BIMM 121: Microbiology Laboratory Fall 2018

Instructor: Cindy Gustafson-Brown

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email: cgb@ucsd.edu (Put **BIMM121** in the subject line!)
Please present your questions about course material in person, not by email.
I cannot guarantee an answer to your email, unless it is an urgent issue.
DO NOT contact the instructor or IAs through TED. Email us directly.

Lecture: Tu/Th 12:30-1:50, York 3010

Office hours: Tues 2-3 PM, York 3010 *(starts on Oct 9)*

Labs: York 2310 and 2332 – Check which room you are in!
Wed/Fri, noon - 3:50 PM

Instructional assistants (IAs)

A01	York 2310	Albert Nguyen	amn026@ucsd.edu
A02	York 2332	Rachel To	r1to@ucsd.edu

Course Structure

This course will introduce you to the fundamentals of microbiology and allow you to explore the many ways in which microbes affect and are used in our world. We begin the course with a foundation in basic techniques, such as aseptic technique, microscopy, methods of quantitating microbes, and preparing and examining stained slides. This will be followed by: bacterial physiology, the roles of microbes in the nitrogen cycle, antibiotics, the use of microbes in food science, and the use of transposons for bacterial mutagenesis. Each of these units involves multi-day experiments, and there will be considerable overlap in the execution, methodology, and analysis. Throughout the course, you will also receive training in data analysis, scientific reasoning, and scientific writing.

Required equipment

For this lab you will need to bring:

1. A lab manual (pick up on first day of class if you ordered it on time)
2. A bound lab notebook (with carbons)
3. A lab coat (extending to your knees)
4. A Sharpie marker (black or blue fine point, NOT extra-fine)
5. Eye protection (You may wear either safety glasses or goggles; standard prescription eye glasses are not sufficient. You must be able to look through a microscope while wearing the safety glasses, so they should not bulge outward.)
6. A calculator … yes – every day (you may NOT use a cell phone in the lab!)
7. Long pants (not leggings, not anything tight-fitting, not cropped)
8. Closed shoes and socks which cover your ankles
9. Something to tie back long hair

Lab safety training

Enrolled and waitlisted students MUST successfully complete the Biology Lab Safety Training and Assessment BEFORE the first lab session: https://dbsportal3.ucsd.edu:3443/safety-training/.

Attendance and Absences

1. Your attendance is required at EVERY **lab** and through the entire lab period, until all the experimental work for the day is completed. *This includes discussion/learning times in lab.*
2. Absences will NOT be treated lightly. Your absence will place an unnecessary burden on your partner. There are no make-up labs and you will not be allowed in the lab on non-lab days or in the other Micro lab sections, although you may be asked to make up the work from the day you missed. If you miss a quiz, this will be the quiz that will be dropped.
3. Absences due to scheduling conflicts (*e.g.* other classes, exams, scheduled meetings, etc) will not be excused. If you are likely to have interviews for graduate school, please schedule them on non-lab days.
4. If you are ill or have an emergency on a day or when there is a lab, exam or assignment due, e-mail or call (instructor and IA) before the start of lab, the due date, or exam. It is not sufficient to contact your IA alone as your IA does not have the authority to excuse your absence. All absences without **PRIOR** approval of the instructor (not the IA) will be considered unauthorized, unless an emergency prevents you from notifying us. If an emergency prevents you from contacting us prior to the lab, you must contact Dr. Gus within 24 hours to explain.
5. If you are ill enough to miss lab, a due date, or an exam, you must go to a health clinic and provide documentation of your illness. Appropriate documentation will be required for all unavoidable absences. Provide this to your IA within 1 week of your absence.
6. YOU MUST MEET WITH YOUR IA TO DISCUSS MISSED WORK. Once you have done this, email your instructor the date of the meeting.
7. **75-point penalty** for the first unauthorized, unexplained absence from the lab. If there is a second such absence, you must drop the course or receive an F in the course.
8. **Tardiness** in lab will impact your grade. You may miss a quiz. You will also miss important announcements and instructions. This puts an undue burden on your partner. If you are late more than once, you may be asked to drop the course.

Assignment Deadlines and Submission Policies:

1. A hard copy of each assignment is due **at the start of lecture or lab** on the due date. Assignments turned in more than 10 minutes after the start of class will be considered late. Penalty for late assignments is 50%, if turned in by 5 PM the next day. Assignments will not be accepted after that. It is your responsibility to make arrangements with your IA, **well in advance**, to turn in the late work.

2. In addition to the hard copy, you are required to submit an electronic copy of some assignments to Turnitin online. A link to the e-submission website will be provided on TED. There is a penalty for late online submissions. Failure to submit to Turnitin will result in zero points recorded for the assignment.

   By taking this course, students agree that their assignments will be subject to review for textual similarity by Turnitin for the detection of plagiarism. All submitted assignments will be included as source documents in the Turnitin reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin service is subject to the terms of use agreement posted on the Turnitin site.

3. Although you will be doing the experiments and collecting data with partners, you must hand in your own homework, *written in your own words*. **Copying someone else's homework is cheating**. **Showing your homework to someone else is likewise cheating.** (see below)

4. Extra credit of any kind, as well as online assignments, must be submitted on time, you will not receive credit.

Before you start this course

It is assumed that before coming to his course, you already have a working knowledge of the topics listed below. These foundational concepts are the bread and butter of a biology major. If these are fuzzy, or fading in your memory, it would be a good idea to review them before class. We will assume you already know this material. It will be necessary understand the course, to complete the assignments, and to pass the quizzes and exams. In fact, you will be specifically tested on some of this material, to ensure you are ready to study microbiology.

- general categories of microbes and their definitions and characteristics
  - eukaryotic organisms
    - protists (algae, protozoa)
    - fungi
  - prokaryotic organisms
    - bacteria and *Archaea*
- basic cell structure
- basic biochemistry (glycolysis, TCA cycle, electron transport chain, photosynthesis, redox equations)
- central dogma of biology
- the scientific method
  - variables
  - controls
  - experimental arm and control arm of an experiment
  - Background articles are posted in the "study aids" folder on TED.
  - There is also a review in the lab manual.
- using Excel spreadsheets
  - calculating simple values such as totals, averages, and standard deviation
  - using data from a spreadsheet to create charts with error bars

Reading for BIMM 121

All required reading for the course is in the lab manual. You are responsible for reading ALL the assigned material in the manual, BEFORE the day when you will do the relevant experiments. Beyond reading the material, you are expected to STUDY it enough to have a good working understanding of the experiments BEFORE coming to class! A reading list corresponding to each day of experiments will be posted on TED. Material is likely to be covered in lecture the day BEFORE lab, therefore, you are encouraged to read the material before the accompanying lecture. This will maximize your understanding of the lecture and your clicker points.

Components of the course grade

All assignments	**Points**
iClicker points	64 points
6 notebook checks at 9 points each	54 points
Lab skills/competence	70 points
Scientific method activity in lab 1	20 points
Homework assignments #1-5	227 points
8 lab quizzes (18 points ea, lowest dropped)	126 points
Midterm 1	128 points
Midterm 2	135 points
Midterm 3	176 points
Total	**1000 points**

Homework assignments	**Due date**		**Points**
1. Simple dilutions	Oct 12	in lab	28 points
2. Growth curve	Oct 26	in lab	40 points
3. Complex dilutions	Nov 2	in lab	28 points
4. Online library tutorial	Nov 14	11:59 PM	26 points
5. Unknown organism	Nov 29	in lecture	105 points
Total			**227 points**

Extra credit opportunities	**Due date**		**Points**
Pre-course survey	Sept 28	8 AM	3 points
Quiz on syllabus & regrade policy	Sept 28	8 AM	8 points
Yogurt worksheet	Dec 4	in lecture	10 points
Post-course survey	Dec 5	11:59PM	3 points

Lab quizzes are pop quizzes. They will be held without prior notice, during the first 15-20 minutes of the lab section. If you are late, you will not be given extra time to complete the quiz.

Every technician/researcher who works in a lab is expected to come to the lab prepared, with a thorough understanding the experiments they are about to conduct. This is basic lab competence, and to do otherwise would be negligence. It requires advance study, before arriving in the lab. Nearly all the students in this class are graduating in June. Think of this as “on the job training!”

Note: Just coming to lab does not ensure that you will get a passing grade in the class. You must hand in all assignments and get a passing score (70%, cumulative) on those assignments to get a C- in the class. You will not pass the course if the combined score for your three exams is less than 220 points (50%).

Exam dates

Midterm 1	Tues, Oct 23	in lecture
Midterm 2 Part 1	Thurs, Nov 8	in lecture
Midterm 2 Part 2 (dilutions only)	Fri, Nov 9	in lab
Midterm 3	Fri, Dec 7	in lab

Regrade Requests

All regrade requests should be submitted in writing within five days (not business days) of receiving the graded material. You must read the regrade policy, posted on TED, and submit your request with a "regrade request form" stapled to the exam/quiz/assignment. If there is free time in the lab, it is recommended that you (respectfully) speak with your IA about material you did not understand prior to submitting a request. Alternatively you may make an appointment with your IA, or come to Dr. Gus' office hours.

iClickers – 64 points total

Your iClicker MUST be registered on TED in order for your responses to be assigned to you. (In the grey menu on the left, click on "tools.")

Participation points – 40 points possible

In order to receive these points each day, you must respond to 80% of the questions in that lecture. It does NOT matter if your answer is correct. Everyone gets 2 free absences.

There are different numbers of questions each day, so you may use the table below to determine how many times you must respond for participation credit a given day.

total questions	7	6	5	4	3	2	1
required responses	6	5	4	4	3	2	1

Answering questions correctly – 24 additional "accuracy" points possible

You may receive additional credit for answering questions correctly.

There are different numbers of questions during each lecture. Every question is graded individually, even if it is a repeated question (e.g. asked before and after group discussion). The total number of questions over the quarter is unpredictable, and will only be known when the quarter ends. Accuracy points will also be allocated for clicker questions that are part of the lab discussion/learning times.

If you correctly answer 75% of the total questions in a quarter, you will receive the full 24 points possible for accuracy.

Here is a hypothetical example: IF there are 100 questions total in a quarter, you must answer 75 questions correctly to receive the maximum credit of 24 points. In

that case, you will receive 24 pt/75 Q = 0.32 points per question up to a maximum of 24 points.

This is NOT all or nothing. You get credit for as many as you answer correctly, up to 24 points.

iClicker FAQ

Q. What kind of clicker should I buy and where can I get it?

The iClicker, preferably version 2, although the regular iClicker works too. You can get one at the UCSD bookstore. iClicker 1 has had issues with "remembering" class settings even within the course of a lecture.

Q. Can I share a clicker with another student?

NO! If you are found to be using another student's clicker, or if another student is using your clicker, you will receive a failing grade in the class, and will be referred to the Office of Academic Integrity for administrative discipline.

Q. Where and when should I register my clicker?

Register it on class web site on TED. Look for the link in the Tools folder.

Q. When do the scored clicker questions start?

On Thurs, April 5, in lecture.

Q. What are the maximum clicker points possible?

64 points = 6.4% of your grade.

Q. How many days will we have clicker questions in lecture?

probably ~15 days

Q. How many days will I have to be present to qualify for full participation points?

~13 … you get 2 free absences without penalty

Q. How many participation points is each day worth?

~3.08 points per day up to a maximum of 40 points

Q. How do I get the participation points each day?

You must answer 80% of the questions posed that day. The number of questions will vary from lecture to lecture.

Q. If my battery fails, or I forget my clicker, but I do attend the class, do I get participation for that day?

No. You are allowed two free absences – so you don't have to ask me about making up the missed days. We don't have to negotiate credit; you can still get all 40 participation points from the remaining days you click in.

Q. If I click in during fewer than 13 lectures, will I get any participation points?

Yes, you can still get 3.08 points each day if you answer 80% of the questions that day.

Q. Will you post the participation points and clicker accuracy points on TED?

No. It is your responsibility to keep track of your own progress accumulating points.

Q. What is my best strategy for getting all the points?

Do your reading in advance, show up for as many lectures as possible, stay awake, and PARTICIPATE!

Lab notebook

Periodically the IA's will collect the carbons from your notebooks, without prior notice.

They will also check your table of contents. So keep your notebooks up to date!

General guidelines

Use pen.

No erasing or white-out.

Bound book with carbons and numbered pages.

Table of contents at front – keep up to date!

Start a new page each day – NO EXCEPTIONS!

NEVER skip pages. Do not fill in data retroactively.

It is best to start a new experiment on a new page.

However, sometimes this is a waste of paper.

So … if you used less than half the page, you may draw a line, specify the new topic with a title, and then start the next experiment on the same page.

If you have blank space left that you will not use, draw an X through it.

Help the reader follow the thread of an experiment from one day to another.

When you resume the experiment, write "continued from page ___." Then go back to where you last left off and write "continued on page ____."

Every page must be dated, indicate the experiment topic, and be signed by you.

Notebook should be clear, organized and complete.

Handwriting must be legible.

If spiral bound, *the fringe must be cut off the carbon copies before submitting them for grading*.

For each experiment, include:

A. Purpose of experiment (only necessary once, at the beginning of an experiment)

B. Procedure

Do not divide the pages into left and right halves.

Provide an outline of the protocol,

OR reference the lab manual, indicating the page(s) from which protocol was taken

Do not write various protocols in advance on different pages of your lab notebook, leaving blank pages between.

It is a good idea to write out a plan in advance.

It is up to you to decide how to do this. You may write out the protocol, or an outline of your plan, on notebook paper or index cards.

We don't do formal checks of "pre-labs" in this course.

Note any changes from the published protocol.

Note who did which part of the procedure
– who inoculated controls, etc

Note which organisms you used
– record the genus and species of every control

Record any errors

ALL calculations must be present.

All numbers must include appropriate units.

You may "continue" an experiment from one page to a distant page.

C. Observations

ALL observations must be recorded, in real time.

Always have your notebook with you when making observations.

Do not write on scraps of paper.

Describe what you observe.

Draw what you observe.

Each drawing should a good likeness of what you saw, so others may recognize it.

Drawings from microscope observations should include magnification.

Note any questions and connections

D. Conclusion or summary (when appropriate)

Include a brief conclusion for each experiment.

Include answers any questions in the manual or that were raised in lab manual, or anything else that you think is relevant.

Lab skills and competence

Seven percent of your grade will be based on participation in the lab, workshops, and computer labs. You will be expected to develop the habit of methodical, well-planned and organized work. This will help you with the experiments throughout the course. Further, all students are expected to be good lab citizens. Your attitude, cooperation with others, conscientiousness, work ethic, techniques and skill in the lab will contribute to your grade. When you get a job, these characteristics will likely be evaluated in your first "job review." Because a lab class is intended to prepare you for doing research in a real lab, we encourage the development of these traits. Lab performance will be based on the following criteria:

1. PRE-LAB PREPARATION
2. PRE-LAB PREPARATION
3. PRE-LAB PREPARATION
4. Paying attention during instructions/introductions
5. Being responsive to correction (Are you teachable?)

6. Technical skill and careful management of lab procedures (*e.g.* sterile technique, microscopy, experimental procedures, judicious use of reagents, proper storage of cultures, proper waste disposal, etc.)
7. Taking care of university property (properly cleaning/storing microscope, consistently locking your locker, etc.)
8. Ability to adapt to unforeseen procedural changes (flexibility)
9. Caliber of thinking before asking questions
10. Scientific approach (*e.g.* controls, experimental design, powers of observation)
11. Accuracy and precision
12. Independence and initiative
13. Safety consciousness
14. Organization and general neatness in lab
15. Contribution to your group and cooperation with classmates (teamwork)
16. Integrity

Grade Distribution

A = 90% - 100%
B = 80% - 89.9%
C = 70% - 79.9%
D = 60% - 69.9%
F = below 60%

There will be pluses and minuses assigned.

Course Website

We will use TED to post announcements, old exams, schedules, readings, practice material, experimental data, homework guidelines, etc. Please check the site regularly and familiarize yourself with the information provided.

UCSD email

The UCSD Policy and Procedural Manual states that UCSD email is "a recognized and official means by which University officials (including your IA and instructor) may, at their discretion communicate with students." This means Your UCSD email is an official means of communication! The policy further states, "it is essential that students attend to messages sent to their official UCSD email address." All UCSD students are responsible for the following:

- Determining their official UCSD email alias.
- Maintaining a valid email delivery destination address.
- Resolving impediments to accessing their UCSD email.
- Attending to delivered and posted messages on a frequent and consistent basis.
- Reading all mandatory UCSD communications.

http://adminrecords.ucsd.edu/ppm/docs/160-3.HTML

Students with disabilities *(from their website)*

Students requesting accommodations for this course due to a disability must provide a current Authorization for Accommodation (AFA) letter issued by the Office for Students with Disabilities (OSD) which is located in University Center 202 behind Center Hall. Students are required to present their AFA letters to Faculty (please make arrangements to contact the instructor privately) and to the OSD Liaison in the department in advance so that accommodations may be arranged.

Contact the OSD for further information: 858.534.4382 (phone)
osd@ucsd.edu (email)
http://disabilities.ucsd.edu (website)

Policy on Integrity of Scholarship

The University Policy on the Integrity of Scholarship is printed in the lab manual. You should read this! Be aware that there is one additional issue that should be added to the list in the lab manual: It is a violation of academic integrity to use another student's iClicker in class, or to allow another student to use your iClicker.

Your homework for this class must be independently written, *i.e.* **your own ideas in your own words**. While discussion of data among lab partners is encouraged, each student must independently complete all text, references, figures, graphs, and tables. The submission of homework assignments by lab partners that contain shared or copied work is forbidden. *Both* students will be held accountable. The exception is when a figure or table contains the raw data that is supplied to all members of the group (*e.g.* absorption spectra or colony counts). In this case the creation and labeling of that figure must be done independently. If you have questions about the difference between discussing your work with others and unauthorized collaboration, please ask your instructor or IA for clarification.

Because homework is to be your own work in your own words, **you may not view, copy or paraphrase, to any extent, current or past homework written by other students.** This is plagiarism**,** a direct attempt by the student to present the ideas of others as their own, and is no different than cheating on an exam. Further, **you are not to show your written work** to any other student.

Copying material from another source without putting it between quotation marks is plagiarism, even if the source is cited as a reference. In science writing it is not customary to directly quote others. Rather, you should paraphrase (or summarize) the ideas of your source **in your own words** and then *cite the reference.*

Plagiarism in homework is rigorously sought out and penalized.

Because all quizzes, exams, homework, and iClicker participation are required for satisfactory completion of this course, any student caught cheating on a quiz, exam, homework or iClicker participation may be given a failing grade for the course and referred to the Office of Academic Integrity for administrative discipline.

Tentative Class Schedule

	Lab 1, Sept 28 **Pre-course survey and syllabus quiz due by 8AM today** ***Assigned before class*** *Division of Biology safety training* *BIMM 121 Pre-course survey* --- Introduction, Safety lecture & video Responsibility agreement Integrity agreement **Aseptic technique** Microbes in environment Bacteria in mixed cultures **Use of pipettors** **Scientific method in-class exercise**
Lab 2, Oct 3 ***Assigned before class*** *Aseptic technique video (21 min)* --- **Aseptic technique** Observe results from last lab Streak & spread plates with mixed culture **Microscopy** Video: parts, focusing, cleaning *(25')* Practice focusing the microscope Observe stained slides Draw observations in notebook! Cleaning the microscope	**Lab 3, Oct 5** ***Assigned before class*** *Microscopy calibration video (9 min)* --- **Aseptic technique** Observe streak & spread plates Self- and peer-evaluation **Unknown organisms** Inoculate unknown organism onto one trypticase soy slant (TSS) **Microscopy** Calibrate the microscope Finish observing stained slides Evaluation of drawings in notebook **Discussion/learning time –** one hour Selective & differential media Observe tests for coliforms

Lab 4, Oct 10

Assigned before class

Dilutions tutorial (51 min)

Microscopy: Staining

Smears, simple stain

Gram stain – demonstrate that you can successfully prepare stained slides of **<u>control</u>** organisms

Unknown organisms

Gram stain, using the TSS culture prepared in lab 3 (fresh culture)

IA must confirm that the staining is correct

Endospore test

inoculate controls onto NSM

*(Come to office hours, 2-3 PM Tues – to review **dilutions**!)*

Lab 5, Oct 12 **HW1 Dilutions due at the start of lab**

Microscopy

Video: Phase contrast microscopy *(13')*

Wet mount and phase contrast

eukaryotes
prokaryotes
hay infusion
mixed cultures
} identify & measure

Unknown organisms

wet mounts from newer culture

streak plates & broth culture, using *original* slant of the organism
incubate at 30° and 37°C

Endospore test

wet mounts & stains of cells from NSM

Lab 6, Oct 17

Measuring microbial growth (yeast)

Hemocytometer
Spectrophotometer
Dilutions & spread plates

Unknown Organisms

confirm temperature preference
- observe streak plates
- measure OD of broth cultures

do wet mounts from both temps

complete worksheet in lab manual

streak a fresh stock (TSS) of unknown, incubate at optimum temp

Lab 7, Oct 19

Measuring microbial growth (yeast)

evaluate spread plates & pool data

Growth curve of *Vibrio natriegens*

Unknown organism

sticky test (along with controls)
inoculate MacConkey
Gram results should be confirmed!
Begin charts for classifying genera

Lab 8, Oct 24 **MIDTERM 1 in lecture on Tue, Oct 23** **Unknown organism** MacConkey – Observe **Macronutrients:** inoculate starch, skim milk, gelatin, rhodamine, blood agar **Workshop** - York 3070, 3 hours Sci method, Sci literacy	**Lab 9, Oct 26** **HW2 Growth curve due at the start of lab** **Macronutrients** – observe starch, skim milk, gelatin, rhodamine, blood agar **Energy production – fermentation** inoculate fermentation tubes inoculate glucose broth (MR/VP tests) **Endospore test** inoculate unknown onto NSM (IAs inoculate controls) **Discussion/learning time** – one hour
Lab 10, Oct 31 ***Assigned before class*** *Kligler tutorials, parts #1 & 2 (28 min)* --- **Energy production – fermentation** observe ferm tubes, MR, VP **Endospore test** wet mounts & stains of cells from NSM include *B. thurengiensis* **Inoculate fresh cultures:** • unknown organism – T-streak! • *Enterococcus faecalis* • *Escherichia coli* • *Pseudomonas aeruginosa* • *Pseudomonas fluorescens* • *Staphylococcus epidermidis* Inoculate 1 TSS of each control/aisle. These fresh cultures will be used for nitrate, cytochrome c, and catalase tests in lab 11. **Energy production – respiration** inoculate Kligler iron deep **Energy production – O_2 requirement** inoculate thioglycollate **Discussion/learning time** – one hour	**Lab 11, Nov 2** **HW3 Dilutions due at the start of lab** ***Assigned before class*** *Kligler tutorial, part #3 (28 min)* --- **Energy production – respiration** observe Kligler iron deep observe cytochrome c test inoculate nitrate broth **Energy production – O_2 requirement** observe catalase test observe thioglycollate **Motility** inoculate motility plates and deeps **Inoculate fresh cultures:** • *Escherichia coli* • *Enterobacter aerogenes* • *Proteus vulgaris* Inoculate 1 TSS of ea control/aisle. These fresh cultures will be used for the urease test in lab 12. **Discussion/Learning time** – one hour

Lab 12, Nov 7 **MIDTERM 2, part 1 in lecture on Thu, Nov 8** **Energy production – respiration** observe nitrate broth **Motility** observe plates and deeps observe wet mounts of controls **Special metabolic functions** inoculate urease agar with fresh cultures! inoculate tryptone broth inoculate Simmons citrate **Genus charts** should be completed today **Discussion/Learning time** – one hour	**Lab 13, Nov 9** **MIDTERM 2, part 2** **Special metabolic functions:** observe indole test, urease test, citrate test **Unknown organism** Repeat any necessary tests **IA's will check genus charts today**
Lab 14, Nov 14 **HW4 Libr tutorial due by 11:59P today** **Unknown organism** Complete any necessary tests **Nitrogen fixation** Check *Anabaena* for heterocysts Observe nodules for *Rhizobium* **Extreme conditions** Observe example organisms Complete worksheets **Discussion/Learning time** – one hour	**Lab 15, Nov 16** **Antibiotic Producers** spread plates grid putative antibiotic producers **Nitrogen fixation** Observe *Rhizobium* grown on plates **Unknown organism – Computer lab** Create elimination flow chart for identification of all genera in class, AND for the species in *your* genus

Lab 16, Nov 21 **Antibiotic producers** observe zones of inhibition **Kirby Bauer method** spread plates w/ standards add discs **Yogurt** Investigate types of dairy products Formulate hypotheses Design experiment	**No lab, Nov 23** **Thanksgiving Holiday**
Lab 17, Nov 28 **HW5 Unknown due in lecture Thu, Nov 29** **Kirby Bauer method** measure zones of inhibition look for resistant colonies **Yogurt** Check hypothesis & expt design Inoculate milk with starter culture Examine pH & texture at **time zero** Incubate Measure pH of uninoculated milk and starter cultures Examine pH & texture at **3 hours** Inoculate fresh culture of *Staphylococcus* to use as Gram pos control in lab 17 **Transposon mutagenesis** (lab 1) Set up conjugation	**Lab 18, Nov 30** **Yogurt** Observe aroma, texture & pH after 2nd incubation Gram stain the starter culture and the yogurt you made Collate information with lab partners **Transposon mutagenesis** (lab 2) Plate exconjugants for selection and counter selection **Discussion/Learning time** – 2 hrs

Lab 19, Dec 5 **Yogurt extra credit due at start of lecture on Tue, Dec 4** **Post-course survey, due today 11:59 P** **Transposon mutagenesis** (lab 3) Count colonies Calculate transposition efficiency Clean up Wrap & label coats/goggles for autoclaving Check out **Discussion/Learning time** – 2 hrs	**Lab 20, Dec 7** **Midterm 3 (in lab)**