

BIOL 4580 (6580), Molecular Genetics

Spring Semester 2021

BIOL 4580 Section A (CRN# 25098, Undergraduate, 4 Credit hours)

BIOL 6580 Section A (CRN# 25105, Graduate, 4 Credit hours)

Department of Biology, College of Science & Math, Valdosta State University

Lecture (BC 2022/Hybrid): M & W 2:00 p.m. – 3:15 p.m.
Laboratory (BC 2071 F2F): M 10:00 a.m. – 12:50 p.m.

NOTE: Students will be split into Groups A & B to maintain social distancing during lectures and labs (see schedule at end).

Instructor: Dr. Brian C. Ring

Office: BC 2084

Office hours: **M & W** 12:30 p.m. – 1:45 p.m. or by appointment- Use *Microsoft Teams* to voice or video chat in lieu of F2F office time during this pandemic.

Phone: 249-4841 (Dept. office 333-5759)

Email: bcring@valdosta.edu (**please use D2L first please**)

Pre-Requisites: BIOL 3200 or permission of instructor.

Note: Graduate student(s) enrolled in BIOL 6580 will be given a supplemental syllabus.

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 catalogue

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 eukaryotic genomes are experimentally investigated using biotechniques 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 posted on Blazeview.
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 of social distancing, most

lectures will be recorded and posted in BV. **It is the responsibility of students to attend during scheduled lecture and review times. If you are unable to attend the live sessions, then it is your responsibility to review the recordings.** 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 & Presentation Sessions: (75%) Students will be graded on their performance during lecture time based on the following criteria: **Short online quizzes, 3 exams, and final presentations on a topic in the field of genomics.**

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 group is 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).

Final presentations (5%) will be based on a particular genome project and are to be presented individually by students at the end of the semester. **By week 10 students will select a Genome Paper for approval and each student will present the paper in the last few weeks during group sessions.** More instructions will be provided by your instructor online in week 10 (see schedule).

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.

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 and decide whether to withdraw at the deadline date (**3/11/2021**). 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 (Mondays @ 10 am):
1	Jan. 11 (M)	Course Introduction & Objectives	--	Introduction, Safety, Split Up (Social Distancing) & Inquiry Based Learning
	Jan. 13 (W)	Group A: Central Dogma & Phage Lambda	Pg. 1-10	
2	Jan. 18 (M)	NO LECTURE- MLK Day	--	NO LAB- prepare for lab 1 See L1 hand out (D2L).
	Jan. 20 (W)	Group B: Central Dogma & Phage Lambda	--	
3	Jan. 25 (M)	Group A: The Master Elements of Control	Chpt. 1	L1: Common Units & Measures Group A: 10:00-11:25 am Group B: 11:25-12:50 pm
	Jan. 27 (W)	Group B: The Master Elements of Control	--	
4	Feb. 01 (M)	Group A: Protein-DNA Interactions & Gene Control	Chpt. 2	L2: Common Stock Solutions Group A: 10:00-11:25 am Group B: 11:25-12:50 pm
	Feb. 03 (W)	Group B: Protein-DNA Interactions & Gene Control	--	
5	Feb. 08 (M)	Group A: Control Circuits- Setting the Switch	Chpt. 3	L3: Dilution Chemistry Group A: 10:00-11:25 am Group B: 11:25-12:50 pm
	Feb. 10 (W)	Group B: Control Circuits- Setting the Switch	--	
6	Feb. 15 (M)	Catch Up & Review- Hybrid/ Collaborate Online Session (BV)	--	L4: Genomic DNA Isolation from cheek cells Group A: 10:00-12:50 pm
	Feb. 17 (W)	Lecture Exam 1- TBD or online	--	
7	Feb. 22 (M)	Group A: How Do We Know?- The Key Experiments	Chpt. 4	L4 Cont.: Genomic DNA (gDNA) Isolation from cheek cells Group B: 10:00-12:50 pm
	Feb. 24 (W)	Group B: How Do We Know?- The Key Experiments	--	
8	Mar. 01 (M)	Group A: 2004: New Developments & Review	Chpt. 5	Lab Exam 1 Group A: 10:00-11:25 am Group B: 11:25-12:50 pm Molecular Mysteries (MM) Introduction/Discussion
	Mar. 03 (W)	Group B: 2004: New Developments & Review	--	
	Mar. 04 (R)	Midterm- last day to drop course 3/11/2021	--	
9	Mar. 08 (M)	Catch Up & Review- Hybrid Collaborate Online Session (BV)	--	L5: Human gDNA Quantification Group A: 10:00-11:25 am Group B: 11:25-12:50 pm Inquiry Lab Discussion
	Mar. 10 (W)	Lecture Exam 2- TBD or online	--	
10	Mar. 15 (M)	Genome Project Discussions- Hybrid Collaborate Online Session (BV)	--	L6: gDNA Extraction from Various Organisms Group A: 10:00-12:50 pm
	Mar. 17 (W)	Wellness Day #2- NO CLASS W	--	
11	Mar. 22 (M)	Group A: DNA Replication & Biotechnology I	Paper 1	L6 Cont.: gDNA Extraction from Various Organisms Group B: 10:00-12:50 pm
	Mar. 24 (W)	Group B: DNA Replication & Biotechnology I	Paper 2	
12	Mar. 29 (M)	Group A: Genomics & Biotechnology II	Paper 3	L7: gDNA Quantification Group A: 10:00-11:25 am Group B: 11:25-12:50 pm
	Mar. 31 (W)	Group B: Genomics & Biotechnology II	Paper 4	

13	April 05 (M)	Group A: What Makes us Human? & Genomic Medicine	Paper 5	L8: gDNA Library Prep & Next Gen. Sequencing MM #1&2 Discussion Group A: 10:00-12:50 pm
	April 07 (W)	Group B: What Makes us Human? & Genomic Medicine	Paper 6	
14	April 12 (M)	Group A Genome Paper Discussion I	--	L8 Cont.: gDNA Library Prep & Next Gen. Sequencing MM #1&2 Discussion Group B: 10:00-12:50 pm
	April 14 (W)	Group B Genome Paper Discussion I	--	
15	April 19 (M)	Group A Genome Paper Discussion II	--	Lab Results Discussion Catch-up & Review Group A: 10:00-11:25 am Group B: 11:25-12:50 pm
	April 21 (W)	Group B Genome Paper Discussion II	--	
16	April 26 (M)	Continued	--	Lab Exam 2 Group A: 10:00-11:25 am Group B: 11:25-12:50 pm MM #1&2 Due by Sunday in BV
	April 28 (W)	Catch Up & Review- Hybrid Collaborate Online Session (BV)	--	
--	May 04 (T)	Lecture Exam 3 + cumulative final	--	2:45 p.m – 4:45 p.m.
		TBD or online		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 complete online in BV.