

MICR/MBMB 480 FALL 2018

Mondays and Wednesdays 2:00-6:00 PM (Primary)

Tuesdays and Thursdays (As needed, limited time frames)

GRADING, SCHEDULE & LAB RULES

Instructors:

Dr. Derek Fisher

Dr. Bethany Rader

Dr. Kelly Bender

Office: Life Science III room 1007

Office: Lindegren room 34

Office: Life Science II room 106

Teaching Assistant:

Noor Kazim

Email: noor@siu.edu

Grading: The course is broken into thirds with Dr. Fisher overseeing the first section, Dr. Rader the second, and Dr. Bender the last. Section grades are compiled to calculate the final course grade. Plus/minus grading will not be used – the standard percentage scale will apply (10% break points for letter grades A-F).

There will be 100 points for each third of the course, awarded as follows:

Exam	25
Lab Reports and Assignments	40
Quizzes (3)	15
Laboratory Skills	20
Total Possible Points	100

Part of your grade will be the instructors' assessment of your lab skills. This is not based on attendance (**since you are expected to attend every lab**), but on how well you follow the directions, how you work with others in a group, and how well you take responsibility for the materials and equipment you use in class. Please note that you will not be penalized in this area if one of your experiments fails. **How you conduct the experiment is more important than the outcome.**

Lab courses involve a great deal of planning and preparation and consume expensive materials. There will be **no** make-ups for any labs, exams, or reports. Any unexcused absences will result in deducted points with the value of deduction at the discretion of the instructor. **You must provide yourself with a lab coat and with marker pens that write on glass and plastic.**

Laboratory Rules

Safety is our main concern in the lab. Every student must wear a lab coat at all times. No sandals or open-style footwear is allowed (fragments of broken glass are often found on lab floors – and can be extremely painful!). Always follow directions carefully and especially be aware of the **CAUTION** notes in your lab manual. You will be told in your lab manual to wear gloves and/or eye goggles during certain procedures -- do so. There is to be absolutely no

eating, drinking, gum chewing, or applying of cosmetics in the lab at any time. Anyone not following these directions will be asked to leave immediately -- there are no exceptions.

One of the instructors will be present during each lab period to explain what is to be done that day, discuss concepts, and answer any questions or problems. We may occasionally exit the lab – this is a senior level lab course and you are expected to develop some independence and to work cooperatively with your lab partners. You will always be able to find us during lab periods either in our offices or labs. Please feel free to come and talk to us, especially if you are experiencing difficulties during the lab period (when you aren't actually in the middle of an experiment, of course). Remember, we will not know that there is a problem and will be unable to address it unless you inform us. We also welcome well-thought-out suggestions or comments on the lab or about the concepts covered in the lab manual.

As mentioned above, how you conduct the experiment is more important than the outcome. Keep this in mind during those times (and there are bound to be a few) when things don't seem to be working. If you conscientiously follow directions and think about what you are doing (both before and during the experiment), you should master those skills expected of you in this lab. But if you're sure you did everything right and your experiment still doesn't work, don't despair. There is such a thing as the fickleness of lab experiments and it happens at some time to everyone. That is why you are graded on your effort and not necessarily on your outcome. If, however, none of your experiments work, some reexamination of your lab technique may be in order.

Units & Conversion Factors etc.

Metric Prefixes

M = mega = 10^6	k = kilo = 10^3	m = milli = 10^{-3}	μ = micro = 10^{-6}
n = nano = 10^{-9}	p = pico = 10^{-12}	f = femto = 10^{-15}	a = atto = 10^{-18}

Conversions

1 μ g of a 1-kb DNA fragment = 1.5 pmol; 3.0 pmol ends
1 pmol of a 1-kb DNA fragment = 0.66 μ g
10 kDa protein \approx 270 bp DNA
1 kb dsDNA = 6.6×10^5 Da

<u>Nucleic acid</u>	<u>Concentration (μg/ml) for 1 A_{260} unit</u>
dsDNA	50
ssDNA	33
ssRNA	40
oligos	20

Dye migration in polyacrylamide denaturing gels

Size of DNA fragments (in bp) with which the dyes would migrate

<u>% Gel</u>	<u>BPB</u>	<u>Xylene Cyanol</u>
6	26	106
8	19	75
10	12	55

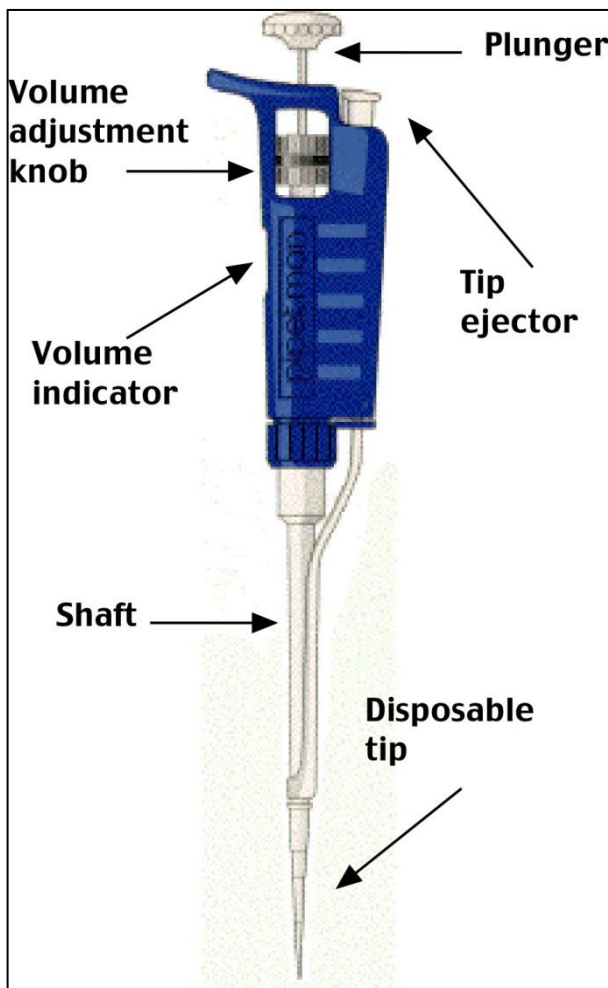
Using a Pipetman

Molecular biology experiments often require accurate and precise transfer of very small volumes of liquids. Adjustable pipeting device called a Pipetman are used for these transfers. There are several different models, each having a specific range of volumes. Use the Pipetman appropriate for the volume you want to transfer for the greatest accuracy. Different plastic disposable tips are used for different models. Tips must seal properly on the shaft for an airtight seal to get the desired volume. Proper technique must also be used.

Instructions for Use

Model	Volume
P2	0.2 - 2 μ l
P10	1 - 10 μ l
P20	2 - 20 μ l
P100	10 - 100 μ l
P200	20 - 200 μ l
P1000	100 - 1000 μ l

1. Hold the Pipetman vertically in one hand. With the other hand, turn the volume adjustment knob until the volume indicator is 1/3 turn above the desired volume, then adjust the volume down to the desired value. The volume indicator shows μ l, with the black numbers showing whole μ l and the red numbers showing 10ths (some also show 100ths of μ l).



For example, to transfer 5.5 μ l using a P-10 Pipetman, the volume indicator should show:

0 (black) 5 (black) 5 (red)

2. Place a clean and/or sterile pipet tip securely on the shaft.

3. Smoothly press the plunger down with your thumb to the FIRST STOP.

4. Immerse the tip below the surface of the sample.

5. Allow the plunger to return smoothly and slowly to up position. Do not let the plunger snap up.

6. Look at the sample in the tip, there should be no air bubbles present.

7. Withdraw the tip from the sample. If liquid clings to the outside of the tip, remove it by gently touching the tip to the inside of the sample container. Keep the Pipetman vertical.

8. To dispense the sample, touch the tip end against the side wall of the receiving vessel and

depress the plunger slowly to the first stop, wait 1-2 seconds (longer for viscous solutions), then depress the plunger completely to the second stop to expel any residual liquid in the tip.

9. Keep the plunger fully depressed and withdraw the tip from the vessel carefully, keeping the tip against the vessel wall.

10. Allow the plunger to return to the up position, then discard the tip by depressing the tip ejector button.

Laboratory Reports

As indicated in the scoring for the course, your performance on the laboratory reports/assignments constitutes more than 40% of your grade. Laboratory reports and assignments are considered individual projects; that is, although you will be working in groups during lab, you must write your own lab report.

All lab reports must be typewritten, single-spaced, in 12-point Arial font. Graphs and tables may be hand-drawn or computer-generated. Reports must be received by no later than **5:00 p.m. on the due date. Late reports will be assessed a point penalty – 5 points will be deducted from the score for every day past the deadline.**

Laboratory reports are due on the following dates and worth the points listed:

<u>Laboratory Report/Assignments</u>	<u>Due Date</u>	<u>Points</u>
Beta Galactosidase Assay	Sept 12	15 – short
Growth Rate & Cell Constituents	Sept 26	25 – complete
<u>Estimated Dates for Later Write Ups</u>		
Rader lab report 1	Oct 17	10 – short
Rader lab report 2	Oct 31	30 – complete
Bender lab report 1 (Ex. 1-3)	Nov 26	25 – complete
Bender lab report 2 (Ex. 4-5)	Dec 5	15 – short

Short laboratory report (10 points for results, 5 points for discussion). Include only the results and a brief discussion, which should be no more than one page.

Complete laboratory reports will be formatted as in standard scientific publications (see description below and the examples on D2L) and will include the following sections:

Conclusion = Summary = Abstract: One paragraph summarizing **YOUR** results. Did your experimental approach successfully test your hypothesis? Summaries of scientific papers are often distributed without the rest of the paper. **The reader should therefore be able to understand your summary on its own.**

Introduction: 2-4 concise paragraphs that describe the experiment and its objectives (*i.e.* the questions you are asking, the hypotheses you are proposing *before* you actually start the experiment). Not to exceed one page.

Materials and Methods: Include any additions to or changes from the procedure in the Lab Manual. Apart from this just say: "Please refer to MICR 480 Laboratory Manual".

Results: 4-5 paragraphs describing the results (either for your group or the entire class, depending on the experiment). Where possible, summarize results in tables or graphs. Number and provide a title for each table or graph. Refer to them by their number or title in the text. Provide a legend for each figure describing what the data refer to and a key for any abbreviations or symbols used. Footnotes may be used below tables. Graphs may be plotted by hand or computer-generated. Table titles should be placed at the top of the table. Figure titles and legends should be placed below or immediately adjacent to the figure (not above the figure).

Discussion: Discuss the principles of the experimental approach. Explain **YOUR** results with reference to these principles and any hypotheses you proposed in your Introduction. The Discussion should also include possible explanations for any problems you encountered, e.g. if you got only negative results. Not to exceed 2 pages.

Example Summary:

Under anaerobic conditions *Escherichia coli* converts pyruvate to D-lactate by an NADH-linked lactate dehydrogenase (LDH). The *ldhA* gene, encoding this LDH was cloned using λ 10E6 of Kohara's collection as the source of DNA. The *ldhA* gene was sequenced. The *ldhA* gene of *E. coli* was highly homologous to genes for other D-lactate specific dehydrogenases, but unrelated to those for L-lactate specific enzymes. We disrupted the *ldhA* gene by inserting a kanamycin resistance cassette into the unique *KpnI* site within the coding region (Figure 1). When transferred to the chromosome, the *ldhA::Kan* construct abolished the synthesis of the D-LDH completely. When present in high copy, the *ldhA* gene was greatly over-expressed suggesting escape from negative regulation (Table 3).

Example Table:

TABLE 4. **LDH Activity of Regulatory Mutants**
LDH (specific activity^{*})

Strain	No buffer	HEPES	TAPS	AMPSO
		pH 8.0	pH 8.5	pH 9.5
NZN130 (Parent)	640	310	250	71
NZN131 (#Mutant)	1690	850	1050	1050
NZN132 (#Mutant)	690	780	710	190

^{*}Specific activity in nmoles of NADH min⁻¹ mg⁻¹ protein.

[#]Spontaneous, derepressed mutants (see Materials and Methods).

All cultures were grown anaerobically in rich broth plus 0.4% glucose for 6 hours at 37°C. Buffers were used at 100 mM.

Note: Put units in the headings of the table or of individual columns (or in footnotes if too long to fit in headings) instead of repeating them on each line of the table. Round off numbers to 3 or 4 significant figures.

Note: Tables and figures should be cited in the text prior to their appearance in the manuscript.

Schedule of Experiments, Fall 2018

General Comments

You will sometimes be required to come in at non-scheduled times to perform various chores such as taking your plates out of the incubator or putting your overnight cultures in the cold room. You may lose points if your experiment is ruined because you forgot to come in to lab to check on something, so don't forget.

Keep good records of all your results, including culture densities, plate counts, etc. Also note any unusual results in your manual (for example, if your culture seems to take much longer than anyone else's to double). Many discoveries rely on *seemingly trivial details*.

All dilutions are to be done in sterile saline unless otherwise instructed. Incubate all liquid cultures in a shaking water bath and incubate plates upside down in the incubator. Centrifugation is to be done only by the instructor. On a regular basis remove and discard plates or cultures in the cold room that you no longer need.

Detailed Timetable

Each week of classes has FOUR lab days. Of these, Monday and Wednesday are the formal lab periods and Tuesday and Thursday are the intervening days when you may have to inoculate cultures, examine plates, etc.

Week 1: Dr. Fisher's Section: Basic Techniques (BT) and Genotypes and Phenotypes (GP)	
Mon 20 Aug	Dilutions, streaking, and spreading (BT)
Tues 21 Aug	Count Colonies (BT)
Wed 22 Aug	Genotypes and phenotypes (GP)
Thu 23 Aug	Record results (GP)
Week 2: Dr. Fisher's Section: Spontaneous and Chemical Mutagenesis (SCM)	
Mon 27 Aug	Select mutants by several approaches (SCM)
Tue 28 Aug	Count colonies (SCM)
Wed 29 Aug	Analyze mutants for growth defects (SCM)

Thu 30 Aug	Check plates for growth, record results and let incubate over break (SCM)
Week 3: Dr. Fisher's Section: Assay of Beta-Galactosidase (BG)	
Mon 3 Sep	Labor Day
Tue 4 Sep	Check results of mutant analysis (SCM)
Wed 5 Sep	Induce <i>lac</i> operon and assay beta-galactosidase (BG)
Week 4: Dr. Fisher's Section: Growth Rate and Cell Constituents (GRCC)	
Mon 10 Sep	Growth rate determination by optical density and viable counts (GRCC)
Tue 11 Sep	Store viable count plates in cold room (GRCC)
Wed 12 Sep	Chemical assays for protein and RNA (GRCC)
First Lab Report Due (15 points - SHORT report) Wed Sep 12	
Week 5: First Exam and Start of Dr. Rader's Section: Exercise 1 and Article Assignment	
Mon 17 Sep	First Exam
Wed 19 Sep	Experimental Design Discussion (Ex. 1)
Week 6: Dr. Rader's Section: Exercises 2-3	
Mon 24 Sep	Conjugation of <i>Serratia</i> and the <i>E. coli</i> WM20767/pRL27 transposon (TN) donor (Ex. 2)
Wed 26 Sep	Selection of transposon induced <i>S. marcescens</i> mutants (Ex. 3)
Second Lab Report Due (25 points - COMPLETE report) Wed 26 Sep	
Week 7: Dr. Rader's Section: Exercises 4-8	

Mon 1 Oct	Calculation of TN insertion frequency and phenotypic analysis of pigment mutants (Ex. 4)
	Extraction of gDNA from <i>S. marcescens</i> TN pigment mutants (Ex. 5)
Tue 2 Oct	Restriction enzyme digestion of <i>S. marcescens</i> TN mutant gDNA (Ex. 6)
Wed 3 Oct	Gel electrophoresis analysis of digested TN mutant DNA (Ex. 7)
	Precipitation of digested DNA and ligation (Ex. 8)
Week 8: Dr. Rader's Section: Exercises 9	
Mon 8 Oct	Transformation of ligations into <i>E. coli</i> DH5 α λ pir cells (Ex. 9)
Wed 10 Oct	Selection of <i>E. coli</i> transformants for plasmid preparation (Ex. 10)
Week 9: Dr. Rader's Section: Exercise 10-12	
Mon 15 Oct	Plasmid preparation of DNA for sequencing (Ex. 11)
Wed 17 Oct	DNA sequence analysis and chromosomal location of TN insertion determination (Ex. 12)
SHORT report for third lab (10 points) due Wed Oct 17	
Week 10: Dr. Rader's Section: Second Exam	
Mon 22 Oct	Second Exam
Week 11: Start of Dr. Bender's Section- Exercise 1: Preparation of Chemically and Electrochemically Competent <i>E. coli</i>, Transformation, and GFP Selection	
Mon 29 Oct	Ex. 1- Plasmid preparation
Wed 31 Oct	Ex. 1 continued- Preparation of cells and transformation
COMPLETE report third lab (30 points) due Wed Oct 31	

Thu 1 Nov	Ex. 1 continued- Count colonies and calculate transformation efficiency. Store plates at 4°C.
Week 12: Dr. Bender's Section- Exercise 2: Biotechnology-Biosynthesis of Indigo by Recombinant <i>E. coli</i>	
Mon 5 Nov	Ex. 1 continued- Compare transformation types and pick colonies for GFP induction. Ex. 2- Induction of naphthalene dioxygenase.
Wed 7 Nov	Ex. 1 continued- Observe GFP induction Ex. 2 continued- Indigo production and analysis
Week 13: Dr. Bender's Section- Exercise 3: SDS-PAGE of <i>E. coli</i>-pGlo proteins and Exercise 4: PCR Detection of GMOs in Food	
Mon 12 Nov	Ex. 3- Pour SDS-PAGE gel and run samples
Wed 14 Nov	Ex. 3 continued- Analyze PAGE and calculate protein molecular weight Ex. 4- Extract DNA from food and PCR
Week 14: Thanksgiving Break	
Nov 19-22	No labs
Week 15: Dr. Bender's Section- Exercise 5: Forensic DNA Analysis	
Mon 26 Nov	Bender Complete Lab Report- Ex. 1-3 (25 points)
Mon 26 Nov	Ex. 4 continued- Gel electrophoresis and analysis of PCR results. Which foods contained GMOs? Ex. 5- Set up PCR for forensic DNA analysis
Wed 28 Nov	Ex. 5- Gel analysis of forensic DNA PCR
Week 16: Dr. Bender's Section: Third Exam	
Mon 3 Dec	Third Exam
Wed 5 Dec	Bender Short Lab Report Due Ex. 4-5 (15 points)

Syllabus Attachment

Fall 2018

MISSION STATEMENT FOR SOUTHERN ILLINOIS UNIVERSITY CARBONDALE

SIU embraces a unique tradition of access and opportunity, inclusive excellence, innovation in research and creativity, and outstanding teaching focused on nurturing student success. As a nationally ranked public research university and regional economic catalyst, we create and exchange knowledge to shape future leaders, improve our communities, and transform lives.

IMPORTANT DATES *

Semester Classes Begin:.....**08/20/2018**
Last day to add full-term course (without Dean's signature):**08/26/2018**
Last day to withdraw from the University with a full refund:.....**08/31/2018**
Last day to drop a full-term course for a credit/refund:.....**09/02/2018**
Last day to drop a full-term course (W grade, no refund):.....**10/28/2018**
Final examinations:**12/10–12/14/2018**

Note: Please verify the above dates with the Registrar calendar and find more detailed information on deadlines at <http://registrar.siu.edu/calendars>. For add/drop dates that apply to shorter-than-full-term courses, please look at the Schedule of Classes search results at <http://registrar.siu.edu/schedclass/index.php>

FALL SEMESTER HOLIDAYS

Labor Day Holiday 09/03/2018
Thanksgiving Break 11/17–11/25/2018

WITHDRAWAL POLICY ~ Undergraduate only

Students who officially register for a session must officially withdraw from that registration in a timely manner to avoid being charged as well as receiving a failing grade for those classes. An official withdrawal must be initiated by the student, or on behalf of the student through the academic unit, and be processed by the Registrar's office. For the proper procedures to follow when dropping courses and when withdrawing from SIU visit: <http://registrar.siu.edu/students/withdrawal.php>

INCOMPLETE POLICY~ Undergraduate only

An INC grade may be assigned when, for reasons beyond their control, students engaged in passing work are unable to complete all class assignments for the course. An INC must be changed to a completed grade within one full semester (undergraduates), and one full year (graduate students), from the close of the term in which the course was taken or graduation, whichever occurs first. Should the student fail to complete the remaining course requirements within the time period designated, the incomplete will be converted to a grade of F and such grade will be computed in the student's grade point average. *For more information visit:* <http://registrar.siu.edu/grades/incomplete.php>

REPEAT POLICY

An undergraduate student may, for the purpose of raising a grade, enroll in a course for credit more than once. For students receiving a letter grade of A, B, C, D, or F, the course repetition must occur at Southern Illinois University Carbondale. Effective for courses taken Summer 2013 or later, only the most recent (last) grade will be calculated in the overall GPA and count toward hours earned.

This policy will be applied to all transferrable credit in that only the last grade will be used to calculate grade point average. Only those courses taken at the same institution are considered repeats under this policy. *See full policy at*

<http://registrar.siu.edu/students/repeatclasses.php>

GRADUATE POLICIES

Graduate policies often vary from Undergraduate policies. To view the applicable policies for graduate students, please refer to the graduate catalog at <http://gradschool.siu.edu/about-us/grad-catalog/>

DISABILITY POLICY

Disability Support Services provides the required academic and programmatic support services to students with permanent and temporary disabilities. DSS provides centralized coordination and referral services. To utilize DSS services, students must contact DSS to open cases. The process involves interviews, reviews of student-supplied documentation, and completion of Disability Accommodation Agreements. <http://disabilityservices.siu.edu/>

PLAGIARISM

See the Student Conduct Code <http://srr.siu.edu/student-conduct-code/>

MORRIS LIBRARY HOURS: <http://libguides.lib.siu.edu/hours>

ADVISEMENT: <http://advisement.siu.edu/>

SAFETY AWARENESS FACTS AND EDUCATION

Title IX makes it clear that violence and harassment based on sex and gender is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, etc. If you or someone you know has been harassed or assaulted, you can find the appropriate resources here:

<http://safe.siu.edu>

SALUKI CARES

The purpose of Saluki Cares is to develop, facilitate and coordinate a university-wide program of care and support for students in any type of distress—physical, emotional, financial, or personal. By working closely with faculty, staff, students and their families, SIU will continue to display a culture of care and demonstrate to our students and their families that they are an important part of the community. For Information on Saluki Cares: call(618) 453-1492, email siucares@siu.edu, or <http://salukicare.siu.edu/>

SIU's EARLY WARNING INTERVENTION PROGRAM (EWIP)

Students enrolled in courses participating in SIU's Early Warning Intervention Program might be contacted by University staff during a semester. More information can be found at the Core Curriculum's Overview webpage: <http://corecurriculum.siu.edu/program-overview/>

EMERGENCY PROCEDURES

We ask that you become familiar with **Emergency Preparedness @ SIU**. Emergency response information is available on posters in buildings on campus, on the Emergency Preparedness @ SIU website, and through text and email alerts. *To register for alerts visit:* <http://emergency.siu.edu/>

STUDENT MULTICULTURAL RESOURCE CENTER

The Student Multicultural Resource Center serves as a catalyst for inclusion, diversity and innovation. As the Center continues its work, we are here to ensure that you think, grow and succeed. We encourage you to stop by the Center, located in Grinnell Commons, to see the resources available and discover ways you can get involved on the campus. *Visit us at* <http://inclusiveexcellence.siu.edu/>

LEARNING AND SUPPORT SERVICES

Help is within reach. Learning support services offers free tutoring on campus and math labs. To find more information please visit the Center for Learning and Support Services website:

Tutoring : <http://tutoring.siu.edu/>

Math Labs <http://math.siu.edu/courses/course-help.php>

WRITING CENTER

The Writing Center offers free tutoring services to all SIU students and faculty. To find a Center or Schedule an appointment please visit:

<http://write.siu.edu/>

DIVERSITY

Southern Illinois University Carbondale's goal is to provide a welcoming campus where all of our students, faculty and staff can study and work in a respectful, positive environment free from racism and intimidation. *For more information visit:* <http://diversity.siu.edu/#>

MILITARY COMMUNITY

There are complexities of being a member of the military community and also a student, and military and veteran related developments can complicate academic life. If you are a member of the military community and in need of accommodations please visit Veterans Services at <http://veterans.siu.edu/>

SIU ONLINE: <https://online.siu.edu/>

Need help with an issue? Please visit SALUKI SOLUTION FINDER at <http://solutionfinder.siu.edu/>