BIOL 4580 (6580), Molecular Genetics

Spring Semester 2017
BIOL 4580 Section A (CRN# 21287, Undergraduate, 4 Credit hours)
BIOL 6580 Section A (CRN# 21306, Graduate, 4 Credit hours)
Department of Biology, College of Arts & Science, Valdosta State University

Lecture (BC 2202): M & W 2:00 p.m. – 3:15 p.m.
Laboratory (BC 2071): T 2:00 p.m. – 4:50 p.m.

Instructor: Dr. Brian C. Ring
Office: BC 2084
Office hours: **M & W** 3:30 p.m. – 4:30 p.m.
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 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.

Lecture/Discussion Sessions: (350 pts, 70%) Students will be graded on their performance during lecture time based on the following criteria: 3 Lecture/cumulative final Exams (20% each, 100 points each) & Participation (10%, 50 points). By week 10 groups will be assigned a Genome Paper and each group will discuss the paper in last few weeks.

Lecture Exams 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.

Participation is key to the success of this course. Some lecture will be provided by your instructor, but the majority of the time is left for discussion of the reading assignments collaboratively. Therefore, attendance in this course is mandatory and each missed lecture will result in **5 points** lost from your participation grade and missed course time equivalent to greater than 20% (~5 days) will result in a failing grade as per University policy. **Group paper discussion will account for the remaining attendance points**. Attendance may be taken at any time during the lecture or laboratory and used as an indicator of class participation as noted. Laboratories in particular are important not to miss as you will not be able to prepare for lab exams. 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."**

Laboratory: (150 pts, 30%) Two exams worth 75 points each. 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 1-3). The second lab exam is based on our inquiry into your own genetic profile using the basic molecular genetic skills learned from labs 1-3 and our analysis of gene sequences from a fish model species.

Grade Calculation & Distribution: Final grades will be based on a percentage of your cumulative points relative to the total points possible (e.g. 400/500 = 80% = B). See below chart.

Grade Calculation		**Grade Distribution**		
Category	**Possible Points***	**Letter**	**Percentage**	**Point Range**
Lecture Exam 1	100	A	90-100%	450-500
Lecture Exam 2	100	B	80-89%	400-449
Lecture Exam 3	100	C	70-79%	350-399
Participation	50	D	60-69%	300-349
Lab Exam 1	75	F	≤ 59%	≤ 299 points
Lab Exam 2	75			
Total	**500**			

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 (**3/6/14**). 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 & Quantification
	Feb. 15 (W)	How Do We Know?- The Key Experiments	**Chpt. 4**	
7	Feb. 20 (M)	Continued	--	**Lab Exam 1**
	Mar. 22 (W)	2004: New Developments & Review	**Chpt. 5**	
	Feb. 27 (M)	Continued	--	**L5:** PCR amplification of Vasa gene from fish lines **Lab Paper 1**
8	Mar. 01 (W)	Catch-up & Review	--	
	Mar. 02 (R)	**Midterm- last day to drop course**	--	
9	**Mar. 06 (M)**	**Lecture Exam 2**	--	**L6:** PCR cleanup, gels & Quantification
	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)	Gene Expression & Biotechnology II	**Paper 2**	**L7:** Human STR PCR **Lab Paper 2**
	Mar. 22 (W)	Modern Molecular Genetics: Experimental Models	**Paper 3**	
11	Mar. 27 (M)	Genomics Revolution I:	**Paper 4**	**L8:** Human STR gels
	Mar. 29 (W)	What Makes us Human?	--	
12	April 03 (M)	Genomics Revolution II:	**Paper 5**	**L9:** Fish PCR sequence & Human STR Analysis
	April 05 (W)	Ancient Genomics	--	
13	April 10 (M)	Engineering Genomes	**Paper 6**	**L10:** Individual Sequence reports- **Discussion**
	April 12 (W)	Group Genome Paper Discussion I	--	
14	April 17 (M)	Group Genome Paper Discussion II	--	**Catch-up & Review**
	April 19 (W)	Group Genome Paper Discussion III	--	
15	April 24 (M)	Group Genome Paper Discussion IV	--	**Lab Exam 2**
	April 26 (W)	Catch-up & Review	--	
--	**May 02 (T)**	**Lecture Exam 3 + cumulative final**	--	**2:45 p.m – 4:45 p.m. BC 2022**

*One human short tandem repeat (STR) review paper and 1-2 primary research articles will be assigned for reading and discussion prior to week 6.

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 applicable to the molecular genetics laboratory.
2) Human STR PCR amplification.
3) PCR amplification of vasa gene region from fish model followed by sequencing and analysis.