

## 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.

### **Staff**

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Current office locations, office hours, and e-mail links can be found 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

### Text and course packets

The required book is a customized text that incorporates material from *Biochemistry* (Mathews, et al., 4<sup>th</sup> ed.), *Molecular Biology of the Gene* (Watson, et al., 7<sup>th</sup> ed.), and *iGenetics* (Russell, 3<sup>rd</sup> ed.), and includes original material. The general text used in Bi211-213, *Biological Science* (Scott Freeman), may be helpful, but is not required. If you have *Biological Science* in your possession you may want to keep it as a reference book; however, I do not recommend that you purchase the book solely for this course.

A laboratory manual is required. A course packet that includes lecture figures and problem sets is strongly recommended. The text, lab manual, and course packet can be purchased at the UO Bookstore. If a manual or packet 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 class or lab. Texts (but not packets) will be placed on 2-hour reserve in the Science Library.

### Grading

Scores from the lecture portion of the course will comprise 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%

The second exam is not cumulative, but the final exam is cumulative. **Make-up and early exams will not be offered.** Three lecture quizzes, each worth 35 points, will be administered at the beginning of three classes (see Lecture Schedule). They will be based upon the reading, lectures, and relevant problems and material for that week. **Make-up and early quizzes will not be offered.** However,

exceptions may be made for verifiable medical or family emergencies, and for sanctioned University travel, and will be considered on a case-by-case basis. UO Club sports events do not qualify for exceptions.

All exams and quizzes must be written in pencil; use an eraser to remove mistakes and unnecessary writing. Exams and quizzes are graded on the correctness of the answer for which the question is asked, and on correctly followed directions. Exams, quizzes, and reports with grading errors must be returned to me **within one week** of your receiving the graded assignment for consideration, and must be accompanied by a written explanation. Requests to look over an answer without a specific identified grading error will not be considered. The entire exam, quiz, or report will be reviewed.

A problem set is provided in the course packet, but will not be turned in for grading. 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.

Participation is in the form of i►clicker responses. There typically will be three to ten questions per lecture (excluding the first lecture) counted with clickers. Ninety percent of the responses will be counted for credit, but most answers do not have to be correct for you to receive credit. Responses beyond 90% will not be counted, so that you won't necessarily be penalized for a few missed sessions. If you forget your clicker for any session you will not be able to receive clicker points for that day; we will not count responses written on scraps of paper. See below for i►clicker policy and registration.

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

### **Laboratories**

Laboratories begin during the second week. 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.

### **Course website**

We use Canvas for the course website. On the site you will find the syllabus, lecture and lab schedules, staff e-mail contacts and office hours, i►clicker answers, problems set answers, links to screencasts, course and lab announcements, supplementary reading, and grade access. These items can be found under the *Home* and *Modules* pages.

### **Accommodations for students with disabilities**

If you have a documented disability and anticipate needing accommodations in this course, please make arrangements to meet with me as soon as soon as possible, and not later than October 1. Please bring a notification letter from the Accessible Education Center stating your approved accommodations.

### **Class conduct and academic honesty**

Class starts promptly at 10:00 and ends at 10:50. Please arrive on time and do not pack up before the conclusion of the lecture. Arriving late and leaving early is disruptive to others around you and to the speaker. Do not talk during lecture in a volume audible to anyone but the intended recipient. **Please do not use any electronic devices during class**; they are of no help to your learning, and are distracting to those around you and to the lecturer.

**Personal computers will not be allowed in lecture or lab.** If you have a requirement for using a computer to take notes, please make accommodations with me on the first day of class. Your use of the computer may be monitored by a teaching assistant.

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 i►clicker policy and registration**

Since lecture participation via polling by i►clickers constitutes 5% of your total score in this course, it is recommended that you purchase an i►clicker from the UO Bookstore. Any version of the i►clicker will be sufficient.

In order to receive credit for in-class use of the clicker, you will need to register your i►clicker online within the first two weeks of class. You must have come to class at least once and responded on all questions posed during that lecture in order to complete this registration properly. Once you have responded in at least one class meeting, go to the *i>clicker* section in the Bi214 Canvas site. Complete the fields with your first name, last name, Duck ID (not student ID number), and clicker ID. Registration through iclicker.com will not result in registration of your iclicker in this course.

The i►clicker response system will be used every day in class (with the exception of the first lecture and the two exam days), and you are responsible for bringing your remote daily. Since the use of clickers in this course contributes to each student's final grade, in-class misuse of these devices may be considered as an act of academic dishonesty; this includes the loaning your clicker to a classmate who registers responses in your absence from lecture. If a student is caught using two clickers, both that student and the owner of the loaned device will be penalized, and the Office of Student Conduct and Community Standards will be notified. A few points of the 840 or so possible of your course score is not worth the risk of a failing grade.

## Bi214 2019 Lecture Schedule

Week	Date	Topic	Reading	Suggested problems*
1	Sept. 30	No class		
	Oct. 2	<b>Amino acid chemistry</b> Introduction; Amino acid structure	1-11	
	Oct. 4	Amino acid structure, continued Ionization of amino acids	12-18	Acid-Base Chem: 1-7
2	Oct. 7	Acid-base properties of amino acids	18-24	Amino Acids: 1-3
	Oct. 9	pH influence on amino acid charges	24-28	Amino Acids: 4-11
	Oct. 11	<b>Protein shape</b> Peptide bonds and primary protein structure	29-37	Amino Acids: 12-15 Protein Structure: 1
3	Oct. 14	<b>QUIZ 1</b> Secondary protein structure	29-37	Protein Structure: 2-4
	Oct. 16	<b>Protein function</b> Secondary protein structure	37-42	Protein Structure: 5-8
	Oct. 18	Secondary and tertiary protein structure	16; 42-46	Protein Structure: 9-10
4	Oct. 21	Hemoglobin structure and function	46-54	Hemoglobin: 1-4
	Oct. 23	<b>EXAM 1</b>		
	Oct. 25	Cooperativity and allostery in hemoglobin	54-64; 72-75	Hemoglobin: 5-12
5	Oct. 28	<b>DNA structure, replication, and mutation</b> Structure of DNA	77-89	DNA Structure: 1-3
	Oct. 30	Structure and replication of DNA	89-99	DNA Structure: 4-5
	Nov. 1	Mechanisms of mutation	100-106	DNA Structure: 6-8
6	Nov. 4	<b>QUIZ 2</b> <b>Defining a gene</b> Mechanisms of mutation, continued	100-106	DNA Structure: 9-11
	Nov. 6	Inborn errors of metabolism	107-113	Metabolic Paths: 1-4
	Nov. 8	Complementation	108-113	Metabolic Paths: 5-9

Week	Date	Topic	Reading	Suggested problems*
7	Nov. 11	Complementation; definition of the gene	108-113	Metabolic Paths: 10-12
	Nov. 13	<b>EXAM 2</b>		
	Nov. 15	<b>Transcription and gene regulation in prokaryotes</b> Transcription in prokaryotes	114-124	Trxn in Proks: 1-11
8	Nov. 18	The <i>lac</i> operon of <i>E. coli</i> : regulation by protein binding	124-128	
	Nov. 20	Negative regulation of the <i>lac</i> operon: Genetic evidence	129-137	Gene Expression: 1-3
	Nov. 22	Positive regulation of the <i>lac</i> operon: Genetic evidence	137-140	Gene Expression: 4-15
9	Nov. 25	<b>QUIZ 3</b> <b>Mechanisms of development</b> Yeast mating type specification	141-146	Development: 1-3
	Nov. 27	Establishing asymmetry in yeast	146-150	Development: 4-5
	Nov. 29	<b>Thanksgiving holiday—no class</b>		
10	Dec. 2	<b>Developmental gene regulation in eukaryotes</b> A developmental switch in yeast Overview of gene regulation in eukaryotes	Chang and Drubin† 150-154	Development: 6-7 Development: 9-11
	Dec. 4	Gene regulation in eukaryotes: The $\beta$ -globin gene cluster	69-72; 154-158	
	Dec. 6	Thalassemias and deregulation of the $\beta$ -globin genes	75-76; 158-160 Banks†	Development: 12-15
	Dec. 9	<b>Final Exam 10:15-12:15</b>		

\*From Problem Sets in the lecture packet and Canvas (Modules>Problem Sets)

†Access via Canvas (Modules>Supplemental Reading and Documents)