

WELCOME TO GENOME DIVERSITY AND DYNAMICS! HOW ARE SCIENTISTS, DOCTORS, AND CONSUMERS USING BIG DATA TO UNDERSTAND HUMAN HEALTH AND THE ENVIRONMENT? WHY ARE "OMICS" TECHNOLOGIES KEY FOR UNDERSTANDING BIOLOGY IN THE 21ST CENTURY, AND HOW DO THEY WORK? WHAT SKILLS AND STRATEGIES WILL BE NEEDED TO MAKE SENSE OF THE MILLIONS OF GENOMES BEING SEQUENCED? DURING THIS COURSE WE'LL COVER ANSWERS TO THESE QUESTIONS AND MORE.

CENTER HALL 115, MWF 11-11:50 PM

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## 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. EXPLAIN HOW PHENOTYPE = GENOTYPE + ENVIRONMENT + EXPRESSION
2. COMPARE AND CONTRAST EXTANT GENOMES AND CONNECT TO PHENOTYPIC DIFFERENCES
3. SUMMARIZE WAYS GENOMES CHANGE AT THE MOLECULAR LEVEL AND PROPOSE HOW EVOLUTION TAKES ADVANTAGE OF THOSE CHANGES
4. RECOGNIZE DIFFERENT LEVELS OF GENOME DIVERSITY: FROM WITHIN INDIVIDUALS TO WITHIN COMMUNITIES
5. RELATE SCALE OF GENOMES AND GENOMIC DATA TO FAMILIAR SCALES
6. SUMMARIZE OMICS TECHNOLOGIES: HOW THEY WORK AND WHAT QUESTIONS CAN THEY ANSWER
7. INTERPRET OMICS DATA TO DRAW CONCLUSIONS
8. EVALUATE MAINSTREAM MEDIA REPORTS OF OMICS DATA
9. RECOGNIZE UNKNOWNNS IN GENOMICS
10. VALUE THE POWER OF GENOMICS RESEARCH TO ANSWER BROADLY RELEVANT QUESTIONS

UNDERSTAND  
HEREDITY

GOALS FOR  
BIO MAJORS

GOALS FOR  
ALL STUDENTS

UNDERSTAND THE  
CORRELATION OF  
STRUCTURE, FUNCTION  
AND PROCESSES

WRITTEN + ORAL  
COMMUNICATION

UNDERSTAND EVOLUTION AND DIVERSITY

QUANTITATIVE  
REASONING

USE CONTEMPORARY  
BIOLOGICAL RESEARCH  
TECHNIQUES AND QUANTITATIVE  
APPROACHES TO ANALYZE  
RESULTS

CONSTRUCT  
REASONABLE  
HYPOTHESES  
TO EXPLAIN  
BIOLOGICAL  
PHENOMENA

CRITICAL THINKING

INFORMATION LITERACY

RECOGNIZE THE  
INTERACTIONS  
BETWEEN  
BIOLOGY AND  
SOCIETY

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

HOW WILL YOU DEMONSTRATE THAT YOU ACCOMPLISHED THE 10 LO'S?

## ASSESSMENTS AND BASIS FOR FINAL GRADE:

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

ASSIGNMENT	% OF GRADE	LO'S ADDRESSED
IN-CLASS CLICKER QUESTIONS	15 %	LO'S 1-7, 9-10
WEEKLY DISCUSSION SECTION QUIZZES	20 %	LO'S 1-7
DISCUSSION SECTION WORKSHEETS	15 %	LO'S 6-8
MIDTERM EXAM	20 %	ALL
FINAL EXAM	30 %	ALL

### 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)

## MATERIALS NEEDED TO SUCCEED:

**A CLICKER:** THERE IS NO REQUIRED TEXTBOOK FOR THIS COURSE, BUT YOU ARE REQUIRED TO HAVE AND BRING TO CLASS AN *i>clicker* THAT IS REGISTERED VIA TRITON ED.

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

**SOMETHING TO TAKE NOTES WITH DURING LECTURE:** LECTURES WILL BE PODCAST, BUT 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 SMARTPHONE OR LAPTOP FOR DISCUSSION SECTION:** SOMETIMES WE'LL BE USING ONLINE RESOURCES IN SECTION. WEB-ENABLED TABLETS WILL BE AVAILABLE FOR EVERY GROUP OF 5-6 STUDENTS, BUT YOU ARE WELCOME TO BRING AND USE YOUR OWN DEVICE.

## REGRADE REQUESTS:

WE ALL MAKE MISTAKES. IF YOU THINK YOUR QUIZ, HOMEWORK, WORKSHEET, 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.

**IN-CLASS WORK: HOW TO SUCCEED**

THERE WON'T BE ANY MAKE-UP WORK IF YOU MISS CLASS. BUT DON'T WORRY....

**DAILY CLICKER QUESTIONS (15% OF GRADE)**

IN EVERY LECTURE, CLICKER QUESTIONS WILL CHALLENGE YOU TO APPLY WHAT YOU'VE JUST LEARNED. SOME QUESTIONS WILL BE OPEN-ENDED DISCUSSION QUESTIONS OR SURVEYS, AND SOME WILL HAVE A CORRECT ANSWER. THE TYPE OF QUESTION WILL BE CLEARLY MARKED AS 'PARTICIPATION' OR 'PERFORMANCE.' 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 PERFORMANCE QUESTION)

THERE ARE USUALLY MORE THAN 2 PERFORMANCE QUESTIONS PER CLASS, SO EVEN IF YOU GET SOME WRONG YOU MAY STILL GET FULL POINTS. CHECK OFTEN TO MAKE SURE YOUR CLICKERS ARE BEING RECORDED.

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 6 CLICKER DAYS.

IF YOU MISS DISCUSSION SECTION, YOU MAY NOT MAKE UP THE QUIZ OR WORKSHEET, BUT WE'LL DROP YOUR 3 LOWEST QUIZZES AND YOUR LOWEST WORKSHEET.

IF YOU MISS THE MIDTERM, YOUR FINAL WILL BE WORTH A BIGGER % OF YOUR GRADE TO MAKE UP THE DIFFERENCE. 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, LIKE WHEN YOU ARE SICK OR YOUR CLICKER BATTERIES DIE.

**WEEKLY DISCUSSION SECTION QUIZZES (20% OF GRADE)**

AT THE END OF MOST SECTIONS, THERE WILL BE A BRIEF QUIZ WHERE YOU RECALL, EXPLAIN, OR APPLY CONCEPTS FROM THE PRIOR WEEK (SEE SCHEDULE FOR EXACT DATES COVERED).

THESE QUIZZES ARE A CHANCE FOR YOU TO PRACTICE GENOMIC THINKING. YOU WILL BE ALLOWED TO BRING A HALF-SHEET OF STANDARD PRINTER PAPER (8.5 X 5.5 INCHES) CONTAINING ANY NOTES YOU LIKE ON ONE SIDE. SUMMARIZING AND PARAPHRASING YOUR NOTES FROM CLASS, OR DRAWING DIAGRAMS OF TECHNIQUES WE COVERED, IS A GOOD PLACE TO START.

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.

**WEEKLY DISCUSSION SECTION WORKSHEETS (15% OF GRADE)**

DURING DISCUSSION SECTIONS, YOU'LL BE WORKING AS A GROUP TO SOLVE PUZZLES AND PROBLEMS RELATING TO GENOMICS DATA.

THERE WILL BE A WORKSHEET THAT EVERY PERSON MUST COMPLETE USING THEIR OWN WORDS. THESE WILL BE GRADED INDIVIDUALLY, BUT YOU WILL OFTEN NEED TO WORK AS A GROUP TO GET ALL OF THE ANSWERS.

YOU SHOULD BE ABLE TO FINISH THE WORKSHEET BY THE END OF DISCUSSION SECTION, BUT WILL HAVE 48 HOURS TO PUT FINISHING TOUCHES ON IT.

**REFERENCE REQUESTS**

IF YOU WOULD LIKE TO REQUEST A LETTER OF RECOMMENDATION FROM ME, PLEASE SUBMIT YOUR REQUEST VIA EMAIL, AND I'LL GET BACK TO YOU WITH SOME ADDITIONAL INFORMATION THAT I WILL NEED FROM YOU BEFORE I CAN AGREE.

**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 CANVAS

**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.

**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 'MUST READ' SECTION ON CANVAS.

**COURSE SCHEDULE (TENTATIVE):**

WEEK 0/1. THE 1ST LEVEL OF DIVERSITY: HOW DO WE ID AND DESCRIBE GENOMES?

(DI) NO SECTION MEETINGS WEEK 0 OR WEEK 1!  
 F - 9/27 INTRODUCTION TO GENOMES AND COURSE  
 M - 9/30 OLD-SCHOOL GENOME SEQUENCING  
 W - 10/2 NEXT-GEN GENOME SEQUENCING 1 (ILLUMINA)  
 F - 10/4 NEXT-GEN GENOME SEQUENCING 2 (ASSEMBLY)

INTRODUCTION

WEEK 2. HOW DO WE FIGURE OUT WHAT THE PARTS OF GENOME DO?

(DI) QUIZ (9/27-10/4), ASSEMBLY ACTIVITY  
 M - 10/7 NEXT-GEN GENOME SEQUENCING 3 (SCAFFOLDING)  
 W - 10/9 GENOME ANNOTATION  
 F - 10/11 COMPARATIVE GENOMICS 1

GENOME  
DIVERSITY  
IN SPACE

WEEK 3. EXTANT GENOME DIVERSITY (SPECIES, POPULATIONS)

(DI) QUIZ (10/7-10/11), ANNOTATION ACTIVITY  
 M - 10/14 COMPARATIVE GENOMICS 2  
 W - 10/16 MEASURING DIFFERENCES AND BUILDING TREES  
 F - 10/18 DIVERSITY WITHIN A POPULATION, RESEQUENCING

GENOME  
DIVERSITY  
AMONG THINGS  
THAT ARE ALIVE  
IN THE BIO-  
SPHERE TODAY.

WEEK 4. EXTANT GENOME DIVERSITY (POPULATIONS, COMMUNITIES)

(DI) QUIZ (10/14-10/18), TREE ACTIVITY  
 M - 10/21 EFFECT OF DIFFERENCES WITHIN A POPULATION  
 W - 10/23 POPULATION DIVERSITY AND CONSERVATION BIO  
 F - 10/25 METAGENOMICS: 16S AND WHOLE-GENOME

WEEK 5. EXTANT GENOME DIVERSITY (COMMUNITIES)

(DI) (NO QUIZ), OPTIONAL 'OFFICE-HOURS' SECTION  
 M - 10/28 REVIEW FOR MIDTERM  
 W - 10/30 IN-CLASS MIDTERM!  
 F - 11/1 METAGENOMES IN THE ENVIRONMENT + HEALTH

MIDTERM!

**COURSE SCHEDULE (TENTATIVE):****WEEK 6. GENOME DYNAMICS OVER SHORT TIME SCALES****(DI) (NO QUIZ) GWAS ACTIVITY**

M - 11/4 PLASTIC RESPONSES AND RNA-SEQ 1

W - 11/6 PLASTIC RESPONSES AND RNA-SEQ 2

F - 11/8 DEVELOPMENT + REGULATORY CASCADES

GENOME  
DIVERSITY  
IN TIMESHORT-TERM  
DYNAMICS:  
CHANGES IN THE  
"EXPRESSED"  
GENOME**WEEK 7. GENOME DYNAMICS OVER SHORT TIME SCALES****(DI) QUIZ (11/1-11/8) METAGENOMICS ACTIVITY**

M - 11/11 NO CLASS - UCSD HOLIDAY

W - 11/13 STEM CELLS, DIFFERENTIATION

F - 11/15 PROTEOMICS

**WEEK 8. GENOME DYNAMICS OVER LONG TIME SCALES****(DI) QUIZ (11/13-11/15), RNA-SEQ ACTIVITY**

M - 11/18 MECHANISMS OF GENOME EVOLUTION

W - 11/20 EXAMPLES OF GENOME EVOLUTION 1

F - 11/22 EXAMPLES OF GENOME EVOLUTION 2

LONG-TERM  
DYNAMICS:  
CHANGES IN THE  
GENOTYPE  
ITSELF**WEEK 9. GENOME DYNAMICS OVER LONG TIME SCALES****(DI) NO SECTION MEETINGS THIS WEEK!**

M - 11/25 EXAMPLES OF GENOME EVOLUTION 3

W - 11/27 NO CLASS TODAY - HAPPY THANKSGIVING!

F - 11/29 NO CLASS TODAY - UCSD HOLIDAY

**WEEK 10. GENOME DYNAMICS OVER LONG TIME SCALES****(DI) QUIZ (11/18-11/25), GENOME EVOLUTION ACTIVITY**

M - 12/2 THE EVOLUTION OF CANCER 1

W - 12/4 THE EVOLUTION OF CANCER 2

F - 12/6 REVIEW FOR FINAL

**FINAL!****FINAL EXAM: TUESDAY, DEC 10TH,  
11:30AM - 2:30 PM**