

PETERSON HALL 108: TUE + THUR, 9:30-10:50 AM

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.

INSTRUCTOR: DR. KATHERINE PETRIE

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DR PETRIE OFFICE HOURS: TBA  
see canvas for office hours sign-up link

IAS: Chen Hsiao (lead IA)

Nicolas Bello    Tianna Huang    Justin Jaehyun Kim

SEE CANVAS FOR... IA contact info  
IA office hours

WHAT WILL YOU  
BE DOING IN  
THIS CLASS?

**LECTURES:** WE'LL HAVE IN-PERSON MEETINGS ON TUESDAYS AND THURSDAYS. THESE WILL BE INTERSPERSED WITH CLICKER QUESTIONS AND PEER DISCUSSION. LECTURE ATTENDANCE IS REQUIRED TO EARN PARTICIPATION POINTS, BUT LECTURES WILL ALSO BE RECORDED FOR YOUR REFERENCE.

## COURSE STRUCTURE:

**DISCUSSION SECTION:** WILL BE HELD ON ZOOM ON TUESDAYS FROM 7-7:50. (SEE CANVAS FOR ZOOM LINK). YOU WILL WORK WITH A SMALL GROUP IN BREAKOUT ROOMS TO COMPLETE A BRIEF WORKSHEET. SECTION ATTENDANCE IS OPTIONAL, BUT HIGHLY ENCOURAGED WITH AN EXTRA CREDIT QUESTION AVAILABLE AT THE END OF SECTION. THE ONLY WAY TO EARN THIS EXTRA CREDIT IS TO ATTEND SECTION (THERE IS NO WAY TO MAKE IT UP).

**ASSIGNMENTS:** THERE WILL BE WEEKLY TAKE-HOME QUIZZES (DUE MONDAYS AT 9 PM), AND THE WEEKLY WORKSHEET FROM SECTION. (DUE FRIDAYS AT 9 PM)

## MATERIALS NEEDED TO SUCCEED:

WHAT DO YOU NEED  
FOR THIS CLASS?

**INTERNET ACCESS + CANVAS NOTIFICATIONS:** ALL COURSE DOCUMENTS AND NOTIFICATIONS WILL BE POSTED ON CANVAS, SO BE SURE YOU HAVE CANVAS SET UP SO YOU RECEIVE CANVAS ANNOUNCEMENTS VIA EMAIL (OR BE SURE TO CHECK CANVAS ANNOUNCEMENTS REGULARLY!)

**AN ICLICKER:** STARTING IN WEEK 1, YOU WILL NEED A PHYSICAL ICLICKER REMOTE. THIS IS HOW WE WILL BE TAKING ATTENDANCE IN LECTURE. IF YOU DO NOT ALREADY HAVE ONE, THEY ARE ~\$59 NEW AND ~\$45 USED AT THE BOOKSTORE. THE BOOKSTORE ALSO HAS AN OPTION TO RENT ONE FOR A SINGLE QUARTER FOR ~\$27. THE MOBILE ICLICKER APP WILL NOT BE PERMITTED; THE CAMPUS WIFI IS NOT RELIABLE ENOUGH FOR IT TO WORK.

**PIAZZA ACCESS:** WE'LL BE USING PIAZZA AS A PLACE FOR YOU TO POST QUESTIONS. THESE ARE NOT GRADED OR REQUIRED, BUT PIAZZA SHOULD BE YOUR FIRST DESTINATION OUTSIDE OF OFFICE HOURS FOR QUESTIONS ABOUT CONTENT AND LOGISTICS (EMAILS SHOULD ONLY BE USED TO DISCUSS PRIVATE INFORMATION OR PERSONAL CIRCUMSTANCES). THERE IS A PIAZZA LINK ON CANVAS.

**ASSESSMENTS AND BASIS FOR FINAL GRADE:****ASSESSMENT % OF GRADE**

LECTURE CLICKERS	15%
SECTION ACTIVITIES (WORKSHEETS)	10%
WEEKLY QUIZZES	15%
MIDTERM EXAM	25%
FINAL EXAM	35%

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)

ASSIGNMENT REMINDERS  
WILL BE ANNOUNCED IN  
LECTURE AND VIA CANVAS  
ANNOUNCEMENTS!

**KEY ASSESSMENTS IN BRIEF:**

**CLICKERS (15% OF GRADE)** - EACH DAY IS WORTH 3 POINTS. 2 POINTS ARE FOR PARTICIPATION - YOU MUST SUBMIT AN ANSWER FOR ALL BUT 1 QUESTION TO EARN 2 POINTS. IF YOU MISS MORE THAN 1 QUESTION, YOU WILL LOSE THE 2 POINTS. THE OTHER POINT IS EARNED BY GETTING CORRECT ANSWERS. IT WILL BE CALCULATED AS THE TOTAL YOU GOT CORRECT OUT OF THE TOTAL NUMBER OF QUESTIONS. YOU CAN FULLY MISS UP TO 3 LECTURES WITHOUT PENALTY (IN CANVAS, WE WILL DROP YOUR 3 LOWEST CLICKERS AT THE END OF THE QUARTER). WE WILL START COUNTING CLICKERS ON 4/4. IF YOU NEED TO MISS MORE THAN 3 LECTURES, PLEASE SEE THE ATTENDANCE POLICY ON THE NEXT PAGE.

**WEEKLY QUIZZES (15% OF GRADE) - DUE MONDAYS AT 9 PM**

QUIZZES WILL BE AVAILABLE FROM 3PM SUNDAY - 9PM MONDAY. THEY ARE OPEN NOTE, BUT ONCE YOU START YOU WILL ONLY HAVE 30 MINUTES TO FINISH, SO YOU WILL NOT HAVE ENOUGH TIME TO LOOK UP EVERYTHING. YOU ARE NOT ALLOWED TO WORK WITH OTHERS OR ASK FOR HELP DURING THE QUIZ. YOUR LOWEST QUIZ WILL BE DROPPED. IF YOU NEED TO MISS MORE THAN 1 QUIZ, SEE THE EXTENSION SECTION ON THE NEXT PAGE.

**SECTION ACTIVITY WORKSHEETS (10% OF GRADE) - DUE FRIDAYS AT 9PM**

IN SECTION, THERE WILL BE TIME TO WORK IN GROUPS ON A WORKSHEET WITH IA SUPPORT. YOUR LOWEST WORKSHEET WILL BE DROPPED. SECTION ATTENDANCE IS NOT REQUIRED, BUT THE WORKSHEETS WILL BE EASIER IF YOU WORK IN A GROUP. SO ATTENDANCE WILL BE INCENTIVIZED. AN OPPORTUNITY TO ANSWER 1 EXTRA CREDIT QUESTION WILL BE AVAILABLE DURING SECTION. THIS 'BONUS' QUESTION WILL REQUIRE YOU TO TALK TO YOUR GROUP TO ANSWER IT. YOU CAN EARN UP TO 6 EXTRA CREDIT POINTS BY ANSWERING THESE BONUS QUESTIONS THROUGHOUT THE QUARTER. IF YOU EARN ALL 6, YOU WILL GET 1% EXTRA CREDIT ADDED TO YOUR OVERALL GRADE.

**EXAMS (60% OF GRADE)**

EXAMS WILL BE IN PERSON + CLOSED-BOOK, AND CALCULATORS WILL NOT BE PERMITTED. YOU WILL BE ALLOWED TO BRING A ONE-PAGE, SINGLE-SIDED, HANDWRITTEN 'CHEAT SHEET.'

**LOGISTICS AND FAQs:**

WE KNOW THAT LIFE IS COMPLICATED AND UNEXPECTED THINGS HAPPEN. WE ACCOUNT FOR THIS IN OUR ATTENDANCE + EXTENSION POLICIES, DESCRIBED BELOW.

**LECTURE ATTENDANCE:**

IF YOU MISS LECTURE, YOU DO NOT NEED TO REACH OUT OR REQUEST APPROVAL, AS LONG AS YOU HAVEN'T MISSED MORE THAN 3 LECTURES. IF YOU HAVE GONE OVER 3 MISSED LECTURES, PLEASE REACH OUT TO DR. PETRIE TO DISCUSS YOUR OPTIONS FOR POTENTIALLY GETTING THAT DAY'S PARTICIPATION EXCUSED - GENERALLY, ANY CHRONIC CONCERNS WILL REQUIRE OFFICIAL ACCOMMODATION FROM OSD, AND ANY ACUTE OR UNEXPECTED ISSUES WILL REQUIRE VALIDATION FROM YOUR COLLEGE'S DEAN OF STUDENT AFFAIRS. UNLESS THE SITUATION IS AN EMERGENCY, YOU MUST CONTACT ME AHEAD OF TIME. PLEASE PRIORITIZE THE HEALTH OF YOURSELF AND OTHERS: IF YOU HAVE ANY COLD SYMPTOMS OR HAVE BEEN ADVISED TO QUARANTINE, PLEASE STAY HOME!

**EXTENSIONS:**

IF YOU EXPERIENCE EXTENUATING CIRCUMSTANCES (ILLNESS, FAMILY EMERGENCIES ETC.) THAT WOULD PREVENT YOU FROM SUBMITTING WORK (QUIZZES, WORKSHEETS) ON TIME, PLEASE REACH OUT TO DR. PETRIE TO REQUEST AN EXTENSION. DOCUMENTATION (FROM OSD OR DEAN OF STUDENT AFFAIRS, AS DESCRIBED ABOVE) MAY BE REQUIRED.

**WHAT IF I MISS AN EXAM?**

IF YOU MISS AN EXAM, YOU MAY BE ELIGIBLE TO MAKE IT UP AT THE TRITON TESTING CENTER FOR A LIMITED AMOUNT OF TIME (UNTIL WE RELEASE THE GRADES). IF THAT TIME IS NOT SUFFICIENT, YOU MAY BE ELIGIBLE FOR AN INCOMPLETE, DEPENDING ON THE CIRCUMSTANCES.

IF HEALTH OR FAMILY EMERGENCIES RESULT IN YOU MISSING A SUBSTANTIAL AMOUNT OF COURSEWORK, YOU MAY BE ELIGIBLE FOR AN "INCOMPLETE". PER UCSD POLICY, YOU MUST BE IN GOOD STANDING BEFORE WORK IS MISSED TO BE ELIGIBLE.

**WHAT IF I HAVE QUESTIONS ABOUT GRADES?**

FOR QUESTIONS ABOUT WHY POINTS WERE TAKEN OFF, PLEASE CONTACT YOUR OFFICIAL IA. IF YOU THINK A GRADE MAY HAVE BEEN ASSIGNED IN ERROR OR IF YOU HAVE ANY CONCERNS, PLEASE CONTACT DR. PETRIE WITHIN 7 DAYS OF GETTING YOUR SCORE BACK.

**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) FRACTURES THE PLAYING FIELD BY GIVING SOME STUDENTS AN UNFAIR ADVANTAGE. ASSIGNMENTS WILL BE MONITORED VIA TURN-IT-IN, AND STUDENTS SUSPECTED OF ACADEMIC DISHONESTY WILL BE REPORTED TO THE ACADEMIC INTEGRITY OFFICE AND MAY RECEIVE A FAILING GRADE.



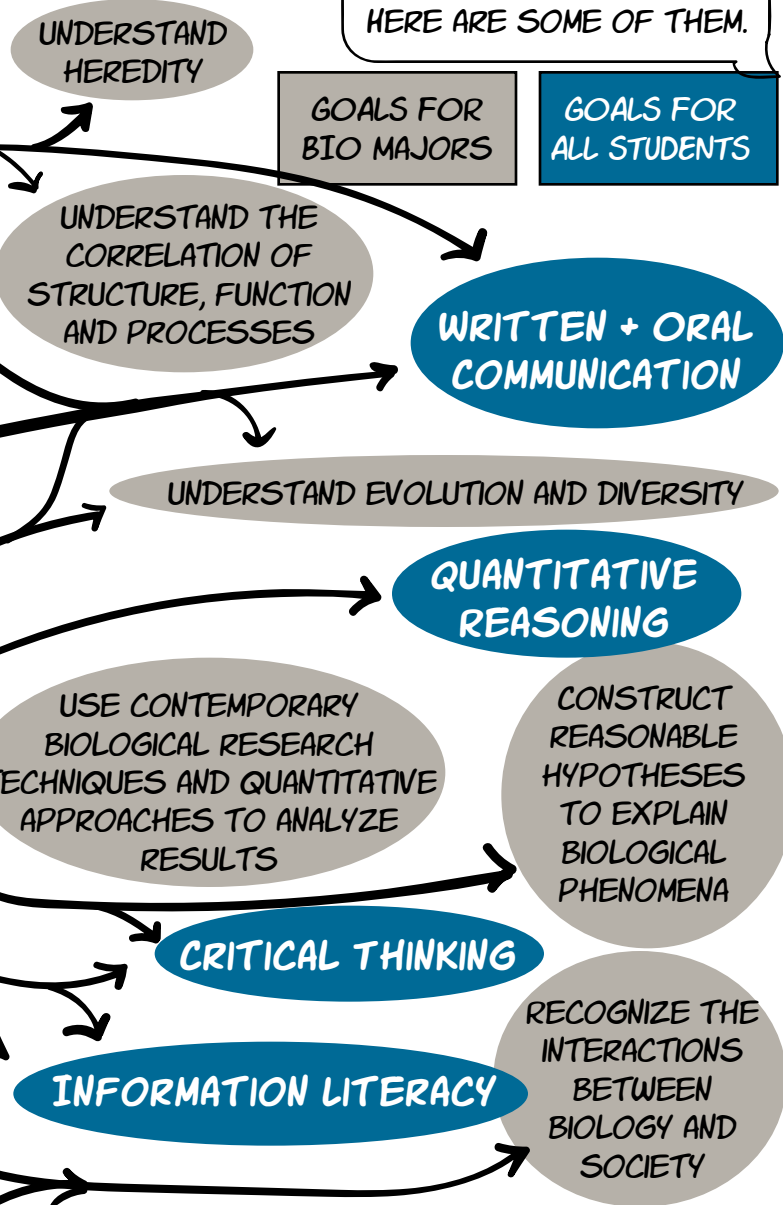
## WHAT THIS COURSE WILL ENABLE YOU TO DO:

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

### 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 DISCUSS 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
11. RECOGNIZE THE LEGACY OF SCIENTIFIC RACISM AND IT'S RELATIONSHIP TO MODERN GENOMICS



GOALS FOR BIO MAJORS

GOALS FOR ALL STUDENTS

**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

**WHERE TO GET HELP IF YOU HAVE QUESTIONS?**  
 PLEASE BE SURE TO WATCH EACH LECTURE. IF YOU DIDN'T GET A CHANCE TO HAVE YOUR QUESTIONS VIA THE IN-CLASS TEXT, YOU CAN ASK YOUR QUESTIONS VIA PIAZZA OR DURING OFFICE HOURS. PLEASE REFRAIN FROM EMAILING GENERAL CONTENT OR LOGISTICS QUESTIONS - EMAILS SHOULD ONLY BE USED TO DISCUSS SPECIFIC/PERSONAL CIRCUMSTANCES, AND GENERAL QUESTIONS RECEIVED VIA EMAIL MAY NOT BE ANSWERED.

**LETTERS OF RECOMMENDATION**  
 DUE TO THE EXTREMELY HIGH VOLUME OF REQUESTS I RECEIVE, I AM ONLY ABLE TO WRITE LETTERS FOR STUDENTS WHO HAVE EARNED A'S IN TWO CLASSES WITH ME, OR WHO I HAVE WORKED WITH OUTSIDE OF ENROLLMENT AS A STUDENT IN THIS CLASS.

**WEEK 1. HOW DO WE SEQUENCE GENOMES?**

S - 3/31 "QUIZ 1" (SURVEY) OPENS, DUE FRIDAY 9PM  
 T - 4/2 INTRODUCTION TO GENOMES AND COURSE  
 T - 4/2 SECTION: NO SECTION TODAY  
 H - 4/4 OLD-SCHOOL GENOME SEQUENCING

INTRODUCTION  
 +  
 KEY GENOMIC  
 METHODS

**WEEK 2. HOW DO WE SEQUENCE GENOMES (CONT)?**

M - 4/8 QUIZ ON WEEK 1 DUE 9 PM  
 T - 4/9 NEXT-GEN GENOME SEQUENCING 1 (ILLUMINA)  
 T - 4/9 SECTION: PRACTICE QUESTIONS FROM WEEK 1  
 H - 4/11 NEXT-GEN GENOME SEQUENCING 2 (ASSEMBLY)

**WEEK 3. EXTANT GENOME DIVERSITY (SPECIES)**

M - 4/15 QUIZ ON WEEK 2 DUE 9PM  
 T - 4/16 ANNOTATION + MEASURING DISTANCE  
 T - 4/16 SECTION: ANNOTATION ACTIVITY  
 H - 4/18 BUILDING TREES

GENOME  
 DIVERSITY  
 IN SPACE

GENOME DIVERSITY  
 AMONG THINGS THAT  
 ARE ALIVE IN THE  
 BIOSPHERE TODAY.

**WEEK 4. EXTANT GENOME DIVERSITY (POPULATIONS)**

M - 4/22 QUIZ ON WEEK 3 DUE 9 PM  
 T - 4/23 COMPARATIVE GENOMICS  
 T - 4/23 SECTION: PRACTICE TREE BUILDING QUESTIONS  
 H - 4/25 HUMAN DIVERSITY: RACE, RACISM, + GENOMICS

**WEEK 5. EXTANT GENOME DIVERSITY (POPULATIONS)**

M - 4/29 QUIZ ON WEEK 4 DUE 9PM  
 T - 4/30 GWAS + SCIENTIFIC BIAS  
 T - 4/30 SECTION: MIDTERM REVIEW  
 H - 5/2 MIDTERM EXAM 9:30-10:50 AM

QUIZZES ARE DUE MONDAYS AT 9PM (QUIZZES OPEN  
 30 HOURS EARLIER, AT 3PM ON SUNDAYS)



**WEEK 6. EXTANT GENOME DIVERSITY (COMMUNITIES)****M - 5/6 NO QUIZ****T- 5/7 ANCESTRY V. RACE: HISTORIC LEGACY + FUTURE****T- 5/7 SECTION: SCI COM ACTIVITY (DUE 5/17)****H - 5/9 POPULATION DIVERSITY AND CONSERVATION**GENOME  
DIVERSITY  
IN SPACE**WEEK 7. GENOME DYNAMICS OVER SHORT TIME SCALES****M - 5/13 QUIZ ON WEEK 5 + 6 DUE 9 PM****T- 5/14 METAGENOMES IN THE ENVIRONMENT AND HEALTH****T - 5/14 SECTION: REVIEW MIDTERM (CONT. WORK ON SCICOM)****H - 5/16 PLASTIC RESPONSES AND RNA-SEQ 1**GENOME  
DIVERSITY  
IN TIME**WEEK 8. GENOME DYNAMICS OVER SHORT TIME SCALES****M - 5/20 QUIZ ON WEEK 7 DUE 9 PM****T - 5/21 PLASTIC RESPONSES AND RNA-SEQ 2****T - 5/21 SECTION: PRACTICE QUESTIONS FROM WEEK 7****H - 5/23 EPIGENETICS**SHORT-TERM DYNAMICS:  
CHANGES IN THE  
"EXPRESSED"  
GENOME**WEEK 9. GENOME DYNAMICS OVER MEDIUM + LONG TIME SCALES****T - 5/28 DEVELOPMENT, STEM-CELLS, DIFFERENTIATION****T - 5/28 QUIZ ON WEEK 8 DUE 6 PM TUES (5/27 HOLIDAY)****T - 5/28 SECTION: DISCUSS EPIGENETICS PAPER****H - 5/30 MECH. OF GENOME EVOLUTON - DE NOVO GENES**LONG-TERM DYNAMICS:  
CHANGES IN THE  
GENOTYPE ITSELF**WEEK 10. GENOME DYNAMICS IN MULTICELLULAR ORGANISMS****M- 6/3 QUIZ ON WEEK 9 DUE 9 PM****T - 6/4 EVOLUTION OF MULTICELLULARITY / EVO-DEV****T - 6/5 SECTION: Q+A REVIEW FOR FINAL****H - 6/6 EVOLUTION OF CANCER + PERSONALIZED MEDICINE****FINAL!**FINAL + MIDTERM WILL BE IN-PERSON. NO  
CALCULATORS ARE PERMITTED, BUT YOU CAN  
BRING A SINGLE-SIDED SHEET (8.5 X 11  
INCHES) OF NOTES WITH YOU.**CUMULATIVE FINAL EXAM:  
TUESDAY  
6/11 8-11 AM**