

# BIEB 146: GENOME DIVERSITY AND DYNAMICS

LIVE ON ZOOM: TUE + THUR, 5-6:20 PM

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**

OFFICE HOURS: [kpetrie@ucsd.edu](mailto:kpetrie@ucsd.edu)  
TUESDAYS 8:30-10:30 AM (via zoom)  
see canvas for office hours sign-up link



**IAS:** Eesha Rangani      Nkechinyere Iroanusi  
Samantha Ivezich      Dingding Ma      Payton Coffman  
Varsha Mathew      Nicole Mendoza      Jimmi Ngyen

**SEE CANVAS FOR...**

IA contact info  
IA discussion section assignments  
IA office hours

WHAT WILL YOU BE DOING IN THIS CLASS?

**LECTURES:** WE'LL HAVE LIVE MEETINGS VIA ZOOM ON TUESDAY AND THURSDAY. THESE WILL BE INTERSPERSED WITH POLL QUESTIONS AND CHAT-BASED DISCUSSION. LECTURES WILL BE RECORDED, AND ATTENDANCE IS NOT REQUIRED.

**DISCUSSION SECTION:** IAS WILL GO OVER QUIZ RESULTS AND QUESTIONS YOU HAVE FROM LECTURE. THERE WILL ALSO BE AN IN-SECTION WORKSHEET, BASED ON PRACTICE PROBLEMS OR A READING. THE WORKSHEET WILL PROBABLY BE EASIER TO DO IF YOU WORK TOGETHER WITH YOUR PEERS AND GET IT OVER WITH DURING SECTION, BUT YOU CAN ALSO WORK ON IT ON YOUR OWN, SO SECTION ATTENDANCE IS NOT TECHNICALLY REQUIRED. PLEASE ATTEND THE SECTION YOU ARE OFFICIALLY ENROLLED IN (EMAIL DR. PETRIE IF YOU HAVE SCHEDULING CONCERNS)

**ASSIGNMENTS:** THERE WILL BE WEEKLY TAKE-HOME QUIZZES, AND WEEKLY DISCUSSION FORUM PARTICIPATION (AS WELL AS THE WEEKLY SECTION WORKSHEET).

## COURSE STRUCTURE:

## 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 THEM REGULARLY!)

**ZOOM ACCESS:** WE WILL HOST LIVE MEETINGS AT OUR REGULARLY SCHEDULED CLASS TIME ON TUESDAYS AND THURSDAYS (THEY WILL BE RECORDED IF YOU CAN'T MAKE IT). WE WILL ALSO USE ZOOM FOR DISCUSSION SECTION AND OFFICE HOURS. YOU ARE NOT REQUIRED TO SHARE VIDEO, BUT WE ENCOURAGE YOU TO PLEASE DO SO, AT LEAST DURING OFFICE HOURS IF YOU FEEL COMFORTABLE.

**PACKBACK ACCESS CODE:** THERE IS NO REQUIRED TEXTBOOK FOR THIS COURSE, BUT WE'LL BE USING THIS AI-MODERATED DISCUSSION FORUM TO DIVE DEEPER INTO THE TOPICS WE COVER IN CLASS. BY ENROLLING IN THIS CLASS, YOU ARE AUTOMATICALLY SET UP TO PURCHASE PACKBACK (~\$30), VIA INCLUSIVE ACCESS AT THE BOOKSTORE. IF YOU DROP THE COURSE, BE SURE TO OPT-OUT OF PACKBACK TO AVOID BEING CHARGED. SEE CANVAS FOR MORE INFO.

## ASSESSMENTS AND BASIS FOR FINAL GRADE:

ASSESSMENT	% OF GRADE
WEEKLY PACKBACK	10 %
SECTION ACTIVITIES (WORKSHEETS)	5 %
WEEKLY QUIZZES	40 %
MIDTERM EXAM	15%
FINAL EXAM	30%

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:

### WEEKLY PACKBACK (10% OF GRADE) - DUE MONDAYS AT 12:00 PM (NOON)

THIS AI-MODERATED DISCUSSION FORUM WILL HELP YOU MAKE CONNECTIONS BETWEEN WHAT WE LEARN IN CLASS AND THE REAL WORLD. EVERY WEEK, YOU ARE REQUIRED TO: MAKE 2 POSTS, AT LEAST 1 OF WHICH MUST BE A RESPONSE. TO EARN CREDIT, YOUR POSTS MUST MEET CERTAIN GUIDELINES. PACKBACK WILL ASSIGN A SCORE BASED ON ITS DEPTH, CREDIBILITY, AND PRESENTATION. HIGH SCORES ARE AN OPPORTUNITY TO EARN EXTRA CREDIT. YOUR LOWEST PACKBACK WILL BE DROPPED.

### WEEKLY QUIZZES (40% OF GRADE) - DUE MONDAYS AT 12:00 PM (NOON)

THESE QUIZZES TEST YOUR ABILITY TO APPLY WHAT YOU'VE LEARNED EACH WEEK. THEY WILL BE 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. TO DISCOURAGE COLLABORATION, QUESTIONS WILL BE PULLED FROM A BANK AND THEY WILL BE RANDOMIZED IN ORDER. YOUR LOWEST QUIZ WILL BE DROPPED.

### SECTION ACTIVITY WORKSHEETS (5% OF GRADE) - DUE AT BEG. OF NEXT SECTION

DURING MOST DISCUSSION SECTIONS, THERE WILL BE A BRIEF WORKSHEET BASED ON A GENOMICS TECHNIQUE OR A READING. YOU CAN DO THIS ON YOUR OWN, BUT IT WILL PROBABLY BE EASIER (AND FASTER) TO COMPLETE IT WITH YOUR PEERS IN SECTION YOUR TWO LOWEST WORKSHEETS WILL BE DROPPED.

### EXAMS (45% OF GRADE)

EXAMS WILL BE OPEN NOTE AND ONLINE, BUT THEY WILL BE SYNCHRONOUS (MIDTERM WILL OCCUR DURING REGULARLY SCHEDULED CLASS TIME, FINAL WILL OCCUR DURING OUR SCHEDULED FINAL EXAM TIME). BE SURE TO PREPARE AHEAD OF TIME - YOU WON'T HAVE ENOUGH TIME TO LOOK EVERYTHING UP! JUST LIKE THE QUIZZES, YOU ARE NOT ALLOWED TO WORK WITH OTHERS OR ASK FOR HELP.

**LOGISTICS AND FAQs:****PARTICIPATION:**

WE KNOW THAT LIFE IS COMPLICATED AND UNEXPECTED THINGS HAPPEN. SO LECTURE ATTENDANCE IS NOT REQUIRED, AND LECTURES ARE RECORDED FOR YOU IF YOU MISS THEM.

BECAUSE WE THINK SECTION ATTENDANCE WILL HELP YOU LEARN THE MATERIAL, WE ARE INCENTIVIZING DISCUSSION ATTENDANCE WITH A BRIEF GRADED WORKSHEET. YOU CAN DO THIS ON YOUR OWN, SO ATTENDANCE IS NOT TECHNICALLY REQUIRED, BUT IT WILL BE EASIER TO WORK THROUGH IT WITH YOUR PEERS IN SECTION SO YOU DON'T HAVE TO WORRY ABOUT IT OUTSIDE OF CLASS. THE WORKSHEET ASSIGNMENT WILL BECOME AVAILABLE DURING THE START OF YOUR SECTION, AND WILL BE DUE AT THE BEGINNING OF YOUR NEXT SECTION. WE'LL DROP YOUR LOWEST TWO SECTION ACTIVITIES.

IF SOMETHING COMES UP AND YOU NEED TO MISS MORE THAN 2 SECTION WORKSHEETS, OR MORE THAN 1 QUIZ OR MORE THAN 1 PACKBACK, EMAIL DR. PETRIE TO DISCUSS YOUR OPTIONS; GENERALLY WE CAN BE PRETTY FLEXIBLE IN THE CASE OF UNEXPECTED ILLNESS OR EMERGENCIES.

**WHAT IF I DON'T TURN SOMETHING IN ON TIME?**

GENERALLY, NO LATE WORK WILL BE ACCEPTED. HOWEVER, YOUR LOWEST QUIZ, YOUR LOWEST PACKBACK WEEK, AND YOUR LOWEST 2 SECTION ACTIVITY WORKSHEETS ARE DROPPED

THESE DROPS ARE DESIGNED TO TAKE CARE OF UNEXPECTED SITUATIONS/TECH ISSUES, BUT PLEASE REACH OUT TO ME IF YOU HAVE ANY EXTENUATING OR SPECIAL 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:**

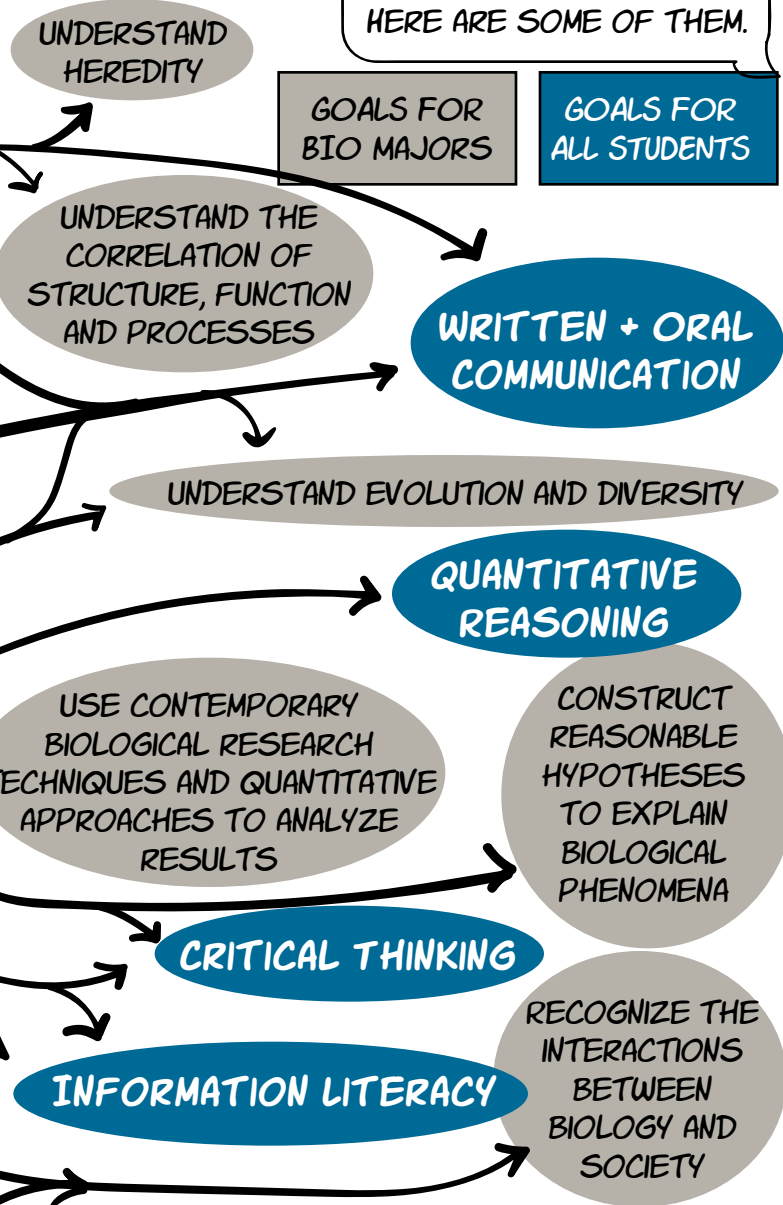
AN INCLUSIVE ENVIRONMENT IS ONE WHERE EVERYONE HAS AN EQUAL OPPORTUNITY TO SUCCEED. ACADEMIC DISHONESTY (INCLUDING, BUT NOT LIMITED TO: CHEATING + PLAGIARIZING) FRACTURES THE PLAYING FIELD BY GIVING SOME STUDENTS AN UNFAIR ADVANTAGE. ASSIGNMENTS WILL BE MONITORED VIA TURN-IT-IN, AND STUDENTS SUSPECTED 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



**WHERE TO GET HELP IF YOU HAVE QUESTIONS?**  
PLEASE BE SURE TO WATCH EACH LECTURE. IF YOU WATCH THE RECORDING, OR IF YOU DIDN'T GET A CHANCE TO HAVE YOUR QUESTIONS ANSWERED VIA THE CHAT, YOU CAN ASK YOUR IA DURING THEIR SECTION OR THEIR OFFICE HOURS, OR YOU CAN EMAIL YOUR IA (IF YOU STILL HAVE QUESTIONS OR CONCERNS AFTER EMAILING YOUR IA, YOU CAN EMAIL THE INSTRUCTOR).

**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 0. INTRODUCTION**

NO SECTION WEEK 0!

H- 9/22 INTRODUCTION TO GENOMES AND COURSE

INTRODUCTION

+

KEY GENOMIC  
METHODS**WEEK 1. HOW DO WE SEQUENCE GENOMES?**

SECTION: PRACTICE QUESTIONS FROM WEEK 0

M - 9/26 "QUIZ" (SURVEY) DUE 12PM, NO PACKBACK YET

T - 9/27 OLD-SCHOOL GENOME SEQUENCING

H - 9/29 NEXT-GEN GENOME SEQUENCING 1 (ILLUMINA)

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

SECTION: ANNOTATION ACTIVITY

M - 10/3 PACKBACK + QUIZ ON WEEKS 0-1 DUE

T - 10/4 NEXT-GEN GENOME SEQUENCING 2 (ASSEMBLY)

H - 10/6 MEASURING DIFFERENCES + BUILDING TREES

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

SECTION: PRACTICE QUESTIONS FROM WEEK 2

M - 10/10 PACKBACK + QUIZ ON WEEK 2 DUE

T - 10/11 COMPARATIVE GENOMICS

H - 10/12 HUMAN DIVERSITY: RACE, RACISM, + GENOMICS

GENOME DIVERSITY  
AMONG THINGS THAT  
ARE ALIVE IN THE  
BIOSPHERE TODAY.**WEEK 4. EXTANT GENOME DIVERSITY (POPULATIONS)**

SECTION: PAPER DISCUSSION 2

M - 10/17 PACKBACK + QUIZ ON WEEK 3 DUE

T - 10/18 GWAS + SCIENTIFIC BIAS

H - 10/20 ANCESTRY V. RACE: HISTORIC LEGACY + FUTURE

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

SECTION: GWAS ACTIVITY

M- 10/24 PACKBACK + QUIZ ON WEEK 4 DUE

T -10/25 POPULATION DIVERSITY AND CONSERVATION

H -10/26 METAGENOMES IN THE ENVIRONMENT AND HEALTH

PACKBACKS AND QUIZZES ARE BOTH DUE MONDAYS AT  
NOON (QUIZZES OPEN 24 HOURS EARLIER, AT 12PM ON  
SUNDAYS, BUT YOU CAN START PACKBACKS ANYTIME  
AFTER TUESDAY'S LECTURE!)

WEEK 6. EXTANT GENOME DIVERSITY (COMMUNITIES)  
 SECTION: NO SECTION THIS WEEK, SEE IA OFFICE HOURS  
 M - 10/31 NO QUIZ + NO PACKBACK  
 T - 11/1 MIDTERM EXAM 5-6:20 PM  
 H - 11/3 PLASTIC RESPONSES AND RNA-SEQ 1

**MIDTERM!**

GENOME  
DIVERSITY  
IN TIME

WEEK 7. GENOME DYNAMICS OVER SHORT + MEDIUM TIME SCALES  
 SECTION: NO SECTION THIS WEEK (UCSD HOLIDAY)  
 M - 11/7 PACKBACK + QUIZ ON WEEK 5 + 6 DUE  
 T - 11/8 PLASTIC RESPONSES AND RNA-SEQ 2  
 H - 11/10 DEVELOPMENT AND REGULATORY CASCADES

SHORT-TERM DYNAMICS  
CHANGES IN THE  
"EXPRESSED"  
GENOME

WEEK 8. GENOME DYNAMICS OVER MEDIUM + LONG TIME SCALES  
 SECTION: PRACTICE PROBLEMS FROM WEEK 7  
 M - 11/14 PACKBACK + QUIZ ON WEEK 7 DUE  
 T - 11/15 STEM-CELLS, DIFFERENTIATION  
 H - 11/16 MECH. OF GENOME EVOLUTON - DE NOVO GENES

LONG-TERM DYNAMICS:  
CHANGES IN THE  
GENOTYPE ITSELF

WEEK 9. GENOME DYNAMICS OVER LONG TIME SCALES  
 SECTION: NO SECTION THIS WEEK (UCSD HOLIDAY)  
 M - 11/21 PACKBACK + QUIZ ON WEEK 8 DUE  
 T - 11/22 EVO-DEVO + ALLELE-SPECIFIC EXPRESSION  
 H - 11/24 NO CLASS - HAPPY THANKSGIVING!!

WEEK 10. GENOME DYNAMICS WITHIN A SINGLE LIFETIME  
 SECTION: PAPER DISCUSSION 3  
 M - 11/28 PACKBACK + QUIZ ON WEEK 9 DUE  
 T - 11/29 KEY MOMENTS IN GENOME HISTORY  
 H - 12/1 EVOLUTION OF CANCER + PERSONALIZED MEDICINE

**FINAL!**

FINAL + MIDTERM WILL BE ONLINE + OPEN  
NOTE (TAKEN REMOTELY) BUT THEY WILL  
ONLY BE AVAILABLE DURING THE SCHEDULED  
TIME (MUST TAKE SYNCHRONOUSLY)

FINAL EXAM:  
FRIDAY  
12/9 7-10 PM