

## 01:694:492 Gene Regulation: Clocks to Cancer

**Pre- or corequisite:** 01:694:407-408 or 01:447:384-385 or 11:115:403-404 or 11:126:481

**Semester Offered:** Spring

**Credits:** 3

**Course Coordinator:** Prof. Annika Barber

### Course Instructors:

Prof. Annika Barber ([annika.barber@waksman.rutgers.edu](mailto:annika.barber@waksman.rutgers.edu))

Prof. Isaac Edery ([edery@cabm.rutgers.edu](mailto:edery@cabm.rutgers.edu))

### Course Information:

Class schedule: Mon. & Thurs. 10:20 - 11:40 AM

Semester: Spring 2023

Class location: Room 1001 of the Waksman Building (190 Frelinghuysen Rd, Piscataway)

Office Hours: By Appointment.

### Synopsis:

Molecular biology is an experimental science, and a major goal of this course is to explain not just what molecular biologists know, but how they know it. The course will cover all aspects of gene regulation from transcription to protein modification to explain how 25,000 human genes can make millions of different protein isoforms and mRNA and ncRNA. Mechanisms of molecular clocks and cancer will be covered in terms of gene regulation complexity, feedback loops and rate-limiting steps with emphasis on the methods, experimental design, history, and deductive reasoning that has led to the current state of understanding of these topics.

### Additional information:

Course delivery format: In-person only. Lecture slides and select recordings will be made available on Canvas. Exams will be given in-person, in hard copy.

Textbook: None. All assigned readings from peer reviewed literature will be available in Canvas.

### Syllabus for Spring 2024 (subject to revision):

Jan 18 TH	Lecture 1	Course introduction & overview of gene regulation, clocks and cancer
Jan 22 M	Lecture 2	Making and regulating mRNA: transcription, splicing, export, degradation
Jan 25 TH	Lecture 3	Making and regulating proteins: translation, folding, modifications, degradation, localization
Jan 29 M	Lecture 4	Non-coding RNAs
Feb 1 TH	Lecture 5	Gene regulatory networks: exponential increases in complexity, adaptability, and stability
Feb 5 M	Lecture 6	Importance of rate-limiting steps
Feb 8 TH	Lecture 7	Cancer: too much, or too little, or altered gene products
<b>Feb 12 M</b>	<b>Exam 1</b>	<b>Lectures 1 -7</b>
Feb 15 TH	Lecture 8	Circadian rhythms: overview and principles
Feb 19 M	Lecture 9	Clock mechanisms I

Feb 22 TH	Lecture 10	Clock mechanisms II
Feb 26 M	Lecture 11	Circadian rhythms and connection to cancer and other diseases I
Feb 29 TH	Lecture 12	Circadian rhythms and connection to cancer and other diseases II
Mar 4 M	Lecture 13	Signaling to the clock
Mar 7 TH	Lecture 14	Clock, feeding, microbiome, disease
<b>SPRING BREAK (no class Mar 11<sup>th</sup> &amp; 14<sup>th</sup>)</b>		
Mar 18 M	Lecture 15	Clock, cancer, metabolism
Mar 21 TH	NO CLASS	STUDY DAY
<b>Mar 25 M</b>	<b>EXAM 2</b>	<b>Lectures 8-15</b>
Mar 28 TH	Lecture 16	Cancer gene expression mechanisms 1
Apr 1 M	Lecture 17	Cancer gene expression mechanisms 2
Apr 4 TH	Lecture 18	Cancer gene expression mechanisms 3
Apr 8 M	Lecture 19	Cancer gene expression mechanisms 4
Apr 11 TH	Lecture 20	Cancer gene expression mechanisms 5
Apr 15 M	Lecture 21	Clock, codon usage, protein folding
Apr 18 TH	Lecture 22	Clocks, immunity, lungs and COVID vaccines
Apr 22 M	Lecture 23	Cancer, elephants and mole rats: Do all animals get cancer?
Apr 25 TH	Lecture 24	Follow the science?
<b>Apr 29 M</b>	<b>EXAM 3</b>	<b>Lectures 16 - 23</b>

### Course Satisfies MBB Departmental Learning Goals

1. Students should demonstrate an understanding of the knowledge that is needed to begin biomedical research and that is required for post-graduate exams and studies.
2. Students should demonstrate the ability to find and evaluate information about specific biological systems or problems.

### Exams & Assignments

PowerPoint lecture material and readings for each class will be posted on the relevant Canvas site for this course. Graded assignments in this class consist of three exams, accompanying open-book study guides, two take-home assignments, and in-class participation in active learning activities. Weighting of these assignments is outlined in the table below:

Graded component	% of final grade
Exam 1	25
Exam 2	25
Exam 3	25
Exam 1 study guide	4
Exam 2 study guide	4
Exam 3 study guide	4
Stem cell literature discussion guide	4
Clock biochemical mechanism question	4
Participation	5
<b>TOTAL</b>	<b>100</b>

Exams & study guides will consist of multiple choice, fill-in-the-blank, short answer, biochemical and genetic problem solving, and design and analysis of experimental findings similar to experiments from primary literature covered in lectures. Study guides will offer similar question types to exams and are

graded based only on completion of all questions. Study guides can be completed in groups and are take-home, open book assignments to support student success on exams.

Stem cell literature discussion guide consists of six short-answer questions about figures in the assigned reading (Takahashi & Yamanaka. Cell. 2006;126:663-76). Each question is worth 0.66 points of the total 4 points.

Clock biochemical mechanism question is a short take-home assignment asking students to consider the physiological outcomes of two genetic scenarios. Each scenario is worth 2 points of the total 4 points.

Participation: This is an active learning course with in-class group problem solving based on assigned literature readings and lecture material. Your participation grade is based on assessment of your presence and preparedness to constructively engage in these activities.

### **Course Closed?**

If this course is closed, please contact Dr. Annika Barber concerning special permission numbers.

### **Policies**

Exams will be given in-person only, during the class period. Absence from exams will be excused only in the case of serious illness or family emergency, and only when backed up by appropriate documentation. Requests for regrades must be submitted within 72 hours of return of the exam.

### **Attendance & class participation**

Attendance will not be taken. However, lectures are not recorded/streamed and exams will be conducted in person during the class period. Information not in assigned reading may be given during lectures. Any material discussed or presented in lecture may be present on a corresponding exam. Active participation in in-class active learning activities is expected, which requires completion of assigned readings.

### **Lateness and missing assignments policy**

Exam makeups can be given under extenuating circumstances. An illness verified by either doctor's note or positive at-home test is acceptable. Family emergencies must be confirmed by the dean of students.

### **Disability Services**

(848) 445-6800

Lucy Stone Hall, Suite A145, Livingston Campus

54 Joyce Kilmer Avenue, Piscataway, NJ 08854

<https://ods.rutgers.edu>

Rutgers Office of Disability Services works with students with a documented disability to determine the eligibility of reasonable accommodations, facilitates and coordinates those accommodations when applicable, and lastly engages with the Rutgers community at large to provide and connect students to appropriate resources.. 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. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.

## **Academic Integrity Policy**

Academic Integrity Policy: Rutgers University takes academic dishonesty very seriously. By enrolling in this course, you assume responsibility for familiarizing yourself with the Academic Integrity Policy and the possible penalties (including suspension and expulsion) for violating the policy (<http://academicintegrity.rutgers.edu/academic-integrity-policy>). As per the policy, all suspected violations will be reported to the Office of Student Conduct. Academic dishonesty includes (but is not limited to):

- Cheating (accessing outside websites or course notes during the exam)
- Plagiarism
- Aiding others in committing a violation or allowing others to use your work
- Fabrication
- Using another person's ideas or words without attribution, including re-using a previous assignment
- Unauthorized collaboration
- Sabotaging another student's work

*If you are ever in doubt, consult your instructor.*

## **Student-Wellness Services:**

### **Just In Case Web App**

<http://codu.co/cee05e>

Access helpful mental health information and resources for yourself or a friend in a mental health crisis on your smartphone or tablet and easily contact CAPS or RUPD.

### **Counseling, ADAP & Psychiatric Services (CAPS)**

(848) 932-7884

17 Senior Street, New Brunswick, NJ 08901

[www.rhscaps.rutgers.edu/](http://www.rhscaps.rutgers.edu/)

CAPS is a university mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professional within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

### **Crisis Intervention:**

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

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

### **Violence Prevention & Victim Assistance (VPVA)**

(848) 932-1181

3 Bartlett Street, New Brunswick, NJ 08901

[www.vpva.rutgers.edu](http://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. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

### **Scarlet Listeners**

(732) 247-5555

<http://www.scarletlisteners.com>

Free and confidential peer counseling and referral hotline, providing a comforting and supportive safe space.

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