Syllabus-Biol 4905
Laboratory in Microbial Molecular Biology
Summer Institution, 2023

This is course taught in a Face-to-Face (In Person)
Please inform Dr. Seoh immediately by text message if you become sick

Course: **Biol 4905 (CRN 53557, CRN 52505)**

Credit hours: 3.0 **Summer Institution, 2023**

Time: MTWThF: 9:00AM~ 11:20AM (Morning Session, CRN 53557)
MTWThF: 2:00PM~ 4:20PM (Afternoon Session, CRN 51505)

Location: **PSC 164**

Instructor: Dr. Hyuk Kyu Seoh
Office: 537 PSC
Phone: 770-639-3345
Email: hseoh@gsu.edu

Office hours: every day before class

Course Objectives & Student Learning Outcomes (SLOs):

Course Objectives:

The primary objectives of this course are, first; introduce students to the basic techniques applied in the typical Molecular/Microbial Laboratory, and second; expend further to some of advanced techniques in molecular biology. To achieve these goals, students will be given hands-on experience in performing "wet lab" practices, employing a variety of standard and advanced techniques. Informational and instructional lectures will be provided prior to the wet-Lab sessions, where needed, to cover the scientific background behind the techniques as well as the experiment protocols. Students will be expected to maintain a concise, legible, and well-organized notebook of their activities.

The outline below explains how this course (*) aligns with the Department of Biology curriculum at GSU and what you can hope to learn upon successful completion.

Department SLO1- Biology Content Knowledge: Students demonstrate knowledge in the core concepts of evolution, structure and function, information flow, exchange, and storage pathways and transformations of energy and matter, and the interconnectedness of living systems.

*Students will be reintroduced to various concepts in microbial physiology and molecular biology to reinforce the bacterial physiology and structure and function of biological macro molecules.

*Students will advance and add-on to their existing vocabulary for communicating about molecular biology and relevant studies.

Department SLO2- Research Experiences: Students will conduct biology research by performing experiments as well as analyzing novel results in inquiry-based labs.

*Students will perform a series of original experiments that lead to acquiring basic research skills and instruments usage useful in an ongoing research project. Even with predesigned experiment, the success or failure might vary to each individual. Therefore, students should not be discouraged if some of the experiments do not work as expected.

Department SLO3- Critical Thinking: Students will apply critical thinking skills and biology content knowledge in order to analyze data and solve real-world challenges.

*Students will be able to analyze the experimental data and provide rationale for appropriate techniques to solve- real laboratory setting.

*Students will be encouraged to think and analyze critically about the data obtained and the relevance of microbial physiology.

Department SLO4 – Communication: Students will communicate, in oral or written form, biology concepts and approaches, effectively presenting to a specialized or general audience as well as recognizing the broader impacts of the biology topic.

*Students will practice reading and interpreting scientific literature and will be able to understand the scientific process including experimental design for hypothesis testing.

*Students will be able to communicate research findings and knowledges in the form of a comprehensive research report, presentations and discussions.

Department SLO5 – Technology and Instrumentation: Students demonstrate effective use of Microsoft Word, Excel, and other software to organize, manipulate, and present data in graphical formats; and demonstrate proficiency at using computers to conduct literature research and bioinformatic analyses.

*Students will learn molecular techniques for characterizing and analyzing biological macro molecules and how to apply “old-new” techniques to elucidate questions related to microbiome study and other relevant studies.

*Students will be familiar with essential molecular techniques including plasmid DNA isolation from bacterial culture, agarose gel electrophoresis, DNA sequencing, and proteomics analysis

Department SLO6 – Quantitative Reasoning: Students will demonstrate their ability to perform basic mathematical calculations to analyze, critique, and interpret real-world biology information found in their textbooks, primary literature, and/or their experiments in the laboratory setting.

> *Students will be able to calculate the volume and concentration of reagents used in wet lab experiments and will learn how to interpret quantitatively the results of gel electrophoresis, quantitative comparison in proteomics.

Course Requirements:

Prerequisites: Thought there is no prerequisites, students are expected have completed at least one semester of Microbiology (BIOL 3880 or equivalent) and Biochemistry (CHEM 4600 or equivalent) with a grade of C or higher.

Course Policies:

Laboratory Dress Code/Personal Protective Equipment (PPE) Requirements:

1. You must wear long pants and shoes that cover your feet.
2. **The facemasks, lab coats and goggles are the essential PPE, and must always be worn while in the lab.**

Attendance/Punctuality:

Students are required to attend all assigned experiments, analyses, practice. Also, students are responsible for all relevant announcements made during class and posted on the class *iCollege* course web site. Owing to the nature of the course, however, some laboratory activities may extend beyond the assigned time. On these occasions, students who need to leave early should talk to the instructor **in advance**. If a student experiences an attendance hardship, she/he should inform Dr. Seoh via email as soon as possible. If a student would miss a class without an official excuse, she/he will lose 50 points for course attendance.

Specific Requirements & Important Note for the Course:

> **Laboratory Notebook** – Each student is required to **maintain a laboratory notebook and bring with them for every class**. This notebook must contain, but shall not be limited to, a table of contents, synopses of laboratory protocols, any corrections or additions to laboratory experiments or protocols, any notes on experimental conditions, observations, results, interpretations, calculations, and assignments given by the instructor. The notebook must be complete, factual, legible and organized at all times. Anyone reading the notebook should be able to understand all that was performed and

should be able to repeat any experiment contained therein. The laboratory notebook will be checked and graded as scheduled. **Laboratory notebooks not prepared on a scheduled check day will forfeit 10 points per day late.**

2. PowerPoint Presentation – Students will be trained how to work independently in the laboratory setting, but on occasion will be assigned into groups. Each individual/group must finish the various projects assigned to them by the instructor. At the end of the semester each student will present the lab notebook for evaluation and presentation for their work (if the schedule allows).

The PowerPoint presentation should contain the following sections: Subtitle of each experiment, Results and interpretation, and a short Discussion.

Grading & Assessments

		Points
Attendance/ Lab Performance		500 (600)
Laboratory Notebook	(50 points for check 1&2)	100 (200)
Exam	Final Exam	100 (200)
Project Presentation	Final Presentation (if not, points will be re-allocated to 100 points each to Attendance, Notebook, and Exam)	300 (0)
Total Points		**1000**

***Final grades will be assigned as follows* (*in accordance with Biology Department standard*):**

	Grading Scale
A+	1000-960
A	959 – 900
A-	899 – 880
B+	879-850
B	849 – 800
B-	799 – 780
C+	779- 760
C	759 - 700
C-	699 - 680
D	679 - 600
F	**Below 600**

Grade Numerical Score (Example)

A+	**4.30**	**97+**			
A	**4.00**	**90-96**	**C+**	**2.30**	**76-77**
A-	**3.70**	**88-89**	**C**	**2.00**	**70-75**
B+	**3.30**	**86-87**	**C-**	**1.70**	**68-69**
B	**3.00**	**80-85**	**D**	**1.00**	**60-67**
B-	**2.70**	**78-79**	**F**	**0.00**	**<60**

Tentative Schedule:

Week 1: Organization and Project Introduction

July 7 (Fri) Organization meeting and Project Introduction
Lecture: Introduction/ Basic concepts of laboratory work and ethics
Media Preparation instructions

Week 2: Culture Media preparation and Bacterial cell culture.

July 10 (Mo) Lab: Culture Media Preparation and Plate Preparation.

July 11 (Tu) Lecture: Microbial/Bacterial Growth and Growth rate/ Batch Culture
Lab: Bacterial cell streaking

July 12 (Wed) Lecture: Manipulation of Gene Expression and Protein Overproduction
Lab: Cell inoculation for the seed-culture

July 13 (Th) Lab: Cell culture and Induction of protein expression

July 14 (Fr) Lecture: Cell-free Extraction and Protein Determination

Week 3: Cell extractions and Protein Analysis

July 17 (Mo) Lab: Protein Determination Assay

July 18 (Tu) Lecture: Protein concentration adjustment and Gel-electrophoresis.

July 19 (Wed) Lab: Adjusting Protein concentration and PA-gel preparation.
Protein sample preparation

July 20 (Th) Lab: SDS-PAGE, Staining

July21 (Fr) Lecture: Image Quantitation
Lab: Destining and Image Scanning

Week 4: Blotting and Western blot analysis

July 24 (Mo) Lecture: Blotting and Antigen-Antibody interaction.
Lab: Sample preparation for Western blot

July 25 (Tu) Lab: PAGE and Protein Blotting

July 26 (Wed) Lab: Western blot, probing with 1o and 2o antibodies.

July 27 (Th) Lab: Western blot developing and Imaging.

July 28 (Fr) Final Exam