

01:694:412 Proteomics and Functional Genomics

Semester: Spring | **Credits:** 3 | **Modality:** In person

Course URL: Canvas course site

Location: Waksman-1001

Time: 2:00 – 3:20 PM Tuesday/Thursday

Prerequisites: Foundational courses in Molecular Biology and Biochemistry (01:694:407 or 01:694:301) and Genetics (01:447:380).

Course Description:

This course is designed as a transitional bridge between undergraduate studies and graduate-level research. Students are expected to build upon a solid foundation in molecular biology and biochemistry to develop independent, self-paced learning abilities. The curriculum emphasizes the intrinsic value of basic science, enabling students to interpret the broader impact of biomedical research, biotechnology, and paradigm-shifting discoveries. Through the self-motivated preparation of a presentation covering the molecular mechanisms, phenotypes, treatments, and limitations of a genetic disorder, students will gain a deeper appreciation for the scientific effort required to understand diseases and develop therapies.

The course includes the following topics:

- Introduction to genomics and proteomics
- Advancements in DNA sequencing technologies and their applications
- Chromatin structure and genome organization (by Dr. Kevin Monahan)
- Single-cell analysis approaches (by Dr. Kevin Monahan)
- Mass spectrometry in proteomics
- Protein folding and interactions
- Macromolecular assemblies and condensates
- CRISPR-based genome editing
- Next-generation sequencing technologies
- Student-led presentations on genetic diseases

Course Schedule:

Date	Topic	Lecturer
Tue. Jan. 20	Course introduction and overview of genomics & proteomics	SA
Thur. Jan. 22	New strategies and technologies for DNA sequencing	SA
Tue. Jan. 27	DNA sequencing – current technologies & applications	SA
Thur. Jan. 29	Applications of new DNA sequencing technologies (con'd)	SA
Tue. Feb. 03	Introduction to Chromatin and genome I	JF
Thur. Feb. 05	Introduction to Chromatin and genome II	JF
Thur. Feb. 05	Deadline for Group Formation and Presentation Schedule	
Tue. Feb. 10	Single-cell - omics	KM
Thur. Feb. 12	3D genome folding	KM
Tue. Feb. 17	Macromolecule interactions: liquid-liquid phase separation I	JF
Thur. Feb. 19	Macromolecule interactions: liquid-liquid phase separation II	JF
Thur. Feb. 19	Deadline for Presentation Topic Selection	
Tue. Feb. 24	Protein Mass Spectrometry and Proteomics I	SA
Thur. Feb. 26	Protein Mass Spectrometry and Proteomics II	SA
Tue. Mar. 03	Protein folding <i>in vitro</i>	SA
Thur. Mar. 05	Protein folding <i>in vivo</i>	SA
Tue. Mar. 10	Protein-protein interactions	SA
Thur. Mar. 12	In-person exam	SA/JF
Tue. Mar. 17	Spring Break	
Thur. Mar. 19	Spring Break	
Tue. Mar. 24	Manipulating protein levels, from RNA interference to Knockout I	JF
Thur. Mar. 26	CRISPR genome editing	JF
Tue. Mar. 31	CRISPR genome editing and Next-generation sequencing	JF
Thur. Apr. 02	Next Generation sequencing methods – ChIP-seq data analysis	JF
Tue. Apr. 07	Next Generation sequencing methods – ChIP-seq data analysis	JF
Thur. Apr. 09	Students' presentations A	

Fri. Apr. 10	Exams 2&3 posted	
Tue. Apr. 14	<i>Students' presentations B</i>	
Thur. Apr. 16	<i>Students' presentations C</i>	
Fri. Apr. 17	<i>Exam 2 due</i>	
Tue. Apr. 21	<i>Students' presentations D</i>	
Thur. Apr. 23	<i>Students' presentations E</i>	
Tue. Apr. 28	<i>Students' presentations F</i>	
Thur. Apr. 30	<i>Students' presentations G</i>	
Fri. May. 1	<i>Exam 3 due</i>	
	Regular Classes End (May 4 2026)	
Tue. May. 05	No Class	

Learning Objectives:

- By the end of the course, students will gain a comprehensive understanding of the knowledge and skills required to conduct biomedical research in proteomics and functional genomics.
- Students will develop the ability to independently research and evaluate information regarding specific biological systems or problems.

Exams, Assignments, and Grading Policy

The final grade will be calculated based on the following components:

- Exam I (In-person): 30%
- Take-home Exam II: 15%
- Student Presentation: 35%
- Attendance: 5%
- Presentation Discussants during student presentations: 5%
 - Must ask a total of 3 questions across all student presentations to receive full credit.
- Take-home Exam III: 10%

Final course grades will be assigned according to the following scale. A corresponds to 90 to 100 percent. B plus corresponds to 85 to 89 percent. B corresponds to 80 to 84

percent. C plus corresponds to 75 to 79 percent. C corresponds to 70 to 74 percent. D corresponds to 65 to 69 percent. Grades below 65 percent result in an F.

The instructor reserves the right to apply a curve to individual exams or to the final course grades if overall performance warrants it. Any curve will be applied uniformly at the instructor's discretion and is not guaranteed.

Exam Format & AI policy

- There will be no final exam.
- Exams will assess your understanding of the course materials
- Exam I: Due to the widespread availability and use of AI Large Language Models (LLMs), Exam I will be administered in-person this year to ensure an authentic assessment of foundational knowledge.
- Exams II and III remain take-home assessments. Late submissions will only be accepted if prior notice is given, and a further extension will not be granted.
- Exams II and III are asynchronous take home exams released on Canvas on the posted dates and completed independently outside of class time.

Students' presentation (35%)

Students will select a genetic disease from a provided list to **research** and **present**. This assignment is designed to simulate a graduate-level seminar.

1. Students are strongly encouraged to form groups. Presentation duration includes Q&A and is strictly determined by group size:

- Group of 3: 30 minutes total.
- Group of 2: 25 minutes total.
- Solo: 15 minutes total.

Note: While solo presenters carry a heavier burden of content generation, group presentations will be held to a higher standard regarding transitions, cohesion, and collaborative delivery.

2. Presentation dates will be determined by a random drawing using an online tool after groups have been formed. Groups with a higher lottery number will have priority in choosing their preferred presentation date. Groups scheduled to present earlier in the semester will have priority in selecting their presentation topics.

3. To ensure the course schedule remains viable, the instructor reserves the right to cap the number of solo presentation slots. If the number of requests for solo presentations exceeds the time available, students may be required to form pairs.

4. Content Requirements

Conflict of Interest: To ensure equal effort, you are prohibited from presenting on a disease or protein you are currently researching in a lab. You must choose a new topic. Presentations must cover:

- Molecular pathology or mechanism of the disease.
- Impact on regular physiology.
- Current research overview (including news/media coverage) and potential cures.
- Clinical trial statuses and outcomes.
- Perspective as a hypothetical physician or scientist.

Presentation Grading Rubric (100 +5 Points Total)

Presentations are graded on five core components:

A. Scientific Content (50%)

- **Depth & Accuracy:** Mechanism, physiology, current research, and clinical outlook.
- **The "Pathway Slide" (Mandatory):** One dedicated slide mapping the disease pathway.
- **Genotype-to-Phenotype:** Clear logical connection from single-protein mutation → pathway defect → clinical phenotype → organ/race specificity.

B. Visual Quality & Slide Design (15%)

- **No "Walls of Text":** Heavy deductions for slides filled with paragraphs.
- **Professional Polish:** High-resolution figures, readable fonts, and defined jargon.

C. Delivery & Professionalism (15%)

- **Individual Presence:** Maintain eye contact, speak clearly and firmly, and command the room with professional authority.
- **Strict No-Reading Policy:** Reading directly from notes, iPads, or screens is strictly prohibited. **Any student found reading from a script will receive an automatic 20% deduction.**

D. Ability to Answer Questions (10%)

- Students must demonstrate the ability to defend their knowledge during Q&A. For groups, all members must contribute to answering questions.

E. Cohesion & Flow (10%)

- For groups, switching between speakers must be seamless. The presentation should sound like one unified narrative, not two separate talks glued together.
- Collaborative Delivery: Partners should interact, reference each other's points, and share the stage equally.
- Solo Presenters: For solo students, this category measures the logical flow of the narrative and the smoothness of topic transitions.

Distinction Bonus (Up to +5 Points of the presentation score): At the instructor's sole discretion, a bonus of up to 5 points may be awarded to presentations that are truly exceptional. This is reserved for rare cases (historically 1-2 students per year) where the student demonstrates superior charisma, creativity, and highly effective communication that exceeds course expectations.

Attendance

Regular attendance is expected and is important for success in this course, particularly during discussion based lectures and all student presentation sessions. Attendance contributes five percent to the final grade and may be recorded during both lectures and presentations. Students should report absences using the Rutgers self reporting absence system. Absences related to illness, religious observance, or university sponsored activities will not be penalized. Medical documentation is not required. Excessive unreported absences may negatively impact performance and grading.

Missed or delayed exams

Exam I will be administered in person on the scheduled date. Students who are unable to attend due to serious illness or emergency must notify the instructor as soon as possible. Makeup exams are not guaranteed and will be handled on a case-by-case basis at the instructor's discretion.

Course Materials

Instructors will supply the necessary readings. For conducting next-generation sequencing analysis, students must have access to a personal computer with a physical keyboard and an internet connection.

Office Hours:

Office Hours will be announced on Canvas

Course Closed?

This course is by special permission only, with priority given to MBB majors. The majority of the class will be juniors and seniors. To obtain a special permission number or to get on the waiting list if you are not an MBB major, CALL 848-445-2075. If you have any questions, please contact the Division of Life Sciences - Office of Undergraduate Instruction at 848-445-2075  or visit our office at Nelson Biological Laboratories B112, Busch Campus.

Disability accommodations

Students with disabilities who require accommodations must register with the Office of Disability Services. ODS will provide an official letter outlining approved accommodations. Students are encouraged to submit accommodation letters as early as possible so that appropriate arrangements can be made. Information about policies and procedures can be found at ods.rutgers.edu.

AI use policy

Use of artificial intelligence tools must comply with the Rutgers Academic Integrity Policy. For take home exams and presentations, students may not use AI tools to generate substantive content, analysis, figures, or answers unless explicitly permitted by the instructor. Limited use for grammar checking or formatting is allowed. Students are responsible for understanding what constitutes substantive content generation. Any use of AI must be disclosed. Unauthorized use will be treated as an academic integrity violation.

Communication expectations

Students should communicate through their official Rutgers email or Canvas. The instructors will make reasonable efforts to respond within 2 business days during the workweek. Course announcements and updates will be posted on Canvas and students are responsible for checking regularly.

Faculty

Dr. Jia Fei; E-mail: jf955@dls.rutgers.edu

Dr. Stephen Anderson; E-mail: anderson@cabm.rutgers.edu

Student Support Services:

- Student Success Essentials: <https://success.rutgers.edu>
- Student Support Services: <https://www.rutgers.edu/academics/student-support>
- The Learning Centers: <https://rlc.rutgers.edu/>
- Rutgers Libraries: <https://www.libraries.rutgers.edu/>
- Bias Incident Reporting: <https://studentaffairs.rutgers.edu/bias-incident-reporting>
- Dean of Students – Student Support Office:
<https://success.rutgers.edu/resource/dean-students-student-support-office>
- Office of Veteran and Military Programs and Services:
<https://veterans.rutgers.edu>
- Student Health Services: <http://health.rutgers.edu/>
- Counseling, Alcohol and Other Drug Assistance Program & Psychiatric Services (CAPS): <http://health.rutgers.edu/medical-counseling-services/counseling/>
- UWill: free immediate access to teletherapy; you can choose a therapist based on your preferences including issue, gender, language, ethnicity.
<http://health.rutgers.edu/uwill/>
- Office for Violence Prevention and Victim Assistance: www.vpva.rutgers.edu/
- Office of Disability Services: <https://ods.rutgers.edu/>
- Basic Needs Assistance (food, housing, and other essentials):
<https://ruoffcampus.rutgers.edu/basic-needs>
- Rutgers Student Food Pantry: <https://ruoffcampus.rutgers.edu/food-pantry>

** All information is subject to change at the discretion of the course coordinator.