

COURSE NAME; NUMBER; SEMESTER; MEETING DAYS, TIMES, AND PLACE.**Methods and Applications in Molecular Biology**

11:126:427 Fall 2023

Monday 8:30-9:50 a.m. IFNH 205

Section 1: Tues. 12:10-5:10 p.m. Foran 193 (Main Lab); Wed. 10:20-11:40 a.m. Foran 193 (Follow-up Lab)

Section 2: Wed. 12:10-5:10 p.m. Foran 193 (Main Lab); Thurs. 10:20-11:40 a.m. Foran 193 (Follow-up Lab)

CONTACT INFORMATION:**Instructor Section 1:** Dr. Amanda Jetzt

108B Foran Hall

jetzt@sebs.rutgers.edu**TA Section 1:** Stephanie Totilosat229@sebs.rutgers.edu**Instructor Section 2:** Dr. Michael Lawton

222A Foran Hall

malawton@sebs.rutgers.edu**TA Section 2:** Antonia Kazak1946@cinj.rutgers.edu**Course Preparator:** Ralph Dapsis

192 Foran Hall

ralph.dapsis@rutgers.edu**COURSE WEBSITE, RESOURCES AND MATERIALS:**

Required Text and Readings: There is no required textbook for this course. “*Methods and Applications in Molecular Biology: A Laboratory Manual*” by W.S. Cohick, R. Di, A. Jetzt, M. Lawton and R. Dapsis will be available electronically through Canvas. *For tech help with Canvas, please visit <https://it.rutgers.edu/help-support>.* Reading to accompany lecture and laboratory material will be assigned through Canvas. We will also use short videos to supplement the lectures. Laboratory exercises are found in the manual. ***Please print out the entire lab manual and put it in a three-ring binder before the first lab. Be sure to read the exercises thoroughly before coming to lab.***

COURSE DESCRIPTION:

This course is designed to introduce you to general techniques used in molecular biology as well as their application in research and industry. Lecture slides will be made available on Canvas. Lectures will be used to orient you to the upcoming laboratory, teach the theory behind the techniques you will be using, and acquaint you with additional methodologies and their applications that we do not have time to cover in lab. In this course you will learn fundamentals such as cloning and DNA sequencing. We will use CRISPR gene editing technology to knock out the heat shock protein 70 (HSP70) gene in mammalian cells. With your lab partners, you will also conduct your own experiment to study the regulation of HSP70 in a mammalian cell line. You will

determine how your experimental treatments regulate HSP70 mRNA and protein levels using quantitative RT-PCR and western immunoblotting, respectively. In the last laboratory session of the semester, each lab group will present their results to their classmates using a PowerPoint presentation.

COURSE SCHEDULE:

Sept 5-8

No lecture or labs

Sept 11-15

Lecture 1

Introduction to the course; CRISPR

Main Lab

CRISPR 1: Generate the guide RNA (gRNA)

Assign treatments for research project

Follow-up

Run gRNA on gel

Sept 18-22

Lecture 2

CRISPR; *PowerPoint presentations guidelines*

Main Lab

CRISPR 2: Transfect MAC-T cells

Follow-up

Work on group proposal PowerPoint

Sept 25-29

Lecture 3

CRISPR; primer design

Primer design assignment assigned

Main Lab

CRISPR 3: determine efficiency of editing

Follow-up

Verify editing results by agarose gel electrophoresis

Oct 2-6

Lecture 4

Cloning in plasmid vectors

Main Lab

CRISPR 4: Clone edited HSP70 into TOPO vector; transformation of competent cells

Follow-up

Pick colonies to inoculate cultures for minipreps

Present proposal PowerPoint

Oct 9-13

Lecture 5

DNA sequencing and analysis; plasmid isolation

Main Lab

CRISPR 5: plasmid preps; **QUIZ 1: CRISPR**

Follow-up Restriction digest to confirm insert; prepare plasmids to send for sequencing
Primer design assignment due

Oct 16-20

Lecture 6 Next Gen sequencing

Main Lab Experimental setup 1

Follow-up

Oct 23-27

Lecture 7 RNA analysis and RNA interference

Sequencing assignment assigned

Main Lab RNA analysis part 1: isolation, quantitation, and assessment of RNA

Follow-up **QUIZ 2: cloning and transformation**

Oct 30-Nov 3

Lecture 8 qRT-PCR

Main Lab RNA analysis part 2: qRT-PCR

Follow-up Run qRT-PCR products on gel

Nov 6-10

Lecture 9 qRT-PCR results analysis

Main Lab Experimental setup 2

Follow-up **QUIZ 3: minipreps**
Sequencing assignment due

Nov 13-17

Lecture 10 Protein quantitation

Main Lab Protein analysis part 1: Protein assay

Follow-up

Nov 20-22

No lecture or labs

Nov 23

THANKSGIVING

Nov 27-Dec 1

Lecture 11

SDS-PAGE and western blotting

Main Lab

Protein analysis part 2: run gel and begin western blotting

Follow-up

Complete western blotting for HSP70 and actin

Dec 4-8

Lecture 12

single cell RNA sequencing (sc-RNAseq)

Main Lab

Quantitation of western blots

No Follow-up

Dec 11-13

No lecture

Main Lab

Final PowerPoint Presentations

No Follow-up

Dec 18

Final Exam 8:00-11:00 a.m.

ATTENDANCE POLICY

Attendance in main lab and follow-up lab is mandatory. Unexcused absence from main lab will result in a zero for that week's notebook assignment. Unexcused absence from follow-up will result in half credit for that week's notebook assignment. Repeated lateness to lab will also result in loss of points from notebook assignment (at the discretion of the instructor).

LABORATORY NOTEBOOK AND ASSIGNMENT LATENESS POLICY

Laboratory notebook entries will not be accepted late.

Assignments will be accepted up to 2 days late. The highest grade possible for an assignment submitted one day late will be 90 out of 100. The highest grade possible for an assignment submitted two days late will be 80 out of 100. After two days the grade will be zero.

GRADING and ASSESSMENT:

Grading Component	Percent of Final Grade
Lab Notebook	20
Assignments (2)	10
Quizzes (3)	15
Proposal PowerPoint Presentation	10
Final PowerPoint Presentation	15
Final Exam	30
Total	100

Grading Scheme

Letter grade	Range
A	100% to 90%
B+	<90% to 85%
B	<85% to 80%
C+	<80% to 75%
C	<75% to 70%
D	<70% to 65%
F	<65%

Final grades will not be rounded up.

Laboratory Notebooks: All students are required to keep a detailed laboratory notebook. Digital notebook entries will be turned in each week on Canvas and graded according to the provided rubric. Instructions for how to keep your lab notebook are on Canvas.

Assignments: There will be two assignments that are designed to assist you with data analysis and highlight important concepts. Due dates will be indicated on Canvas.

Quizzes: These will be completed in person during the laboratory sessions.

Proposal and Final PowerPoint presentations for your group's experiment: A rubric describing the required components of the presentations will be provided.

Final Exam: The final exam will be given during the university final exam period (Monday December 18, 2023, 8:00-11:00 a.m.).

UNDERGRADUATE MAJOR PROGRAM LEARNING GOALS:

1. Be able to describe the basic molecular concepts essential for understanding the field of biotechnology and the applications of biotechnology.
2. Demonstrate proficiency in using the tools of biotechnology in an applied laboratory setting.
3. Be able to find and read published scientific research in biotechnology and summarize and communicate that research effectively and critically.
4. Acquire knowledge of ethical aspects of biotechnology and be able to analyze alternate viewpoints.
5. Learn to work as a team in the laboratory setting or group presentations.

COURSE LEARNING GOALS:

1. To master basic laboratory techniques and the use of standard equipment used in molecular biology studies.
Assessment: quizzes, exam (PLG 2)
2. To understand the principals that underlie molecular biology techniques and their applications.
Assessment: assignments, quizzes, exam, and laboratory notebook (PLG 1)
3. To learn proper experimental design with appropriate controls.
Assessment: group research presentations
4. To learn how to formulate and test a scientific hypothesis, i.e., how to conduct hypothesis-driven research.
Assessment: group research presentations
5. To learn how to document, record, and interpret scientific data.
Assessment: laboratory notebook and group research presentations
6. To develop effective oral and written communication skills.
Assessment: short essay component of exam, group research presentations
7. To build skills required to work as a member of a team (PLG 5).
Assessment: group research presentation

ACCOMODATIONS FOR STUDENTS WITH DISABILITIES

Rutgers University welcomes students with disabilities in all educational programs of the University. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible.

Please follow the procedures outlined at <https://webapps.rutgers.edu/student-ods/forms/registration>. Full policies and procedures are at <https://ods.rutgers.edu/>

ACADEMIC INTEGRITY

The university's policy on Academic Integrity is available at <http://academicintegrity.rutgers.edu/academic-integrity-policy>. The principles of academic integrity require that a student:

- properly acknowledge and cite all use of the ideas, results, or words of others.
- properly acknowledge all contributors to a given piece of work.
- make sure that all work submitted as his or her own in a course or other academic activity is produced without the aid of impermissible materials or impermissible collaboration.
- obtain all data or results by ethical means and report them accurately without suppressing any results inconsistent with his or her interpretation or conclusions.

- treat all other students in an ethical manner, respecting their integrity and right to pursue their educational goals without interference. This requires that a student neither facilitate academic dishonesty by others nor obstruct their academic progress.
- uphold the canons of the ethical or professional code of the profession for which he or she is preparing.

Adherence to these principles is necessary in order to ensure that

- everyone is given proper credit for his or her ideas, words, results, and other scholarly accomplishments.
- all student work is fairly evaluated and no student has an inappropriate advantage over others.
- the academic and ethical development of all students is fostered.
- the reputation of the University for integrity in its teaching, research, and scholarship is maintained and enhanced.

Failure to uphold these principles of academic integrity threatens both the reputation of the University and the value of the degrees awarded to its students. Every member of the University community therefore bears a responsibility for ensuring that the highest standards of academic integrity are upheld.

SEBS DEI STATEMENT

It is our intention that students of all backgrounds will be well served by this course. We will work to create an environment of inclusion which respects and affirms the inherent dignity, value, and uniqueness of all individuals, communities and perspectives. We are lucky to have a diverse university. Diverse voices and life experiences enhance the learning process, and we welcome students to share their personal experiences. We will not tolerate disrespectful language or behavior against any individual or group. If you feel as though you have been disrespected or treated unfairly by the instructors or any other individual, please let us know. You may speak with the instructors in person, over email or report anonymously via the Office of Academic Programs. In addition, you may also report bias to the Rutgers Diversity and Inclusion initiative using this link: <http://inclusion.rutgers.edu/report-bias-incident/>.

STUDENT WELLNESS SERVICES

Counseling, Alcohol and Other Drug Assistance Program & Psychiatric Services (CAPS)

<http://health.rutgers.edu/medical-counseling-services/counseling/>

DoSomething button through Rutgers Dean of Students office

<http://health.rutgers.edu/do-something-to-help/>

Wellness Coaching through Rutgers HOPE

<http://health.rutgers.edu/education/hope/wellness-coaching/>

Self-Help Apps found on the Rutgers Student Health website:

<http://health.rutgers.edu/education/self-help/self-help-apps/>

Violence Prevention & Victim Assistance (VPVA)

(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 / www.vpva.rutgers.edu/

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty.

NJ Hopeline (1.855.654.6735) <https://njhopeline.com/>

National Suicide Hotline (1.800.273.8255) <https://suicidepreventionlifeline.org/>

988 is now active across the United States. This new, shorter phone number will make it easier for people to remember and access mental health crisis services. (Please note, the previous 1-800-273-TALK (8255) number will continue to function indefinitely.) <https://988lifeline.org/>

BASIC NEEDS RESOURCES

Any student who has difficulty affording groceries or accessing sufficient food, or who lacks a safe and stable place to live, is urged to contact the Rutgers Student Food Pantry and/or the Dean of Students (details below). Furthermore, please notify the professor if you are comfortable doing so, as they may be able to provide additional support.

Rutgers Student Food Pantry

848-932-5500 / College Ave Student Center, Room 115 (126 College Ave) / <http://ruoffcampus.rutgers.edu/food/>
Check their website for hours and additional locations. The Rutgers Student Food Pantry is dedicated to helping all Rutgers students in need of food, no questions asked. Students will be provided with groceries that typically last about one week.

Dean of Students Office

848-932-2300 / 88 College Avenue, New Brunswick, NJ 08901 / <https://deanofstudents.rutgers.edu/>
Mon-Fri, 8:30am-5:00pm

The Dean of Students Office at Rutgers University-New Brunswick provides solutions, services, and support to help students navigate Rutgers University. The Office serves as a student support network by providing advocacy, problem resolution, and critical incident intervention for those times when additional assistance is needed. Please call to schedule an appointment to meet with a representative from the Dean's office.