

COURSE NAME; NUMBER; SEMESTER; MEETING DAYS, TIMES, AND PLACE.

Molecular and Cellular Physiology

11:067:492 (3 credits) Spring 2019

Tuesday/Thursday 3:55-5:15 PM

138B Foran Hall

CONTACT INFORMATION:

Instructor: William J. Belden, Ph.D.

Office Location: 326 Foran Hall

Phone: 848-932-5617 Email: beldenwj@sebs.rutgers.edu

Office Hours: 9 AM to 10:45 AM Tuesday/Thursday or by appointment

COURSE WEBSITE, RESOURCES AND MATERIALS:

Text book; *Molecular Biology of the Cell* (5th or 6th Edition) by Alberts et al published by Garland Science.

COURSE DESCRIPTION:

The overall goal of this course is to provide a solid understanding of the molecular basis of how eukaryotic cells function in the context of whole organisms. The molecular mechanisms of cell biology as they pertain to mammalian physiology will be explored. Specific emphasis is placed on the molecular mechanisms of gene expression and genome function including the role of chromatin and non-coding RNA, translation, cell cycle and division, protein trafficking, cellular metabolism and cell signaling. Other topics include the specific function of cellular organelles, DNA replication and repair, mRNA processing and translation, the nuclear pore complex and shuttling between the cytoplasm and nucleus, cytoskeleton, protein trafficking between organelles and through the secretory pathway, electron transport, cell homeostasis and apoptosis, extracellular matrix, stem cell development and hematopoiesis, and cellular clocks.

PREREQUISITES:

This course is designed for seniors and advanced juniors. Prerequisites include 2 semesters of General Biology and 2 semesters of Organic Chemistry. Special permission may be granted on a case-by-case basis.

LEARNING GOALS:**Students will:**

1. Learn cell organelles, gene/protein nomenclature and the function of specialized cells. (PLG 3)
Assessment: 2 exams, 2 assignments and a final exam.
2. Gain a fundamental understanding of the molecular mechanisms that guide cell specialization as it pertains to mammalian physiology. Specifically, students will learn the mechanistic control of DNA replication and repair, transcription, translation, cell cycle, the secretory pathway, central metabolism, cell signaling and aspects of development. (PLG3)
Assessment: 2 exams, 2 assignments and a final exam.
3. Learn critical reasoning skills, hypothesis development, experimentation, and some rudimentary molecular biology data analysis. The goal is to understand how to integrate molecular and cellular mechanisms with physiological processes at the animal level. (PLG3)
Assessment: 2 exams, 2 assignments and a final exam.

ASSIGNMENTS/EXAMS & ASSESSMENTS:

Students will be responsible for completing reading assignments to help them develop a comprehensive understanding of cellular processes. Assessments will come from 2 exams (25% each, 50% total), a comprehensive final (30%) and 2 assignments (20%). Short answer questions on exams will be used to assess goal 2 and large comprehensive questions (1 or 2 per exam) will be used to assess Goal 3.

ACCOMODATIONS FOR STUDENTS WITH DISABILITIES

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

ABSENCE POLICY

Students are expected to attend all classes; if you expect to miss one or two classes, please use the University absence reporting website <https://sims.rutgers.edu/ssra/> to indicate the date and reason for your absence. An email is automatically sent to me.

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COURSE SCHEDULE:

T/F Reading for 5th Edition colored Red, Reading for 6th Edition colored Blue

- Jan 22:** Course Overview, Introduction to Cells, and Cell Specialization in mammals
(Reading assignment, Chapter 1 and Chapter 9).
- Jan 24:** Chemistry of cellular components and organelles: Nucleic acids, amino acids, polypeptides, and lipids
(Reading assignment, Chapter 2)
- Jan 29:** Proteins
(Reading assignment, Chapter 3)
- Jan 31:** The Nucleus, genome structure and Chromatin
(Reading assignment **Chapter 4 pgs 197-219**, **Chapter 4 pgs 175-194**)
- Feb 5:** Chromatin regulation
(Reading assignment **Chapter 4 pgs 219-260**, **Chapter 4 pgs 194-234**)
- Feb 7:** DNA replication
(Reading assignment **Chapter 5, pgs 263-295**, **Chapter 5, pgs 237-266**)
- Feb 12:** DNA, Recombination and Repair
(Reading assignment **Chapter 5 pgs 295- 326**, **Chapter 5 pgs 266-295**)
- Feb 14:** Transcription and splicing
(Reading assignment **Chapter 6, pgs 329 -366**, **Chapter 6, pgs 299-333**)
- Feb 19:** Translation and the Ribosome
(Reading assignment **Chapter 6 pgs 366- 400**, **Chapter 6 pgs 333-362**)
- Feb 21:** **Exam #1**
- Feb 26:** Control of Gene expression
(Reading assignment, **Chapter 7, pgs 411-476**, **Chapter 7, pgs 369-413**)

- Feb 28:** Post transcriptional control (miRNA and RNAi)
(Reading assignment, [Chapter 7, pgs 477-499](#), [Chapter 7, pgs 413-436](#))
- Mar 5:** Cell signaling and homeostasis
(Reading assignment, [Chapter 15, pgs 879-943](#) & [Chapter 17, pgs 1101-1112](#)
[Chapter 15, pgs 813-876](#) & [Chapter 17, pgs 1010-1018](#))
- Mar 7:** Actin and Tubulin cytoskeleton
(Reading assignment, [Chapter 16 pgs 965-1010](#), [Chapter 16 pgs 889-914](#))
- Mar 12:** Motor proteins
(Reading assignment, [Chapter 16 pgs 1010-1050](#), [Chapter 16 pgs 915-960](#))
- Mar 14:** Cell cycle, cell division, mitosis and meiosis
(Reading assignment, [Chapter 17, 1053-1101](#), [Chapter 17, 963-1010](#))
- Mar 19,21** **SPRING BREAK**
- Mar 26:** Membrane Structure and The Secretory Apparatus
(Reading assignment, [Chapter 10, pgs 617-629](#), [Chapter 12 pgs 695-704](#)
[Chapter 10, pgs 565-576](#), [Chapter 12 pgs 641-649](#))
- Mar 28:** **Exam #2**
- Apr 2:** Membrane Proteins and Translocation into the ER and Nucleus
(Reading assignment, [Chapter 10 pgs 629-667](#) & [Chapter 12, 723-745](#)
[Chapter 10 pgs 576-611](#) & [Chapter 12, 669-691](#))
- Apr 4:** Vesicle transport
(Reading assignment, [Chapter 13, pgs 750-779](#), [Chapter 13, pgs 695-721](#))
- Apr 9:** Endosomes, lysosome and phagocytosis
(Reading assignment, [Chapter 13, pgs 779-809](#), [Chapter 13, pgs 722-750](#))
- Apr 11:** Ion Channels
(Reading Assignment, [Chapter 11, pgs 667-693](#), [Chapter 11, pgs 611-638](#))
- Apr 16:** Extracellular Matrix
(Reading Assignment, [Chapter 19, 1131-1178](#), [Chapter 19, 1035-1081](#))
- Apr 18:** Mitochondria Transport and electron transfer
(Reading Assignment, [Chapter 12, pgs 713-720](#) & [Chapter 14 813-840](#)
[Chapter 12, pgs 658-666](#) & [Chapter 14 753-782](#))
- Apr 23:** Cellular stress, apoptosis and senescence
(Reading Assignment, [Chapter 18, pgs 1115-1129](#), [Chapter 18, pgs 1021-1032](#))
- Apr 25:** The cellular Clock
(No Reading)

Apr 30: Cellular differentiation, stem cells and hematopoiesis
(On CD 1450-1463, TBD)

May 2 : Course overview session/Review for Final

FINAL EXAM/PAPER DATE AND TIME

Online Final exam Schedule: <http://finalexams.rutgers.edu/>

Comprehensive Final Exam according to final exam schedule

ACADEMIC INTEGRITY

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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.

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STUDENT WELLNESS SERVICES

The Rutgers University Student Assembly urges that this information be included at the end of every syllabus. Edit or delete as you wish:

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/

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.

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. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

Disability Services

(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / <https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. 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>.

Scarlet Listeners

(732) 247-5555 / <https://rutgers.campuslabs.com/engage/organization/scarletlisteners>

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