Bi214

General Biology IV: Mechanisms

This course is about how stuff works: the mechanisms by which biological processes, practiced by all cellular life, operate. Through a combination of lectures, problem solving, and laboratory exercises we will explore amino acid chemistry, the structures and functions of proteins, the genetics of biochemical pathways, the structure, replication, and mutation of DNA, the structure and regulation of prokaryotic and eukaryotic genes, and the genetics and molecular biology underlying development. Bi211 and Bi212, or the equivalent, and a full year of General Chemistry are prerequisites.

Instructor

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GEs and BTUs are yet to be assigned. Current office locations, office hours, and e-mail links will be posted on the Bi214 Canvas site on the *Staff contacts* link on the home page.

Student learning objectives

By the end of this course, my hope is that students will be able to achieve the following objectives:

- Explain the chemical basis for molecular structure, and the association between that structure and a function of that molecule
- Describe mechanisms linking molecular or biochemical mechanisms with resulting physiological responses
- Evaluate and accurately interpret new empirical data
- Combine and apply general knowledge of some biological mechanisms underlying physiological outcomes to solve problems in novel settings
- Apply basic mathematical approaches to understanding chemical phenomena that affect molecular, and ultimately biological, function

Format

The lecture component of the course will be presented remotely. Pre-recorded lectures will be posted on Canvas no later than the morning of the scheduled day. These will be in a "quiz" format so that we can embed clicker-style questions to help you monitor your understanding. Answering the questions correctly will count 5% toward your overall course grade. Incomplete images that are used for the lectures will be made available with the recorded lectures so that you may make notes on them if you wish.

Zoom sessions with the teaching assistants will begin at the scheduled lecture time. In these sessions you can ask questions about lecture content, work on problem set problems, and work on additional challenging problems that we may assign during these sessions. It is essential that you watch the lecture videos prior to the start of the Zoom sessions. Attendance at the lecture Zoom sessions is not mandatory, but we cannot stress enough their importance in helping you learn the material.

Text and course packets

The required book is a customized text that incorporates material from *Biochemistry* (Mathews, et al., 4th ed.), *Molecular Biology of the Gene* (Watson, et al., 7th ed.), and *iGenetics* (Russell, 3rd ed.), and includes original material. A laboratory manual is required. The text and lab manual can be purchased at the UO Bookstore. If a manual is not available, request one at the UO Bookstore and they will have it for you within 24 hours. Note that it is your responsibility to order these; we will not have copies available in lab. We are unable to provide texts on reserve in the Science Library this term.

Grading

Scores from the lecture portion of the course will make up 65% of your course grade, with lab accounting for the remaining 35%. The course grade will be determined from the highest score calculated by three methods:

	Method 1	Method 2	Method 3
Exam 1	12%	16%	–
Exam 2	12%	–	16%
Final exam	24%	32%	32%
Quizzes	12%	12%	12%
Participation*	5%	5%	5%
Lab	35%	35%	35%

*answering questions that accompany the lecture videos

The second exam is not cumulative, but the final exam is cumulative. **Make-up and early exams will not be offered**. Two lecture quizzes, each worth 50 points, will be administered at the beginning of two classes (see the Lecture Schedule). They will be based upon the reading, lectures, and relevant problems. **Make-up and early quizzes will not be offered**.

All exams and lecture quizzes will be administered on Canvas. The styles of questions will include multiple choice, fill-in blank, and calculations. You will be given one question at a time, and cannot return to an earlier question once you have answered it. It is imperative that you read the directions for each question carefully; answers that do not follow the required format will be marked as incorrect, and will not be contestable.

Problem sets are available on Canvas, and problems from the sets will be assigned each week (see the Lecture Schedule). These will not be graded; however, working the problems will be your best form of preparation for the exams and quizzes, so you are encouraged to make a sincere effort in solving them. Problem set answers are posted on Canvas.

No other opportunities for points will be offered. Please do not ask.

Laboratories

The current plan is to teach laboratories in-person, which will begin during the second week. However, the week 10 lab will be done remotely, as required by the University. We will do a total of 8 laboratory exercises. The exercises, background information, and report pages are contained within the lab manual. You must read the material BEFORE coming to your lab. Details of the lab format,

assignments, and grading are included in the lab manual. This course is full, so you may not be able to switch lab sections if a conflict arises for you in a given week.

Accommodations for students with disabilities

If you have a documented disability and anticipate needing accommodations in this course, please contact me as soon as soon as possible, and not later than October 5. Please include a notification letter from the Accessible Education Center stating your approved accommodations.

Class conduct and academic honesty

All work submitted in this course must be your own. Instances of suspected cheating or plagiarism on exams, quizzes, and reports will be referred to the Office of Student Conduct and Community Standards. I take such cases seriously, and pursue charges of academic misconduct and their sanctions to the fullest extent allowable, including but not limited to a failing mark for the course. For definitions of violations, a description of the hearing process, and a summary of penalties for findings of academic misconduct, go to

http://policies.uoregon.edu/vol-3-administration-student-affairs/ch-1-conduct/student-conduct-code

Bi214 2020 Lecture Schedule

Topics for each date are tentative; updates will be provided as needed

Week	Date	Topic	Reading	Suggested problems*
1	Sept. 28	No class		
	Sept. 30	**Amino acid chemistry** Introduction; Amino acid structure	1-11	
2	Oct. 5	Ionization of amino acids Acid-base properties of amino acids	12-18 18-24	Acid-Base Chem: 1-7 Amino Acids: 1-3
	Oct. 7	pH influence on amino acid charges	24-28	Amino Acids: 4-11
3	Oct. 12	**Protein shape** Peptide bonds; primary, secondary protein structure	29-37	Amino Acids: 12-15 Protein Structure: 1-4
	Oct. 14	**QUIZ 1** Secondary and tertiary protein structure	16; 37-46	Protein Structure: 5-10
4	Oct. 19	**Protein function** Hemoglobin structure and function	46-54	Hemoglobin: 1-4
	Oct. 21	Cooperativity and allostery in hemoglobin	54-64; 72-75	Hemoglobin: 5-12
5	Oct. 26	**EXAM 1**		
	Oct. 28	**DNA structure, replication, and mutation** Structure and replication of DNA	77-99	DNA Structure: 1-5
6	Nov. 2	Mechanisms of mutation	100-106	DNA Structure: 6-11
	Nov. 4	**Defining a gene** Inborn errors of metabolism; complementation	107-113	Metabolic Paths: 1-5
7	Nov. 9	Complementation; definition of the gene	107-113	Metabolic Paths: 6-12
	Nov. 11	**QUIZ 2** **Transcription and gene regulation in prokaryotes** Transcription in prokaryotes The *lac* operon of *E. coli*: regulation by protein binding	 114-124 124-128	 Trxn in Proks: 1-11

Week	Date	Topic	Reading	Suggested problems*
8	Nov. 16	Negative regulation of the *lac* operon: Genetic evidence	129-137	Gene Expression: 1-4
	Nov. 18	Positive regulation of the *lac* operon: Genetic evidence	137-140	Gene Expression: 5-15
9	Nov. 23	**EXAM 2**		
	Nov. 25	**Mechanisms of development** Yeast mating type specification Establishing asymmetry in yeast	 141-146 146-150	 Development: 1-3 Development: 4-5
10	Nov. 30	A developmental switch in yeast **Developmental gene regulation in eukaryotes** Overview of gene regulation in eukaryotes The β-globin gene cluster in humans	Chang and Drubin† 150-154 69-72; 154-158	Development: 6-7 Development: 9-11
	Dec. 2	Thalassemias and deregulation of the β-globin genes	75-76; 158-160 Banks†	Development: 12-15
		FINAL EXAM TBA		

*From Problem Sets on Canvas (Modules>Problem Sets)
†Access via Canvas (Modules>Supplemental Reading and Documents)