Research Project Lab: Learning genetic engineering tools to study chromosome metabolism (3 credit hours)
Course Prefix and Number: BIOS 4590B
Term: Fall 2025

Instructor: Kirill Lobachev, Associate Professor, School of Biology (kirill@gatech.edu)
Office hours: Tuesday 11AM-12PM, IBB room 2304.
A prior e-mail appointment is strongly recommended for meetings during office hours and required for meetings outside office hours.

TA: Soobin An | san75@gatech.edu | Office hours by appointment, IBB 2204

Time and location: Lectures: Tuesday, 12:30 – 1:20 PM, **Boggs 1-67**
Lab: Tuesday, 1:30 – 4:15 PM and Thursday, 12:30 – 3:15 PM, **Boggs 1-67**

Course description: This course is designed for upper-level undergraduate students interested in learning modern molecular biology techniques and applying them to study biological processes in model organisms. No previous experience working in the lab is required. Modern approaches and tools used for the modification of genetic information will be presented. The course is an essential resource for those who seek to expand their knowledge of modern molecular genetics tools.

Course Objectives: As a result of this training, students will learn how to work with *E. coli* and baker's yeast, carry out plasmid and genomic DNA extractions, design and set up PCR reactions, do restriction digestion analysis, clone genes, and create mutations and analyze their effect *in vivo*. The course will include traditional lectures, laboratory time and individual projects. During individual projects, students, working as a team, will carry out their own investigation of the effect of mutations in particular genes on chromosomal metabolism.

Required course materials: You are not required to purchase a textbook for this course.
The following book is a useful reference:

D.A. Miklos and G.A. Feyer., (2003). *DNA Science: A First Course.* 2d edition Cold Spring Harbor Laboratory Press

RULES AND REQUIREMENTS

Students should organize into groups of two. All laboratory work will be performed with a partner.

Equipment

Each person receives individual equipment. The equipment you receive is your responsibility and you have to make sure that it is returned to the TA at the end of the course. *Completing an equipment checklist is required at the end of the course.* The Course Coordinator of the School of Biology may see you for damaged or lost units of equipment.

Grading
Quizzes – 20%
Notebooks – 20%
Individual project – 60%

Notebooks

Your notebooks should be handwritten (not typed) and should include original notes you take during experiments. They are graded individually (each student is required to present their *own* notebook). Your notebooks should contain descriptions of the procedures you have performed and actual/original data. It is not necessary to rewrite the protocols (you may attach them if you wish to) in your notebooks. However, you have to outline experimental steps so that an experienced person (including yourself) would be able to trace your experiments without frequent references to the original detailed procedures. In addition, it is required that you include all changes made (compared to the original protocols), as well as all calculations, measurements/observations, etc.

Notebooks are to be turned in for the first time on 09/11 by the end of the lab. You will receive them back with critical comments. Notebooks are to be turned in for grading on 09/25 and also on the last day of lab. Notebooks will be graded on a 0-20 scale with an emphasis on recording events in the experiments (esp. critical and usual data/observations) and clarity.

Students who want their notebooks back should make requests no later than one month after the completion of the course. Notebooks remaining beyond that point will be discarded.

Individual projects (One per team; teammates will receive the same grade for individual projects)

Individual projects will be assigned one week before the projects begin. You may choose your project from the available list if you wish. You may also suggest your own mini-projects, but please remember that they have to use techniques, equipment, and materials already available for the project lab.

Project Reports: should be typed as double-spaced manuscripts according to the format of a specific scientific journal, for example, the *Journal of Biological Chemistry (JBC)*. It is recommended that you find a few examples of papers published in the journal and use them as references. The first issue of each year usually has rules and instructions on the preparation of manuscripts; they can be found on the website as well as in the Information for Contributors. Please note that different journals may have slightly different rules on manuscripts, even though the principles are similar. You may choose a journal other than JBC, but you have to define which journal's rules you followed and follow them exactly. A report generally includes the following sections: *Abstract (or Summary), Introduction, Materials (*or *Experimental Procedures), Results, Discussion,* and *References Cited*. Experimental data should be presented as figures or tables with appropriate legends.

Practice reports: Each team may turn in one report for Experiment II or IV (by the team's choice) on Thursday, 09/25. These reports are **NOT to be graded**. Their meaning is to demonstrate major errors that have to be taken into consideration while the individual project reports are being prepared. Practice reports will be returned to the students with comments. Typical errors will be discussed in the class during lecture hours.

Final individual project reports: Each team turns in one report for the individual project. These reports are due on the last day of lab. These reports will be graded and will contribute 40% to your final score. If your experiment did not yield the expected results, you can still get a high score if you properly address possible reasons and present reasonable strategies for correcting the problems. Your working habits will be observed in class and will be counted toward your report grades. NOTE: individual project reports will not be returned, although you may see them by appointment to learn about your errors.

DNA samples you have obtained during individual projects (and by request, some of the samples obtained during Experiments I-V) should be properly marked (with sample name, date, and your group number), referred to in the text and returned to the TA when your reports are turned in. Failure to turn in DNA samples or to properly mark them will result in severe subtractions.

Safety in Lab: While in the lab, all students will be required to wear all appropriate PPE. This includes goggles, lab coats, and gloves. Students will be responsible for their own lab coats. Gloves, goggles, and disposable facemasks will be provided for in-lab use.

Failure to bring the required PPE will result in denial of admission to the lab with grade penalties for missing the lab, no exceptions. In addition, refusal to comply with proper PPE usage will result in grade reduction as well as potential disciplinary action for violating the Georgia Tech Honor Code.

Attendance: Laboratory hours are mandatory.

Academic and Research Honesty/Integrity Statement
Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review the **Student Code of Conduct** and the **Academic Honor Code**, especially **Appendix A: Graduate Addendum to the Academic Honor Code**.
Students are expected to perform research in an ethical and responsible manner.
Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.
Allegations of scientific or scholarly misconduct are handled in accordance with the procedures outlined by the **Policy for Responding to Allegations of Scientific or Other Scholarly Misconduct**.

Core IMPACTS
Not applicable

Accommodations for Students with Disabilities
If you are a student with learning needs that require special accommodation, **contact the Office of Disability Services** as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. **The Student-Faculty Expectations** **a**rticulates some basic expectations that you can have of me and that I have of you. Additional information for research-related work is given in **The Expectations of Advisors and Advisees.** In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.