due on Canvas 4 weeks before the Final Instructional Class Day |
| Preliminary manuscript | During the second half of the semester, the student prepares a draft manuscript to be graded by the faculty mentor. Contents should be arranged with the faculty mentor and should comprise draft elements of the final manuscript related to the student’s research project. Best practices for the preliminary manuscript are that it be ~1500 words long and include the background, justification, and goals for the research project. Elements of the methods, results, and discussion may be included depending on how far the project has advanced. The preliminary manuscript should cite at least 5 different articles, with citations in-text and a journal-style literature cited section listed at the end of the manuscript (not included in the word limit). Feedback from the instructor can then be used to improve the style and content for re-submission as part of the final manuscript. | Due to your PI by email *and* as a submission on Canvas by midnight *one week prior* to the Final Instructional Class Day |
| Final manuscript | Should be 3500± words (this is at the discretion of your PI), and include figures and/or tables, and at least 10 citations. The final manuscript must include an abstract, introduction, methods, results, and discussion. Data should be appropriately summarized and provided in tables and/or figures with legends. The final manuscript should cite at least 10, and probably many more, different articles, with citations in-text and a journal-style literature cited section listed at the end of the manuscript (not included in the word limit).  The research supervisor and student should select a relevant scientific journal, and model the final manuscript after a submission to that journal, including use of the journal’s preferred citation style. Note that the structure and length of the Research Proposal, Preliminary Manuscript, and Final Manuscript may be more rigorous at the request of the research supervisor.  Each student will write their own final manuscript in their own words, following the guidelines and best practices in the academic integrity section of this syllabus. | Due to your PI *and* Second Reader by email, and as a submission on Canvas, all by midnight on the Final Instructional Class Day |
| Await manuscript review, grade, and possible comments | The research supervisor and the second reader will read the student’s work and then communicate a recommended grade to the faculty mentor within 1 week. The student will receive a written evaluation from the faculty mentor at the end of the semester summarizing the strengths and weaknesses of the project. The second reader may also submit comments back to the student.  The faculty mentor is responsible for communicating the course student grade to the student and submitting the final grade to the Instructor of Record for BIOS 4690 by the Friday after exams end. | During exams week |
| Revised final manuscript | If substantial revision, then resubmit the latest revision to the Final Manuscript assignment before the last day of exams. This version will be reviewed the Instructor of Record for BIOS 4690 to approve the student’s research as counting for the Senior Research Experience. | By the last day of exams |

**Lab safety:** Georgia Tech has a strict policy regarding appropriate clothing in laboratories where chemicals and organisms are used or manipulated. Students not conforming to the following requirements will be asked to leave the lab to acquire appropriate clothing. Each lab on campus has its own policies to comply with lab safety guidelines. In wet bench labs, it is best practice for students to wear:

1. Long pants.
2. Close-toed shoes that cover the sides and top of the foot.
3. Lab coats, when working at the bench. Lab coats must be 100% cotton and cover the wearer to the knees. Students are responsible for keeping their lab coats in good condition and reasonably clean so as to not create a hazard.
4. Safety glasses, when working at the bench. Safety glasses must have side shields for splash protection and conform to the wearer’s face. Glasses must be worn over prescription glasses and contact lenses. Georgia Tech Biology provides safety glasses for student use in the lab. Safety glasses prevent eye exposure to liquid reagents and breakables, as well as dangerous substances such as bacteria, toxins, acids or UV light.

**Class attendance:** Students will work with their supervisors to develop a schedule that will fulfill the required hours for this class (135 hours expected). Any alterations to the schedule must be agreed upon by the supervisor and student. Missing schedule research without prior notification may result in a 5% grade deduction per instance.

**Evaluation:** Grades in this course are based on student research and the ability to communicate that research in writing, as follows:

Research portion (evidence that research is being conducted effectively) 40%

Scientific writing portion (evidence that student can communicate research)

Research Proposal 10%

Preliminary Manuscript 15%

Final Manuscript 35%

All writing portion documents should be submitted directly to the Research Supervisor and also submitted electronically to the course Canvas site. Canvas submissions should be formatted as .doc, .docx, or .pdf filetypes, single-spaced with 12-point font and 1-inch margins on all sides.

**Academic Integrity**: While students will often collaborate in performing the experiments and collecting the data, each student is expected to write their own notebooks and manuscripts, including creating their own tables and figures. Plagiarism includes reprinting the words or ideas of others without citation. As direct quotes are seldom used in scientific writing, you are expected to rephrase the words of others and provide the citation. If this is unclear, please consult with your instructor as your write before turning in your assignment.

This course uses TurnItIn plagiarism detection software and releases the report directly to the student upon submission. As you review your report, if you see similarities to the work of others, then you need to address those immediately and resubmit with a revised filename that makes it clear which version is the revision. Note that if you are submitting your same thesis to LMC 4701 and 4702 as part of the research option, this is a case where I expect you will submit the same document to both that course and this course. Simply check the report to confirm that the similarities detected are solely from your own work submissions in these different courses.

Academic dishonesty will not be tolerated. This includes plagiarism, cheating, lying about course matters, stealing classroom materials, or helping others commit a violation of the Honor Code. Students are reminded of the obligations and expectations associated with the Georgia Tech Academic Honor Code and Student Code of Conduct, available online at [www.honor.gatech.edu](http://www.honor.gatech.edu). Any infractions will be submitted to the Office of Student Integrity for adjudication.

**Learning Accommodations:** Please contact the instructors (the Instructor of Record and your Research supervisor) during the first week of class or as soon as possible if you need classroom accommodations. Accommodations should be arranged in advance and in accordance with the Office of Disability Services (http://disabilityservices.gatech.edu/)

**Campus Resources for Students**

In your time at Georgia Tech, you may find yourself in need of support. Below you will find some resources to support you both as a student and as a person.

**Academic support**

* Center for Academic Success <http://success.gatech.edu>
  + 1-to-1 tutoring <http://success.gatech.edu/1-1-tutoring>
  + Peer-Led Undergraduate Study (PLUS) <http://success.gatech.edu/tutoring/plus>
  + Academic coaching http://success.gatech.edu/coaching
* Residence Life's Learning Assistance Program

<https://housing.gatech.edu/learning-assistance-program>

* + Drop-in tutoring for many 1000 level courses
* OMED: Educational Services (<http://omed.gatech.edu/programs/academic-support>)
  + Group study sessions and tutoring programs
* Communication Center (<http://www.communicationcenter.gatech.edu>)
  + Individualized help with writing and multimedia projects
* Academic advisors for your major

<http://advising.gatech.edu/>

**Personal Support**

Georgia Tech Resources

* The Office of the Dean of Students: <http://studentlife.gatech.edu/content/services>; 404-894-6367; Smithgall Student Services Building 2nd floor
  + You also may request assistance at <https://gatech-advocate.symplicity.com/care_report/index.php/pid383662?>
* Counseling Center: <http://counseling.gatech.edu>; 404-894-2575; Smithgall Student Services Building 2nd floor
  + Services include short-term individual counseling, group counseling, couples counseling, testing and assessment, referral services, and crisis intervention. Their website also includes links to state and national resources.
  + *Students in crisis may walk in during business hours (8am-5pm, Monday through Friday) or contact the counselor on call after hours at 404-894-2204.*
* Students’ Temporary Assistance and Resources (STAR): <http://studentlife.gatech.edu/content/need-help>
  + Can assist with interview clothing, food, and housing needs.
* Stamps Health Services: <https://health.gatech.edu>; 404-894-1420
  + Primary care, pharmacy, women’s health, psychiatry, immunization and allergy, health promotion, and nutrition
* OMED: Educational Services: <http://www.omed.gatech.edu>
* Women’s Resource Center:  <http://www.womenscenter.gatech.edu>; 404-385-0230
* LGBTQIA Resource Center:  <http://lgbtqia.gatech.edu/>; 404-385-2679
* Veteran’s Resource Center:  <http://veterans.gatech.edu/>; 404-385-2067
* Georgia Tech Police: 404-894-2500