

Virginia State University
Department of Biology
BIOL 414 Lecture and Laboratory
Techniques of Molecular Biology (BIOL 414)

Instructor: Dr. Ross Johnson
E-mail: rsjohnso@vsu.edu

Office: 201A Lockett Hall
Phone: 804-524-6839

Required Textbook: Applied Molecular Genetics By Roger L. Miesfeld
Course Pre-requisite: Microbiology and Genetics

The lecture class meets three times a week to discuss molecular genetic methodologies and experimental strategies currently used to investigate biological systems. Resource information is obtained from the textbook and primary literature materials, and also the Internet. One of the primary pedagogical tools in Biol 414 is the use of Lab Practicums to illustrate how molecular genetic applications are used in the context of basic science research.

Laboratory experiences will demonstrate the concepts covered in BIOL 414 lecture. Experiments will employ techniques such as electrophoresis of DNA, PCR, restriction mapping of plasmid DNA, transformation of bacteria, Southern blotting, and genetic engineering techniques.

Course Goals

BIOL 414 Lecture

1. To introduce students to the theory behind each technique and to describe common applications of each methodology in biological research.
2. To appreciate the historical breakthrough these molecular techniques represent.
3. To identify the major strengths of the evaluated molecular techniques and their specific applications in biology.
4. To be able to critically evaluate and interpret experimental results.

BIOL 414 Laboratory

1. To develop hands-on experience with such techniques as electrophoresis, PCR, restriction mapping of plasmid DNA, transformation of bacteria, Southern blotting, and genetic engineering.
2. To understand the importance of positive and negative controls in experimental design and implementation.
3. To appreciate that many biological studies involve ongoing experiments which cannot be "wrapped up" in a single lab period.
4. Teach students how to organize and maintain a lab notebook.

The Honor Code

All students are bound by the University Honor Code. Cheating and plagiarizing, (copying one's work to be handed in as your own), will not be tolerated. If such an incident occurs, proper actions according to the VSU student handbook will be followed.

Evaluation of student performance:

Students are challenged to use effective writing and oral communication skills to demonstrate competence in applied molecular genetic concepts.

BIOL 414 Lecture

In-class Exams (300 pts.)

There will be three in-class exams (Exam 1, Exam 2 and Final) which count for 100 points each. The Exam 1 and Exam 2 will only cover material covered in the respective lectures, and the Final exam (during Finals Period) covers material from all Lectures and student-generated questions from the Class Presentations.

Class Presentation (100 pts.)

Each student is required to participate in a journal club presentation of a current research article, in an oral format (20 – 30 minutes in length with time for questions) and a written summary paper (3 – 5 text pages in length) with complete references to be submitted following the presentation. Each student is responsible for writing three study questions for the Final Exam using material discussed in their oral presentation.

Final Course Grade

The course grade will be based on percentage of total points (400 pts) with allowance for adjusted scores depending on overall student performance with regard to the in-class exams. Conventional percentages for assigning grades will be; 100-90% = A, 89-80% = B, 79-70% = C, 69-60% = D, <50% = F.

*Participation in class discussions will be used as a subjective evaluation for students that earn a total number of points for the course that fall on or near the grade cut-off.

BIOL 414 Laboratory

Laboratory Notebooks

Each student will be expected to keep a lab book containing detailed information about each lab. This includes date, purpose of the exercise, specific notes regarding the experimental protocol, the results of the experiment, and interpretation of experimental results. Lab books should be legible (write neat enough for me to be able to read it!) and keep it up to date. They will be collected and evaluated periodically. Additional information will be given out in class.

Scientific Laboratory Report

Each student must summarize their lab research for the semester. This will require each

student to submit a paper written in scientific format. The report must have an abstract that summarizes the topic, introduction, materials and methods, results, discussion, references, and finally figures.

Class attendance and Participation

Class attendance is mandatory and any absences from lab must be excused. The major objective of the laboratory is to provide students with 'hands on' experience performing molecular biology, and all students are expected to participate.

Laboratory Final Course Grade

Attendance/Class Participation is 20%

Lab book/Experimental results is 40%

Scientific Laboratory Report is 40%

The course grade will be based on percentage of total points (500 pts).with allowance for adjusted scores depending on overall student performance with regard to the in-class exams. Conventional percentages for assigning grades will be; 100-90% = A, 89-80% = B, 79-70% = C, 69-60% = D, <60% = F.

All cell phones, beepers and electronic devices should be turned off before entering the classroom. If a cell phone, beeper, or electronic device alarms, you will be asked to leave class for the day.

BIOL 414 – TECHNIQUES IN MOLECULAR BIOLOGY

Date	Reading	Discussion Topic
Jan 12	-	Introduction and Overview of the course
Jan 14-21	3-27	Overview of Applied Molecular Genetics; DNA metabolizing enzymes; Biochemical methods; Laboratory Practicum 1
Jan 23	-	Journal Presentation Preparation
Jan 26-30	31-55	<i>E. coli</i> K12 bacterial host; Plasmid biology, DNA transformation; Bacteriophage vectors; Laboratory Practicum 2
Feb 2-6	59-78	Overview of DNA libraries; In vitro mutagenesis; Laboratory Practicum 3
Feb 9-13	96-111	Overview of Genomics; Genomic mapping; Laboratory Practicum 4; Journal Presentation
Feb 16-20	115-138	Biochemistry of cDNA synthesis; Representative cDNA libraries; Functional cDNA libraries
Feb 23	115-138	Using cDNA as a reagent; Laboratory Practicum 5
Feb 25	-	EXAM 1
Feb 27	-	Journal Presentation
Mar 1-5	143-169	Biochemistry of the polymerase chain reaction (PCR); Reverse Transcriptase-Mediated PCR; Laboratory Practicum 6
Mar 8-12	-	<i>Spring Break</i>
Mar 15-19	175-195	Gene expression in cultured cells; Yeast as a model; Protein expression in cultured cells; Laboratory Practicum 7
Mar 22-26	205-231	Molecular Genetics of <i>Drosophila</i> ; Transgenic crop plants; Mouse transgenesis; Transgenic livestock; Laboratory Practicum 8
Mar 29	237-250	Microarray Technology; Bioinformatics and Proteomics
Mar 31	-	EXAM 2
Apr 2	-	Journal Presentation
Apr 5-9	244-263	Bioinformatics and Proteomics; Gene Therapy and Stem Cell Biology; Laboratory Practicum 9

Apr 12	-	Class Presentation
Apr 14	-	Class Presentation
Apr 16	-	Class Presentation
Apr 19	-	Class Presentation
Apr 21	-	Class Presentation
Apr 23	-	Class Presentation
Apr 26	-	Last Day of Class
May 3	-	FINAL EXAM (1 – 3 PM)

BIOL 414 Laboratory – TECHNIQUES IN MOLECULAR BIOLOGY

Date	Laboratory Activities
Jan 14	Introduction and Overview of the course
Jan 21	Laboratory Safety; Make Stock Solutions; DNA in Practice: Extraction of DNA from Cells;
Jan 28	Extraction of DNA from Cells
Feb 4	Electrophoresis of DNA
Feb 11	Restriction Mapping of DNA
Feb 25	Genetic Engineering Lab Session 1
Mar 3	Genetic Engineering Lab Session 2 - Transformation
Mar 10	Spring Break
Mar 17	Genetic Engineering Lab Session 3 – Plasmid Prep
Mar 24	Genetic Engineering Lab Session 4 – Restriction Mapping
Mar 31	Genetic Engineering Lab Session 5
Apr 7	Genetic Engineering Lab Session 6
Apr 14	Genetic Engineering Lab Session 7
April 21	Laboratory Books and Scientific Laboratory Report Due at the start of class. Laboratory check-out