

BIMM 121: MICROBIOLOGY LABORATORY

WELCOME TO MICROBIOLOGY LABORATORY. HERE WE'LL BE USING TECHNIQUES IN MICROBIAL PHYSIOLOGY, MICROBIAL GENOMICS, MICROBIAL EVOLUTION, AND MICROBIAL ECOLOGY TO EXPLORE THE ROLE OF MICROBES IN HEALTH, INDUSTRY, AND THE ENVIRONMENT. INQUIRY-BASED EXPERIMENTS WILL COVER THE FUNDAMENTALS OF BOTH WORKING WITH LIVE MICROSCOPIC ORGANISMS AT THE BENCH AND BIOINFORMATICALLY ANALYZING THEIR GENOMES AT THE COMPUTER.

LECTURE, YORK 3010, T+H 11-12:20
LAB, TATA 2101, W+F, 1-4:50

INSTRUCTOR DR. KATHERINE PETRIE



kpetrie@ucds.edu

OFFICE: AP&M 2824

OFFICE HOURS: H 130-330 or by appt.

IA DANIEL TYLER
datyler@ucsd.edu

DID YOU KNOW UCSD HAS
CORE SKILLS FOR ALL
STUDENTS TO MASTER?
HERE ARE SOME OF THEM.

WHAT THIS COURSE WILL ENABLE YOU TO DO:

LEARNING OUTCOMES AKA LO'S

BY THE END OF THE COURSE YOU'LL BE ABLE TO:

1. APPRECIATE THE STRUCTURE, PHYSIOLOGY, AND DIVERSITY OF MICROORGANISMS.
2. APPRECIATE INTERACTIONS OF MICROBES WITH OTHER ORGANISMS.
3. APPRECIATE INTERACTIONS OF MICROBES WITH THEIR ENVIRONMENT.
4. DETECT AND INTERPRET EVIDENCE OF MICROBIAL EVOLUTION.
5. ISOLATE, IDENTIFY, GROW, AND QUANTITATE MICROORGANISMS.
6. EXECUTE LABORATORY TASKS USING ASEPTIC TECHNIQUE.
7. PLAN AN EXPERIMENT FROM A GENERAL OUTLINE OF RESEARCH OBJECTIVES.
8. ANALYZE AND INTERPRET EXPERIMENTAL DATA TO DRAW ACCURATE AND STATISTICALLY SOUND CONCLUSIONS.
9. COMMUNICATE SCIENTIFIC RESEARCH - ITS JUSTIFICATION, METHODS, AND FINDINGS - EFFECTIVELY.
10. RECOGNIZE UNKNOWN'S IN MICROBIOLOGY
11. VALUE THE RELEVANCE OF MICROBIOLOGY TODAY

GOALS FOR
BIO MAJORS

GOALS FOR
ALL STUDENTS

UNDERSTAND
BIOTIC AND PHYSICAL
INTERACTIONS

UNDERSTAND EVOLUTION
AND DIVERSITY

USE CONTEMPORARY
BIOLOGICAL RESEARCH
TECHNIQUES AND QUANTITATIVE
APPROACHES TO ANALYZE
RESULTS

QUANTITATIVE
REASONING

CRITICAL THINKING

CONSTRUCT
REASONABLE
HYPOTHESES
TO EXPLAIN
BIOLOGICAL
PHENOMENA

WRITTEN + ORAL
COMMUNICATION

RECOGNIZE THE
INTERACTIONS
BETWEEN
BIOLOGY AND
SOCIETY

INFORMATION LITERACY

HOW WILL YOU
DEMONSTRATE THAT
YOU ACCOMPLISHED
THE 11 LO'S?

ASSESSMENTS AND BASIS FOR FINAL GRADE:

ASSESSMENT	WEIGHT
IN-LECTURE CLICKER QUESTIONS	10 %
NOTEBOOK CHECKS	5 %
LAB WORKSHEETS	5 %
PRACTICAL	2.5 %
EFFECTIVE PARAPHRASING HOMEWORK	2.5 %
MICROBIAL ZOO	5%
MICROBES + HEALTH LAB REPORT	20 %
MICROBES + INDUSTRY LAB REPORT	15 %
MICROBES + ENVIRONMENT MINI REPORT	10 %
MIDTERM EXAM	10 %
FINAL EXAM	15 %

NO BELL CURVE:
YOU WON'T BE
COMPETING
AGAINST
EACH OTHER!

GRADING SCALE

97-100	A+	(4.0)
93-97	A	(4.0)
90-93	A-	(3.7)
87-90	B+	(3.3)
83-87	B	(3.0)
80-83	B-	(2.7)
77-80	C+	(2.3)
73-77	C	(2.0)
70-73	C-	(1.7)
60-70	D	(1.0)
<60	F	(0)

FOR REPORT
GUIDELINES + RUBRICS,
STAY TUNED TO
TRITON ED!

MATERIALS NEEDED TO SUCCEED:

A CLICKER: FOR LECTURE, YOU ARE REQUIRED TO HAVE AND BRING AN *i>clicker* THAT IS REGISTERED VIA TRITON ED.

TRITON ED: LAB PROTOCOLS, GRADES, AND OTHER COURSE INFORMATION WILL BE POSTED ON TRITON ED, SO MAKE SURE YOU CAN ACCESS IT.

PPE: A LAB COAT THAT YOU ONLY USE FOR THIS CLASS THAT EXTENDS TO YOUR KNEES, SAFETY GLASSES (REGULAR PERSCRIPTION GLASSES AREN'T SUFFICIENT).

LAB NOTEBOOK: BOUND STYLE.

SOMETHING TO TAKE NOTES WITH DURING LECTURE: RESEARCH SHOWS THAT PEN + PAPER NOTE-TAKING WHERE YOU ORGANIZE, SUMMARIZE AND REPHRASE KEY IDEAS IS ONE OF THE BEST STRATEGIES TO HELP YOU LEARN NEW INFORMATION.

(OPTIONAL) A LAPTOP FOR LECTURE: OFTEN IN LECTURE YOU'LL BE PLANNING OUT YOUR EXPERIMENTS WITH YOUR LAB PARTNER AND GROUP. YOU CAN DO THIS ON PAPER, BUT A LAPTOP IS USEFUL FOR CALCULATIONS. SOME TABLETS WILL BE AVAILABLE.

IN-CLASS WORK: HOW TO SUCCEED

DAILY CLICKER QUESTIONS (10% OF GRADE)

IN EVERY LECTURE, CLICKER QUESTIONS WILL CHALLENGE YOU TO APPLY WHAT YOU'VE JUST LEARNED. EVERY DAY YOU WILL HAVE THE OPPORTUNITY TO EARN:

- 2 PARTICIPATION POINTS (SUBMIT ANSWER TO 75% OF ALL QUESTIONS FOR 2 PTS, ELSE GET 0)
- 2 PERFORMANCE POINTS (GET 1 PT FOR EVERY CORRECTLY ANSWERED QUESTION)

THERE ARE USUALLY MORE THAN 2 PERFORMANCE QUESTIONS PER CLASS, SO EVEN IF YOU GET SOME WRONG YOU MAY STILL GET FULL POINTS, AND...

...YOU CAN MAKE UP ONE POINT BY SUBMITTING A 'MUDDIEST POINT' ON TRITON ED BEFORE THE NEXT CLASS (LIMIT = 1 PER DAY). CHECK OFTEN TO MAKE SURE YOUR CLICKERS ARE BEING RECORDED.

IF YOU MISS LECTURE....

IF YOU MISS LECTURE, OR IF YOUR CLICKER IS HAVING TECHNICAL DIFFICULTIES, YOU MAY NOT MAKE UP THE QUESTIONS. HOWEVER WE'LL DROP YOUR LOWEST 4 CLICKER DAYS.

IF YOU MISS THE MIDTERM, YOUR FINAL WILL BE WORTH A BIGGER % OF YOUR GRADE TO COMPENSATE. IF YOU MISS THE FINAL, YOU MAY BE ELIGIBLE FOR AN INCOMPLETE.

USE THESE DROPS WISELY: IT'S BETTER TO SAVE THEM FOR THE UNEXPECTED.

LAB REPORT DELIVERABLES

YOUR GRADE FOR THE LAB REPORT WILL BE BASED ON MORE THAN JUST THE WRITTEN REPORT YOU TURN IN. PRIOR TO THE DEADLINE FOR THE FINAL REPORT, YOU MAY BE ASKED TO SUBMIT DATA TO A COMMON REPOSITORY OR, OCCASIONALLY, REPORT YOUR FINDINGS TO THE CLASS.

THESE EARLY PARTS OF THE LAB REPORT GRADE, AND THEIR DEADLINES, WILL BE CLEARLY EXPLAINED IN THE GUIDELINES FOR EACH LAB REPORT ON TRITON ED, SO STAY TUNED.

IF YOU MISS LAB...

YOU MUST LET DR. PETRIE + YOUR GROUP KNOW AHEAD OF TIME. YOU WILL STILL BE RESPONSIBLE FOR UNDERSTANDING THE MATERIAL YOU MISSED AND SUBMITTING ASSIGNMENTS ON TIME. IN THE CASE OF REPEATED ABSENCES, YOU MAY BE ASKED TO PROVIDE DOCUMENTATION OF YOUR EXCUSE. ABSENCES DUE TO SCHEDULING CONFLICTS (OTHER COURSEWORK, VACATIONS, BEYONCE CONCERTS, ETC) WILL NOT BE EXCUSED AND EACH WILL RESULT IN A GRADE PENALTY (1 % OFF OVER-ALL GRADE). WE WILL DROP ONE LAB WORKSHEET.

IF HEALTH OR FAMILY EMERGENCIES RESULT IN HAVING TO MISS MORE THAN THE ALLOWED DROPS, SEE DR. PETRIE TO DISCUSS THE POSSIBILITY OF AN "INCOMPLETE". PER UCSD POLICY, YOU MUST BE IN GOOD STANDING BEFORE CLASS IS MISSED TO BE ELIGIBLE.

NOTEBOOK CHECKS (10% OF GRADE)

IN LECTURE, YOU WILL BE SOMETIMES ASKED TO WRITE A DETAILED PROTOCOL FROM A GENERAL OUTLINE OF THE RESEARCH GOALS FOR THE NEXT DAY'S LAB, AND PUT IT IN YOUR NOTEBOOK. THERE WILL BE UNANNOUNCED CHECKS OF YOUR LABORATORY NOTEBOOK. THE GUIDELINES AND RUBRICS FOR PROTOCOLS AND NOTEBOOKS WILL BE POSTED ON TRITON ED.

INCLUSIVITY:

EVERYONE WILL COME TO THIS COURSE WITH DIFFERENT BACKGROUNDS, KNOWLEDGE, AND PERSPECTIVES. WE WANT TO CREATE A CLASSROOM CULTURE THAT RESPECTS AND REVELS IN THIS HUMAN DIVERSITY. IF YOU HAVE ANY CONCERNS RELATED TO INCLUSIVITY OR FEEL YOUR IDENTITIES (RACE, GENDER, SEXUALITY, RELIGION, ABILITY, ETC) ARE NOT BEING HONORED, PLEASE LET US KNOW! ACCOMMODATIONS CAN BE MADE FOR STUDENTS WITH A LETTER FROM THE OSD. FOR MORE INFORMATION ON CAMPUS + COMMUNITY RESOURCES, CHECK TRITON ED.

ACADEMIC INTEGRITY:

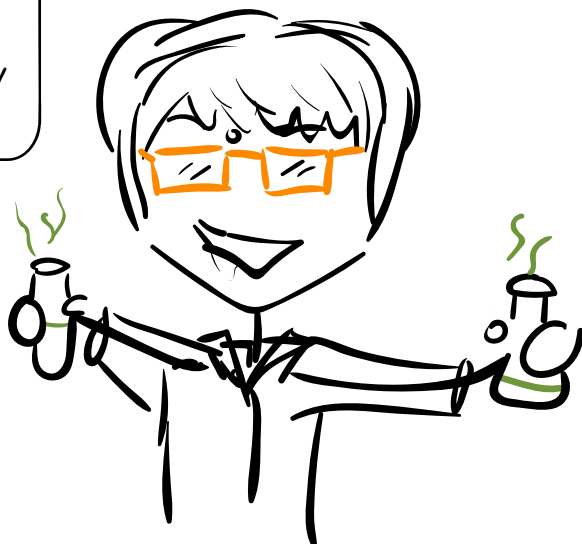
AN INCLUSIVE ENVIRONMENT IS ONE WHERE EVERYONE HAS AN EQUAL OPPORTUNITY TO SUCCEED. ACADEMIC DISHONESTY (INCLUDING, BUT NOT LIMITED TO: CHEATING, PLAGIARIZING, ANSWERING WITH SOMEONE ELSE'S CLICKER) FRACTURES THE PLAYING FIELD, BY GIVING SOME STUDENTS AN UNFAIR ADVANTAGE. ASSIGNMENTS WILL BE MONITORED VIA TURN-IT-IN, AND STUDENTS FOUND TO HAVE COMMITTED ACADEMIC DISHONESTY WILL BE REFERRED TO THE UCSD ACADEMIC INTEGRITY OFFICE AND MAY RECEIVE A FAILING GRADE FOR THE COURSE.

REGRADE REQUESTS:

WE ALL MAKE MISTAKES. IF YOU THINK YOUR HOMEWORK, WORKSHEET, REPORT, OR EXAM WAS GRADED IN ERROR, SUBMIT A REQUEST **BY EMAIL** TO DR. PETRIE WITHIN 7 DAYS OF RECEIVING YOUR GRADE. INCLUDE A WRITTEN DESCRIPTION OF THE ERROR, INCLUDING WHICH QUESTION YOU ARE CONCERNED ABOUT AND WHY YOU THINK THE GRADE IS MISTAKEN. **NO IN-PERSON REQUESTS WILL BE CONSIDERED.** THE REGRADE OPTION IS TO SAFEGUARD YOU FROM GENUINE MISTAKES IN GRADING; THERE IS NO GUARANTEE YOU SCORE WILL GO UP.

WE'RE WORKING TO IMPROVE YOUR EDUCATIONAL EXPERIENCE:

DID YOU KNOW THAT YOU CAN BE PART OF A RESEARCH STUDY IN THIS CLASS?



NO! NOT LIKE THAT! INSTEAD, DURING THIS CLASS, I'LL BE WORKING TO FIGURE OUT THE MOST EFFECTIVE TEACHING METHODS FOR YOUR LEARNING. THIS MEANS YOU MIGHT DO SURVEYS AND PROVIDE FEEDBACK. FOR MORE INFORMATION, PLEASE READ THE PAGES AT THE END OF THIS SYLLABUS.

MICROBES AND HEALTH

MICROBES AND INDUSTRY

MICROBES AND
THE ENVIRONMENT

WEEK 1.

T LECT. (1/8): INTRO TO COURSE

W LAB. (1/9): LAB BASICS/MI-
CROBES ALL AROUND USH LECT. (1/10): BIOFILMS + HEALTH,
MODEL MICROBIAL ORGANISMSF LAB. (1/11): START MICROCOSMS
FOR BIOFILM EVOLUTION/INTRO
TO MICROSCOPY

PLEASE REMEMBER THAT YOUR WORK IN
LECTURE (CLICKERS) WILL BE GRADED, SO
BE SURE TO SHOW UP ON TUESDAYS AND
THURSDAYS!

WEEK 2.

T LECT. (1/15): DILUTIONS AND BIO-
FILM ASSAYSW LAB. (1/16): DILUTE, PLATE, AND
ASSAY MICROCOSMS

H LECT. (1/17): MICROSCOPY

F LAB. (1/18): COUNT PLATES,
PREP SPECIMENS FOR MICRO-
SCOPE, SELECT ISOLATES

PARAPHRASING HW
DUE 1/18!

WEEK 3.

T LECT. (1/22): MICROBIAL DIVERSITY

W LAB. (1/23): INOCULATE ISO-
LATES, LAB PRACTICAL!!!H LECT. (1/24): MICROBIAL GENOMES
+ GENOME EXTRACTIONF LAB. (1/25): FREEZER STOCKS,
EXTRACT GENOMIC DNA FROM
EVOLVED STRAINS, MOTILITY?

PRACTICAL!

PARAPHRASING HW
REVISIONS DUE 1/25!

THIS IS A GRADED OBSERVATION
OF YOUR LAB SKILLS. MAKE
SURE YOU GET IN LOTS OF PRAC-
TICE BY SHARING THE WORK WITH
YOUR PARTNER IN WEEKS 1 + 2.
WHILE YOU'RE WAITING YOUR
TURN, YOU CAN WORK ON YOUR
MICROBE ZOO.

MICROBES AND HEALTH

MICROBES AND INDUSTRY

MICROBES AND
THE ENVIRONMENT

WEEK 4.

T LECT. (1/29): ILLUMINA SEQUENCING

W LAB. (1/30): QUANT DNA, START
ILLUMINA LIBRARY PREP

H LECT. (1/31): MIDTERM!!!! ←

F LAB. (2/1): FINISH ILLUMINA
LIBRARY PREP, QUANT LIBRARY,
SUBMIT TAPE STATION SAMPLESMIDTERM
1/31!BIOFILM LAB PART 1 DUE
MON 2/4 11:59 PMSEE TRITON
ED FOR LAB
REPORT GUID-
LINES!

WEEK 5.

H LECT. (2/7): DISCUSS TAPE STA-
TION RESULTS, PLAN POOL

F LAB. (2/8): POOL + SUBMIT

T LECT. (2/5): FERMENTATION

W LAB. (2/6): MAKE YOGURT

H LECT. (2/7): NATURAL CRISPR,
DIFFERENTIAL IDENTIFICATIONF LAB. (2/8): COMPARE LAB +
COMMERCIAL YOGURT, SCOPE +
PLATE

WEEK 6.

T LECT. (2/12):

W LAB. (2/13): EXAMINE COLONIES,
SELECT + INOCULATE ISOLATES

H LECT. (2/14): PCR, ETC.

F LAB. (2/15): MAKE FREEZER
STOCKS, PCR 1 CRISPR LOCIT LECT (2/12): PHOTOSYNTHESIS
AND TOLERANCE TO CHANGEW LAB. (2/13): SET UP TOLER-
ANCE TESTS FOR PHOTOSYN-
THETIC MICROBES

H LECT. (2/14): OD

F LAB. (2/15): CHECK PHOTOSYN-
THETIC MICROBES

MICROBES AND
THE ENVIRONMENT

MICROBES AND INDUSTRY

WEEK 7.

T LECT. (2/19): SANGER SEQUENC-
INGW LAB. (2/20): GEL + CLEAN UP
PCR 1, SUBMIT SANGER?, PCR 2

H LECT. (2/21): DISCUSS PCR 1

F LAB. (2/22): GEL + CLEAN UP
PCR 2, SUBMIT SANGER SE-
QUENCING

T LECT. (2/19):

W LAB. (2/20): CHECK PHOTOSYN-
THETIC MICROBES

H LECT. (2/21):

F LAB. (2/22): CHECK PHOTOSYN-
THETIC MICROBES

MICROBES AND HEALTH

WEEK 8.

T LECT. (2/26):

W LAB. (2/27):

H LECT. (2/28): FIELD TRIP TO IGM

F LAB. (3/1):

T LECT. (2/26): BLAST

W LAB. (2/27): ANALYZE SANGER
SEQUENCING DATA

H LECT. (2/28):

F LAB. (3/1): ANALYZE SANGER
SEQUENCING DATA

T LECT. (2/26):

W LAB. (2/27): CHECK PHOTOSYN-
THETIC MICROBES

H LECT. (2/28):

F LAB. (3/1): CHECK PHOTOSYN-
THETIC MICROBES

WEEK 9.

T LECT. (3/5): ANALYZING ILLUMINA
DATAW LAB. (3/6): ANALYZE ILLUMINA
SEQUENCE DATA

H LECT. (3/7):

F LAB. (3/8): ANALYZE ILLUMINA
SEQUENCE DATA3
↑YOGURT LAB REPORT DUE
MON 3/4 11:59 PM

T LECT. (3/5):

W LAB. (3/6): CHECK PHOTOSYN-
THETIC MICROBESH LECT. (3/7): SHARE
GROWTH/TOLERANCE DATA

F LAB. (3/8):

MICROBES AND HEALTH

MICROBES AND INDUSTRY

MICROBES AND
THE ENVIRONMENT

WEEK 10.

T LECT. (3/12): SHARE ILLUMINA DATA

W LAB. (3/13): ANALYZE ILLUMINA
SEQUENCE DATA, CLEAN UP

H LECT. (3/14): REVIEW

F LAB. (3/15): FINAL!!!!

FINAL!

T LECT. (3/12):

W LAB. (3/13):

H LECT. (3/14): REVIEW

F LAB. (3/15): FINAL!!!!

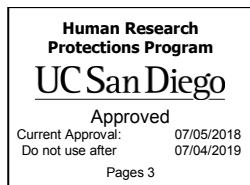
T LECT. (3/12):

W LAB. (3/13):

H LECT. (3/14): REVIEW

F LAB. (3/15): FINAL!!!!

MINI REPORT DUE
MON, 3/11 11:59 PMBIOFILM LAB PART 2 DUE
FRI 3/22 11:59 PMTHAT'S DURING
FINALS WEEK!



University of California, San Diego
Consent to Act as a Research Subject

Investigating the Impact of Pedagogical Choices on University Student Learning and Engagement

Who is conducting the study, why you have been asked to participate, how you were selected, and what is the approximate number of participants in the study?

Gabriele Wienhausen, Director of the Teaching and Learning Commons, together with her education research colleagues is conducting a research study to find out more about how pedagogical choices affect student learning and experience in the classroom. You have been asked to participate in this study because you are a student in a class that is being studied or used as a control. There will be approximately 500,000 participants in this study.

Why is this study being done?

The purpose of this study is to create knowledge that has the potential to improve the learning and educational experience of students at UC San Diego and beyond.

What will happen to you in this study and which procedures are standard of care and which are experimental?

If you agree to be in this study, the following will happen:

- Your data from this class including grades, homework and exam submissions, and survey responses will be included in the analysis to determine the effectiveness of the pedagogical techniques used in this course compared to other similar courses.

How much time will each study procedure take, what is your total time commitment, and how long will the study last?

Your participation involves only agreeing to let us use your data in our analysis. It will require no time on your part above the time you put into this course without agreeing to the study.

What risks are associated with this study?

Participation in this study may involve some added risks or discomforts. These include the following:

1. A potential for the loss of confidentiality. We will not share your personally identifying data with people outside our research team. Data will only be kept in anonymized form for research purposes. Course data will not be used for this research study until after final grades have been posted and will be rendered confidential by removing any identifiers before analysis. Your instructor will not know whether or not you are participating in this study until after final grades have been posted. Data from students who opt out of the study will be removed prior to data analysis. Research records will be kept confidential to the extent allowed by law. Research records may be reviewed by the UCSD Institutional Review Board.

Since this is an investigational study, there may be some unknown risks that are currently unforeseeable. You will be informed of any significant new findings.

What are the alternatives to participating in this study?

The alternatives to participation in this study are not to participate. If you choose to opt-out of participating in this research study, we will exclude your data from analysis. Whether you participate will have no impact on your experience or grade in the associated class as the professor will not know who is or is not participating in the study until after final grades are assigned.

What benefits can be reasonably expected?

There is no direct benefit to you for participating in the study. The investigator, however, may learn more about how to improve student learning, and society may benefit from this knowledge.

Can you choose to not participate or withdraw from the study without penalty or loss of benefits?

Participation in research is entirely voluntary. You may refuse to participate or withdraw or refuse to answer specific questions in an interview or on a questionnaire at any time without penalty or loss of benefits to which you are entitled. If you decide that you no longer wish to continue in this study before the end of the quarter, simply respond to the online opt-out form here: <https://goo.gl/forms/JSBRjEmkES6W6xYc2>. If you decide to opt out after the quarter has ended, you must contact Ying Xiong (yix184@ucsd.edu) and give the quarter and the course from which you would like your data withdrawn.

You will be told if any important new information is found during the course of this study that may affect your wanting to continue.

Can you be withdrawn from the study without your consent?

The PI may remove you from the study without your consent if the PI feels it is in your best interest or the best interest of the study. You may also be withdrawn from the study if you do not follow the instructions given you by the study personnel.

Will you be compensated for participating in this study?

You will not be compensated for participating in this study.

Are there any costs associated with participating in this study?

There will be no cost to you for participating in this study.

Who can you call if you have questions?

Gabriele Wienhausen and/or her colleague has explained this study to you and answered your questions. If you have other questions or research-related problems, you may reach Gabriele Wienhausen at gwienhausen@ucsd.edu or (858) 534-3958.

You may call the Human Research Protections Program Office at 858-246-HRPP (858-246-4777) to inquire about your rights as a research subject or to report research-related problems.

Your Consent

If you consent to participate in this study, no action is needed. If you DO NOT consent to participate in this study, or you choose to opt-out at any time during the quarter, please submit this form online at https://docs.google.com/forms/d/e/1FAIpQLScs0Cznypp4SxQJOsFMgP9nFDjJ0zzYPISBWsiP3_wiWkdjaA/viewform. Your instructor will not have access to the list of students who opted out until after grades are posted. Note that you must separately opt-out of the study for each course involved in this study.

[] I am not 18 years or older or I do not consent to anonymized research use of my data from the course specified below.

Course name: _____

Course section number: _____

Term: _____

Name: _____

PID: _____