Course Title	Principles of Genetics and Molecular Biology
Course Code	BIOL 2413
Semester	Summer 2025
Course Length	10 Weeks, 60 Contact Hours
Credits	4
Instructor	TBA
Office	TBA
Email	TBA
Prerequisite	BIOL 1101 Principles of Biology
Antirequisite	BIOL 2411 Principles of Genetics and Molecular Biology (5 Weeks)

Course Description:

This course will survey the discipline of genetics and molecular biology. Two broad areas will be considered 1) Genetics: basic Mendelian & molecular genetics, and 2) Molecular Biology: DNA replication, transcription, translation, regulation of gene expression in both prokaryotic and eukaryotic systems and genomics.

In this course students will study various genetic topics including Mendelian genetics, chromosome mapping, the genetic code, DNA repair & mutations, genetics of cancer, DNA technology, and epigenetics.

Course Goals:

Students who successfully complete this course will demonstrate competency in the following general education core goals:

- **Critical thinking skills** – Students will engage in creative and/or innovative thinking, and/or inquiry, analysis, evaluation, synthesis of information, organizing concepts, and constructing solutions.
- **Communication skills** – Students will demonstrate effective written, oral, and visual communication.
- **Teamwork** – Students will demonstrate the ability to work effectively with others to support a shared purpose or goal and consider different points of view.
- **Social responsibility** – Students will demonstrate intercultural competency and civic knowledge by engaging effectively in local, regional, national, and global communities.

Student Learning Outcomes:

Upon completion of this course, students will be able to:

- give examples of how advances in genetics and molecular biology, from the discovery of DNA's structure to the sequencing of individual genomes, have changed the world;
- explain where genetic variation comes from in a population (e.g. meiosis, mutation, and epigenetic changes);
- describe the general organization of prokaryotic and eukaryotic genomes, including the identification and significance of the different parts of a gene;
- explain how a gene can be regulated transcriptionally and post-transcriptionally and how this leads to limited expression under different conditions;
- predict the outcome of experimental manipulations in genes;
- describe the basic steps in gene cloning.

Textbooks/Supplies/Materials/Equipment/ Technology or Technical Requirements:
William S Klug, Michael Cummings, Charlotte A. Spencer, Michael A Palladino, Darrell Killian, *Essentials of Genetics,* 10th ed. PEARSON.

Course Requirements:

Quizzes
Students will complete 5 periodical quizzes to reinforce key concepts covered in lectures and assigned readings. These quizzes will consist of multiple-choice, true/false, and short-answer questions. Each quiz will contribute to the final grade.

Problem Sets
Throughout the course, students will complete five problem sets that require applying genetic principles to solve numerical problems, analyze data, and interpret genetic scenarios. These assignments will assess students' understanding of key topics such as Mendelian genetics, probability calculations, and genetic mapping. Clarity of explanations, correct application of concepts, and proper formatting will be considered in grading. While discussions with peers are encouraged, all submitted work must be original.

Laboratory Assignments & Reports
Students will complete six laboratory assignments that involve virtual experiments, bioinformatics exercises, and data interpretation. These assignments are designed to provide hands-on experience with molecular genetics techniques, including DNA analysis, gel electrophoresis, and genome annotation. Each lab report must include a summary of the experimental methods, results, and interpretations. Reports will be graded based on accuracy, depth of analysis, and clarity of presentation.

Midterm Exam
The midterm exam will assess students' understanding of lecture material, assigned readings, and laboratory exercises. The exam will consist of a combination of multiple-choice, short-answer, and problem-solving questions. The midterm will cover material from the beginning of the course through the first half of the semester, evaluating students' ability to apply genetic concepts to novel problems.

Final Exam

The final exam will be cumulative, covering all topics discussed throughout the semester. It will include multiple-choice, short-answer, and applied problem-solving questions. Emphasis will be placed on integrating knowledge across different areas of genetics and applying concepts to real-world genetic case studies. The exam will take place during the university's scheduled final exam period, and no make-up exams will be offered without prior approval and valid documentation.

Assessments: Activity	Percent Contribution
Quizzes (5)	10%
Problem Sets (5)	15%
Laboratory Assignments Reports (6)	30%
Midterm Exam	20%
Final Exam	25%

Grading:

Final grades will be based on the sum of all possible course points as noted above.

Percentage of available points	Grade
90 - 100	A
80 - 89	B
70 - 79	C
60 - 69	D
$<$60	F

Course Schedule:
The schedule of activities is subject to change at the reasonable discretion of the instructor. Minor changes will be announced in class, and major ones provided in writing.

BIOL 2413 Schedule		
Lecture	Topic	Readings & Labs
L1	Course introduction	Chapter 1
	Overview of genetics; process of science	
L2	Chromosomes, mitosis, meiosis and the cell cycle	Chapter 2
L3	Genetic crosses; Mendel's pea experiments	Chapter 3; **LAB 1**
L4	Pedigrees and probability	Chapter 3
L5	Modifying Mendel's ratios	Chapter 4
	Extranuclear inheritance modifies Mendelian patterns	
L6	Sex determination & sex chromosomes	Chapter 5
	Problem-Set 1 Due	
L7	Chromosome mutations	Chapter 6
L8	Linkage and mapping	Chapter 7; **LAB 2**
L9	Bacterial genetics	Chapter 8
L10	DNA/RNA structure	Chapter 9
L11	DNA replication	Chapter 10; **LAB 3**
L12	Chromosome structure	Chapter 11
	Problem-Set 2 Due	
	Midterm Exam	Chapters 1-11
L13	Genetic code	Chapter 12; **LAB 4**
L14	Transcription and splicing	Chapter 12
L15	Translation/protein structure	Chapter 13; **LAB 5**

L16	Recombinant DNA technology	Chapter 17
	Problem-Set 3 Due	
L17	Genomics & bioinformatics	Chapter 18
L18	Regulating gene expression prokaryotes	Chapter 15
L19	Regulating gene expression eukaryotes	Chapter 16
L20	Gene mutation	Chapter 14; **LAB 6**
	Problem-Set 4 Due	
L21	DNA repair and transposons	Chapter 14
L22	Cancer genetics	Chapter 19
L23	Population and evolutionary genetics	Chapter 21
L24	Genetic testing	Special Topic 2
L25	Epigenetics	Special Topic 1
	Problem-Set 5 Due	
	Final Exam	All Topics

Accommodation Statement

Academic accommodations may be made for any student who notifies the instructor of the need for an accommodation. It is imperative that you take the initiative to bring such needs to the instructor's attention, as he/she is not legally permitted to inquire. Students who may require assistance in emergency evacuations should contact the instructor as to the most appropriate procedures to follow.

Academic Integrity Statement

Each student is expected to maintain the highest standards of honesty and integrity in academic and professional matters. The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or otherwise fails to meet the standards. Any student judged to have engaged in academic dishonesty in coursework may receive a reduced or failing grade for the work in question and/or for the course.

Academic dishonesty includes, but is not limited to, dishonesty in quizzes, tests, or assignments; claiming credit for work not done or done by others; hindering the academic work of other students; misrepresenting academic or professional qualifications within or without the University; and nondisclosure or misrepresentation in filling out applications or other University records.

Other Items:

Lab Policies
- **Attendance:** Attendance at all lab sessions is mandatory. Missing a lab without a valid excuse will result in a grade penalty.
- **Late Reports:** Late lab reports will incur a 10% penalty per day.
- **Safety:** Proper lab attire (lab coat, gloves, safety goggles) is required at all times. Failure to follow safety protocols may result in dismissal from the lab.
- **Academic Integrity:** Plagiarism and fabrication of data will not be tolerated and will result in disciplinary action.

Lab Materials
- Lab manual (provided during class).

- Lab notebook for recording data and observations.
- Personal protective equipment (lab coat, gloves, safety goggles).

Attendance and Expectations

All students are required to attend every class, except in cases of illness, serious family concerns, or other major problems. We expect that students will arrive on time, be prepared to listen and participate as appropriate, and stay for the duration of a meeting rather than drift in or out casually. In short, we anticipate that students will show professors and fellow students maximum consideration by minimizing the disturbances that cause interruptions in the learning process. This means that punctuality is a must, that cellular phones be turned off, and that courtesy is the guiding principle in all exchanges among students and faculty. You will be responsible for the materials and ideas presented in the lecture.

Assignment Due Dates

All written assignments must be turned in at the time specified. Late assignments will not be accepted unless prior information has been obtained from the instructor. If you believe you have extenuating circumstances, please contact the instructor as soon as possible.

Make-Up Work

The instructor will not provide students with class information or make-up assignments/quizzes/exams missed due to an unexcused absence. Absences will be excused and assignments/quizzes/exams may be made up only with written documentation of an authorized absence. Every effort should be made to avoid scheduling appointments during class. An excused student is responsible for requesting any missed information from the instructor and setting up any necessary appointments outside of class.

Access, Special Needs and Disabilities

Please notify the instructor at the start of the semester if you have any documented disabilities, a medical issue, or any special circumstances that require attention, and the school will be happy to assist.