

BIOL 4580(6580), Molecular Genetics
Spring Semester 2021, Section A (CRN# 26260, 4 Credit hours) & 6580 (CRN# 26261)
Department of Biology, College of Science & Math, Valdosta State University

Lecture (BC 1202): M & W 3:30 p.m. – 4:45 p.m.

Laboratory (BC 2071): T 9:30 a.m. - 12:20 p.m.

Instructor: Dr. Brian C. Ring
Office: BC 2084
Office hours: M & W 12:00 p.m. – 2:00 p.m.
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Pre-Requisites: BIOL 3200 or permission of instructor.

Course Description: The study of the molecular nature of eukaryotic genomes, with emphasis on biotechnology. The lecture will focus on using modern molecular genetic techniques as a means to understanding complex eukaryotic genomes. Emphasis will be placed on reading current, relevant scientific literature. The laboratory will involve hands-on experience in which the student will learn the latest technology of molecular genetic analysis and manipulation.

Course Outcomes: Upon completion of this course the student should be able to:

- 1) Comprehend the central dogma of molecular biology as illustrated through elegant experimental studies of the phage lambda (**BO3, BO4, & GE4, & GE7**);
- 2) Understand how genomes are experimentally investigated using bio techniques such as molecular biology, genomics, gene expression, and transgenics (**BO3, BO4, & GE4**);
- 3) Develop practical laboratory knowledge and skills through inquiry based experimentation employing molecular genetic techniques (**BO1, BO4, GE5 & GE7**).

These course outcomes support the VSU Biology Department Outcomes # 1, 3, & 4 and the University General Educational Outcomes # 4, 5 & 7 as listed in the VSU Undergraduate Catalogue (see below).

VSU Biology Department Objectives:

BO1. Develop and test hypotheses, collect and analyze data, and present the results and conclusions in both written and oral formats.

BO3. Demonstrate an understanding of the cellular basis of life.

BO4. Relate the structure and function of DNA/RNA to the development of form and function of the organism and to heredity.

VSU General Educational Outcomes:

GE4. Students will express themselves clearly, logically, and precisely in writing and in speaking, and they will demonstrate competence in reading and listening.

GE5. Students will demonstrate knowledge of scientific and mathematical principles and proficiency in laboratory practices.

GE7. Students will demonstrate the ability to analyze, to evaluate, and to make inferences from oral, written, and visual materials.

Required Materials:

- Text:**
- 1) Mark Ptashne. *A Genetic Switch: Phage Lambda Revisited*. 2004. 3rd Ed. Cold Spring Harbor Laboratory Press (ISBN # 0879697164)
 - 2) Additional Primary Articles: **TBA** (see schedule below)

Laboratory Manual: None; mainly handouts or laboratory protocols and papers. **TBA**

Graded Course Components: Your final grade will be based on your performance and participation in lecture and the laboratory as outlined below. Due to this course being taught under CDC guidelines please be aware of precautions. **It is the responsibility of students to attend during scheduled lecture and review times. Previous recordings of past lectures may also be provided in BV.** If you miss **more than 2 laboratory** sessions you will fail this course as per University policy. In the event that a student will miss a lab, s/he should notify the instructor in writing by email and be prepared to provide documentation of the excused absence. It is the instructor's prerogative to accept the excuse or not. **ABSOLUTELY NO LECTURES OR LABORATORIES CAN BE "MADE UP"**

Lecture Quizzes & Exams: (75%) Students will be graded on their performance during lecture time based on the following criteria: **Short online quizzes and 3 exams and short presentations.**

Quizzes (10%) will be provided as we cover each chapter or lecture and are due at the end of each week taken

in BlazeView (BV, Sundays by 11 PM). Use the time when your not in lecture to complete the quizzes online. These quizzes will help you prepare for exams. Please follow the schedule in BV and it is recommended you use the app to keep track of calendar dates on your phone or digital device.

Lecture Exams (60%) will cover material from lecture and will be based upon our discussion of the Phage Lambda Genetic Switch and various journal articles assigned in class. Exams are composed of primarily short answer or may be a combination of online multiple choice and short answer (TBD).

Student presentations (5%) on Molecular Genetics topics. This will be discussed in class and occur during the end of the semester.

Laboratory: (25%) Two exams worth 10% each and molecular mysteries (5%). Exams are composed of multiple choice and/or short answer covering what we learned in the laboratory. The first lab exam is the practical introduction to molecular genetics chemistry in the lab (labs 1-4). The second lab exam is based on our results of inquiry-based research. In addition, a series of molecular mysteries will be provided for you to solve and require you to upload a written response in BV using Turn it in monitoring. These postings are worth 5% of the laboratory grade. **NOTE:** Additional inquiry-based labs will be provided for graduate students enrolled (BIOL 6580).

Grade Calculation & Distribution: Final grades will be based on a percentage of your cumulative points relative to the total points possible. See below chart.

Grade Calculation		Grade Distribution		
Category	Possible Weight	Letter	Percentage	Point Range
Lecture Exam 1	20%	A	90-100%	N/A
Lecture Exam 2	20%	B	80-89%	
Lecture Exam 3	20%	C	70-79%	
Lecture Quizzes	10%	D	60-69%	
Genome Presentations	5%	F	≤ 59%	
Lab Molecular Mysteries	5%			
Lab Exam 1	10%			
Lab Exam 2	10%			
Total	100%			

Notes on grading: Students should note that a grade of "A" in this course represents an exemplary command of the material covered. To obtain this grade of excellence, it is recommended that students study daily, be prepared to participate in class discussion and laboratory sessions, and clarify with their instructor any problems regarding course information, as they arise. Additionally, the instructor may implement an overall curve based on class performance at the end of the course.

Mid-term and Attendance: Students will have several lecture and laboratory assignments to determine their overall grade by the Mid-Term (3/2/2023) and decide whether to withdraw at the deadline date (see Registrar dates online). As detailed above, attendance is mandatory.

Student identification: Students should have in their possession at all times their VSU student identification card. In order to verify the identification of students officially enrolled in the course, it is the instructor's prerogative to request official student photo identification cards at any time during lecture or during exams.

Academic Dishonesty (e.g. cheating or plagiarism): A student cheating or plagiarizing will be penalized by receiving a zero for the assignment and will be reported to the dean of students. Refer to the Student Code of Ethics in the VSU Student Handbook.

Privacy Act (FERPA): The Family Educational Rights and Privacy Act (FERPA) prohibit the public posting of grades by Social security number or in any manner personally identifiable to the individual student. No grades can be given by email or over the telephone, as positive identification cannot be made by this manner.

Students with Disabilities: Students requesting classroom accommodations or modifications because of a documented disability must let me know and must also contact the Access Office for Students with Disabilities located in room 1115 Nevins Hall. The phone numbers are 245-2498 (voice) and 219-1348 (tty).

TENTATIVE LECTURE & LABORATORY OUTLINE:

Week:	Date:	Topics:	Text/ Paper:	Laboratory Topic:
1	Jan. 09 (M)	Course Introduction & Objectives	--	Introduction, Safety, & Inquiry Based learning
	Jan. 11 (W)	Central Dogma & Phage Lambda	Pg. 1-10	
2	Jan. 16 (M)	NO LECTURE- MLK Day	--	NO LAB - prepare for lab 1 See L1 hand out (D2L).
	Jan. 18 (W)	The Master Elements of Control	Chpt. 1	
3	Jan. 23 (M)	Continued	--	L1: Common Units & Measures
	Jan. 25 (W)	Protein-DNA Interactions & Gene Control	Chpt. 2	
4	Jan. 30 (M)	Continued	--	L2: Common Stock Solutions
	Feb. 01 (W)	Control Circuits- Setting the Switch	Chpt. 3	
5	Feb. 06 (M)	Continued	--	L3: Dilution Chemistry
	Feb. 08 (W)	Catch-up & Review	--	
6	Feb. 13 (M)	Lecture Exam 1	--	L4: Human Genomic DNA Isolation from cheek cells
	Feb. 15 (W)	How Do We Know?- The Key Experiments	Chpt. 4	
7	Feb. 20 (M)	Continued	--	L5: Quantification of Human DNA & PTC PCR set up Lab Papers
	Feb. 22 (W)	2004: New Developments & Review	Chpt. 5	
8	Feb. 27 (M)	Continued	--	Lab Exam 1 Molecular Mysteries MM#1 Discussion
	Mar. 01 (W)	Catch-up & Review	--	
	Mar. 02 (R)	Midterm- last day to drop course	--	
9	Mar. 06 (M)	Lecture Exam 2	--	L6: Electrophoresis of PTC Products & media prep.
	Mar. 08 (W)	DNA Replication & Biotechnology I	Paper 1	
--	Mar. 13 (M)	Spring Break- NO CLASS M & W	--	NO LAB
	Mar. 15 (W)	Spring Break- NO CLASS M & W	--	
10	Mar. 20 (M)	Genomics & Biotechnology II	Paper 2	L7: Lambda Phage Plating & Analysis of PTC gels
	Mar. 22 (W)	Recombinant DNA plasmids	Paper 3	
11	Mar. 27 (M)	Genomics Revolution I:	Paper 4	L8: Selection of mutants & Growth
	Mar. 29 (W)	What Makes us Human?	--	
12	April 03 (M)	Genomics Revolution II:	Paper 5	L9: Mutant Archive and DNA Isolation
	April 05 (W)	Ancient Genomics	--	
13	April 10 (M)	Engineering Genomes	Paper 6	L10: Sequence of wild-type Lambda vs. Mutants MM #2 Discussion
	April 12 (W)	Group Genome Paper Discussion I	--	
14	April 17 (M)	Group Genome Paper Discussion II	--	Lab Results Discussion Catch-up & Review
	April 19 (W)	Group Genome Paper Discussion III	--	
15	April 24 (M)	Group Genome Paper Discussion IV	--	Lab Exam 2
	May 26 (W)	Catch-up & Review	--	
--	May 04 (T)	Lecture Exam 3 + cumulative final	--	2:45 p.m – 4:45 p.m. BC 2022

NOTES: Papers, protocols, and lab handouts will be posted on D2L Blazeview. Lab schedule subject to change.

The following two major goals will be accomplished in the laboratory and assessed on each lab exam:

- 1) Practice and employ basic molecular biology laboratory skills prior to lab exam 1.
- 2) An inquiry-based investigation of a biological question at the molecular genetic level (instructor will discuss) prior to lab exam 2.
- 3) Group discussion on solving "Molecular Mysteries". I will present several recent molecular mysteries and you will work in groups during lab "down time" (e.g. 30 minute incubation or gel run) to solve these and present later to the class in group discussions.