BIOLOGY 285

2.0 units
Section 0416
Summer 2015
Professor: Patricia Zuk, PhD
email: zukp@wlac.edu

LABORATORY: MSA Rm. 303
3:00 to 4:50 PM

OFFICE HOURS: by appointment or from:

1. 9:00 to 10:00 AM Monday through Thursday
2. Office is MSB Room 210

PREREQUISITES: none but Biology 3A or Biology 6 is strongly recommended

COURSE DESCRIPTION: This directed study course is designed to give students hands-on experience in the isolation and manipulation of DNA in a laboratory setting. Students will learn how to transform bacteria with recombinant DNA, expand these bacteria and isolate the introduced DNA. Students will also learn about the analysis of DNA using restriction enzymes and agarose gel electrophoresis, DNA amplification through PCR and the creation and introduction of recombinant plasmids.

ATTENDANCE: In taking this class, you are committing to the entire course. Therfore, attendance at every lab is mandatory (see Administration Regulation E13). Your grade in this course also depends on your performance – which is dependent upon your attendance. If you miss more than two labs during the semester, **I WILL DROP YOU from the course.** So be sure to check your schedules. If you cannot commit to this entire course, you will not be allowed to take it.

The labs begin at 3:00 PM and will run until 4:50 PM. Most labs will be prefaced with a small lecture that introduces the topic of the day and the fundamental theories behind it. Following the short lecture, the labs will begin. If you arrive late for lab, you will miss this lecture and I will NOT repeat it. As a result, you may lose valuable information. So be sure to be on time.

I consider extreme tardiness or early departure from lab without a valid cause to be very disrespectful conduct. However, I realize traffic and life gets in the way sometimes. So being late and having to leave early is fine – every now and then. **Do NOT insult me or your classmates by consistently showing up late to lab every time!!!**

That being said, if you have conflicts in your schedule – come and talk to me. I am very understanding about many things and do not bite my students (much!). Also, exchange numbers with your lab-mates so that if you are running late for you can relay a message to me through them.

WITHDRAWING FROM THE CLASS: Any student withdrawing from the class must inform the admissions office and complete the required steps for withdrawing. Students failing to follow the correct procedure for withdrawing will receive an 'F' at the end of the semester. I will not be held responsible for your grade if you fail to correctly withdraw from this course. Therefore, confirm your registration status. Finally, there are deadlines for withdrawing without a "W", with a "W" and a deadline where withdrawing is no longer possible. Be aware of these dates.

COURSE CONSTRUCTION: This course is comprised of three labs per week that each run for one hour and fifty minutes. Breaks will NOT be given during these sessions but there will be plenty of "down-time" that will allow you to relax for a bit.

You are welcome to make an audio recording of my lectures and you are welcome to make a video recording what you are doing in the lab. Please don't video me! I would hate to see myself one day on YouTube!!

I also have my own personal website – www. patriciazuk.com where any lecture presentations associated with our lab can be found along with any additional learning materials. This website is password protected with the username of **student** and the **case-sensitive password** of **#1Wlacstudent**. The lectures on this site are "student lectures" and do NOT contain every detail you will find in my lecture presentations or will hear throughout my lectures. This is so that you are required to pay attention and write some things down. Therefore, please print out these lectures and bring them to class so that you may supplement them with your own notes. You may be also required to re-create simple figures and diagrams that I may draw on the white board so bring a lecture notebook for these notes. This lecture notebook should be kept separate from the lab notebook that you will also bring to class.

Videos shown in lab are to be considered as important and you should pay close attention to the material presented in them.

Handouts will be given in class so be sure to pick them up the day they are offered. I am not guaranteeing that these handouts will be available after the day I offer them.

LABORATORIES: While I may give a small lecture presentation at the start of each lab, this course is a lab-based course. You will be required to purchase a lab manual from the bookstore. This manual will contain the protocols that you will be performing in lab. This lab manual is MANDATORY. Any student not purchasing a lab manual will NOT be allowed to participate in this course. Don't worry, this manual is not expensive! Make sure to **ALWAYS BRING YOUR LAB MANUAL TO EACH LAB.**

You will work in teams of 2 or 3 for each lab but are also encouraged to interact with other groups throughout the lab. Each student will keep a **lab notebook** for their observations and conclusions. This lab notebook is a bound notebook and should be kept as a separate notebook containing only your laboratory information. These notebooks are available in the bookstore. If not, your professor will tell you where to buy one. You MUST buy a lab notebook or you will NOT be allowed to participate in this course. Don't confuse your lecture notebook with your lab notebook. Your lecture notebook is for taking whatever notes you wish to during the short pre-lab lectures. It is also for taking notes on any research you do outside the lab. Your lab notebook is a bound notebook for outlining the protocol you are performing and for recording the data you obtain during that protocol. DO NOT put lecture notes in this lab notebook unless they pertain specifically to the lab.

Each lab you do will be recorded in this book. Use the format below for each lab:

1. Each lab must be titled and dated.
2. The Purpose or the Specific Aims of the lab should be written out. If there is more than one purpose, be sure to write out all of them.
3. You should write a section titled Background that details the theory behind what you are doing and references any previous results other groups have achieved. In this section, you can also detail what you think might happen once you perform the lab.
4. You should also write out a list of the Equipment you will be using and include any calibration results if the equipment requires it. For example, if you are doing a lab that involves a pH meter,

you would write down how you calibrated the machine using two distinct buffers. If the equipment provides a print-out of the calibration results, you would place that here.

5. Your lab manual should also include a detailed Protocol for the procedure you are performing. Any changes you make to the protocol must be recorded here. This is so that you may repeat this protocol again and again and get consistent results every time.
6. A Data & Observations section should also be part of each lab in which you obtain data and create the required graphs, tables and diagrams in your notebook. In addition to data, you will also make an observations about the protocol in this section
7. Conclude each lab with some brief statements as to how your data and observations related to the purpose of the lab. Label this section as Conclusions.

WEST LA COLLEGE STUDENT LEARNING OUTCOMES (SLOs): West LA College as an institution is committed to an environment of learning and respect for its students. Its mission is to serve the community by providing quality instructional services through its programs and facilities. The college has created a series of Student Learning Outcomes (SLOs) that are designed to maximize the successes and experiences of the students here at WLAC.

A. Critical Thinking: Analyze problems by differentiating facts from opinions, using evidence, and using sound reasoning to specify multiple solutions and their consequences.
B. Communication: Effectively communicate thought in a clear, well-organized manner to persuade, inform, and convey ideas in academic, work, family, and community settings.
C. Quantitative Reasoning: identify, analyze, and solve problems that are quantitative in nature.
F. Technological Competence: Utilize the appropriate technology effectively for informational, academic, personal, and professional needs.

BIOLOGY PROGRAM SLOs: In addition, the Biology program also has several unique SLOs.

A student who completes this program will be able to:
1. Explain how scientists investigate causes of natural biological phenomena.
2. Explain how living things are organized, reproduce, acquire matter & energy, and inherit & express genetic instructions.
3. Utilize biological information to make informed decisions about environmental issues.
4. Utilize biological information to make informed decisions about personal issues.
5. Perform basic biological lab procedures.

STUDENT LEARNING OUTCOMES FOR BIOLOGY 285: At the end of the semester, the students should understand and be able to explain the fundamental concepts of the following:

LEARNING OBJECTIVES FOR BIOLOGY 285: In addition to overall learning outcomes, there are multiple subject and technical objectives that the students should achieve by the end of the semester. These objectives encompass many of the major themes presented in this course, in addition to covering more specific topics.

SUBJECT OBJECTIVES: At the end of the semester the students should demonstrate proficiency in understanding and explaining the following:

1. The structure and function of the nucleus, including how DNA is organized in both prokaryotes and eukaryotes.
2. The process of DNA replication and RNA transcription and protein translation in prokaryotes.

3. The control of prokaryotic gene expression.
4. The structure of a bacterial plasmid and how it can be used in recombinant DNA technology
5. How bacteria can be transformed with recombinant plasmids
6. How the pGLO plasmid works in transformed bacteria, including how it can be used to identify transformed DNA colonies
7. The importance of sterile technique when working with bacteria.
8. How bacteria grow in overnight liquid cultures.
9. The principles behind how recombinant DNA plasmids can be isolated from bacterial cells through an alkaline lysis protocol.
10. The principles of amplifying DNA through polymerase chain reaction (PCR).
11. How restriction enzymes work, including what sequences of DNA do these enzymes recognize and how they can be used in the creation of a piece of recombinant DNA.
12. The types of ligations that can be used in creating recombinant DNA.
13. How agarose gel electrophoresis separates DNA pieces of different sizes.
14. How the individual techniques of this course are brought together by researchers in order to create a piece of recombinant DNA for use in the research lab, clinic or in commercial applications.

TECHNICAL OBJECTIVES: Add the end of the semester, the student should be able to perform the following within a laboratory setting:

1. Weighing a given substance using an electronic balance.
2. Determining the absorbance of DNA using a spectrophotometer and the ability to calculate its concentration based on this value.
3. The ability to pipette specific volumes using serological pipets and a pipet-aid or a micropipet
4. The set up and performance of an experiment to transform DNA into a bacterial cell.
5. The set up and performance of an experiment to amplify transformed bacterial in a liquid culture.
6. The set up and performance of an experiment to isolate of DNA from bacterial cells
7. The set up and performance of an experiment to analyse isolated DNA, including being able to make an agarose gel, run the DNA using that gel and analyze the resulting DNA migration pattern
8. The set up and performance of an experiment to analyse isolated DNA by means of a restriction digest.
9. The set up and performance of an experiment to amplify DNA by PCR.
10. The set up and performance of an experiment to purify DNA.
11. The set up and performance of an experiment to ligate DNA into a bacterial plasmid.
12. The simulation of DNA replication, RNA transcription and protein translation if given specific DNA sequences.
13. Sterile bacterial technique used in the propagation of bacterial cultures.

COURSE MATERIALS: be sure to bring these to each and every lab:

1. Lab Manual: The manual will be available to you in the bookstore for a small price. You MUST purchase this manual to participate in this course

2. Lab notebook: A bound notebook. Appropriate lab notebooks are available at the bookstore or your professor will give you information as to where to obtain one. This book will be used to record your laboratory observations

4. Lecture notebook: The type you use may be your own preference but please purchase a separate notebook from that of your lab notebook. This book will be used to supplement the lectures given in the morning and afternoon sessions. You should also print out the lecture slides prior to coming to class and put these in your notebook. As a result, a three-ring binder may be a good option. That way you can place your notes and the printed slides together in the same notebook.

5. Numerous colored pens and pencils for lectures and labs.

COURSE EVALUATION: There will be one exam for this course. It will make up 25% of your grade and will be based on the protocols you have performed in this course and the theories behind them. **I will not give a make-up exam if you miss the final written exam.** Let me say this again, **I will NOT allow you to re-take your missed exam at any other time.** I realize that everyone has a good reason for missing a test from time to time, but in the interest of being fair to everyone, I must create a single policy and stick to it no matter the individual, personal circumstances.

I will discuss each exam and what to expect – so don't freak out! I may also provide you with some study guides to ensure you are keeping yourself on track during your study times. But don't count on it! **This is a majors biology course** so you are expected to know what could be on an exam.

You will also be assessed in the 6th week. This week will assess your performance in the lab. During this week, you will be given specific lab protocols to perform. I will watch you perform these tasks and will ask you questions about what you are doing. You will be expected to be able to tell me what you are doing, why you are doing it and what you expect to happen. I will NOT penalize you if your experiment does not work. This evaluation week is designed to assess what you learned in the previous 5 weeks. I will also ask to see your lab notebook. An assessment of your lab notebook will be done and will be part of the 25% performance grade.

Finally, the other 50% of this course is based entirely on attendance. Show up for each and every lab and get 50 out of 100 total course points. Each lab you miss will result in the subtraction of 5 points from your attendance total. This means if you miss 5 labs – you will lose half of your attendance points and 25% of the entire point total! As specified in the attendance section of this syllabus, you must commit to this entire course. I reserve the right to drop you from this course if you miss more than two labs.

Exam breakdown:
Lecture exam = 1 x 50 points = 50 points
Lab performance = 50 points
Attendance = 100 points
Total points = 200 points

Here are the ranges for the following grades (test and overall course grade):
85% - 100% = A
73% - 84% = B
60% - 72% = C
50% - 59% = D

Cheating will NOT be tolerated. ANY STUDENT FOUND CHEATING WILL RECEIVE THE GRADE OF 'F' FOR THAT EXAM AND MAY BE EXPELLED FROM THE COURSE!!! Please see the college's policy on academic dishonesty for additional information. While not written in this syllabus, the college's policy on academic dishonesty will be adhered to in this course.

Schedule of Topics

Week	Class	Lab Experiment	Lecture Topic
1	1	Introduction to lab	Safety in the Lab
	2	Pipetting & weighing & spinning	Lab equipment
	3	Making solutions	Molarity
2	1	Bacterial transformation	Bacterial recombination
	2	Analysis of transformation & Bacterial Culture set-up	Bacterial growth curves Gel electrophoresis
	3	Isolation of plasmid DNA	
3	1	Agarose gel electrophoresis	Restriction enzymes
	2	Analysis of precut lambda DNA	Restriction digest questions
	3	Restriction digest of DNA & analysis of restriction digest	PCR
4	1	PCR amplification of DNA	PCR worksheet
	2	Analysis of PCR results	PCR worksheet - answers
	3	Purification of PCR products	Genomic DNA protocol
5	1	Genomic DNA isolation	Amelogenin project
	2	Amelogenin PCR	
	3	Analysis of Amelogenin PCR	
6	1	Restriction digest analysis/PCR analysis (**Evaluation method)**	
	2	Electrophoretic analysis of digest/PCR (**Evaluation method)**	
	3	Lab exam	Lab clean up & party???