

ANTH 376: GENOMICS & ANTHROPOLOGY
4 credit hours (satisfies an SC requirement)

Course Time (lecture): 12pm – 1:20pm, Mondays & Wednesdays

Course Location (lecture): 208 DEA

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Office Hours: Wednesdays 2pm to 4pm

Prerequisite

Students should have completed at least one of the following courses: ANTH 270 (Introduction to Biological Anthropology), ANTH 175 (Evolutionary Medicine), BI 211 (General Biology I: Cells), or BI 282H (Honors Biology II: Genetics and Molecular Biology). Students who took ANTH 199 Introduction to Molecular Anthropology during the Winter 2013 term are not eligible to enroll in this course.

Course Description

This course explores how molecular data are used to address anthropological questions concerning human (and nonhuman primate) biological variation, health and evolution.

Extended Course Description

The Human Genome Project and recent advances in genome sequencing techniques have made it possible to sequence human genomes relatively quickly and inexpensively. As more and more genomes are being sequenced, scientists are exploring these data in hopes of finding the molecular underpinnings of human traits and diseases. This group-satisfying (science) course will explore how genomics and other types of molecular data are used to address fundamental questions of human (and nonhuman primate) evolution and biology. Each week we will explore different topics in molecular anthropology including: the Human Genome Project and related spin-off projects; genomic insights into human diversity and evolution; personal genomics and medicine; gene X environment interactions (e.g., epigenetics); ancient DNA (e.g., Neanderthal genome); primate comparative genomics; and molecular primatology. In addition, students will have an opportunity to discuss and critically analyze current biological and social issues related to human genetics/genomics during their weekly discussion sections.

The course will also serve as an introduction to molecular anthropology for anthropology majors and an introduction to the field for non-majors. As one of the fastest growing subfields

of biological anthropology, molecular anthropology is a critical component in the education of all students in the discipline. After successfully completing this course, students will be prepared to enter upper-level courses in molecular anthropology.

This course has three main sections:

Unit 1: This course begins with a two-week section that introduces students to key concepts and methods used in molecular anthropology. During this section we will also establish a scientific framework through which students will be expected to interpret and assess the material and readings presented during the term. **The ultimate objective of this section is for students to learn key concepts and terminology common in human genomics (and other -omics).**

Unit 2: The second section of the course will focus on human genomics. We will discuss the promises and pitfalls of personal genomics, focusing on the intersection of genomic data and medicine. We will also explore the complex ethical issues and social implications of human genome sequencing and direct-to-consumer genomic testing. **The ultimate objective of this section is for students to learn how to interpret and assess genetic/genomic information encountered in daily life.**

Unit 3: During the final section of this course we will explore how genomic (and other -omics) data are currently being used to study human origins. Using an evolutionary framework, we will place the human genome in context with other hominins (e.g., Neanderthals) and primates (e.g., chimpanzees) in order to understand the molecular underpinnings of distinctly human traits. We will start by examining research that compares human and nonhuman primate genomes and then expand out to studies that attempt to connect human-specific genotypes to human-specific characteristics. **The ultimate objective of this section is for students to understand how molecular data are being used to explore fundamental questions in human biology and evolution.**

Student Learning Outcomes

By the end of this course students will be able to:

1. define key concepts in genetics and genomics
2. outline how genomic data are collected and analyzed
3. explain how genomics is currently used in healthcare
4. explain how genomics has contributed to our understanding of human evolution
5. discuss ethical issues and social implication of human genome sequencing
6. discuss practical and ethical issues for direct-to-consumer genomic testing

Course Content

The course consists of lectures and required weekly discussion sections.

Canvas

A Canvas site will be maintained for this class, which will be your main source for course information, documents, and announcements. **Make sure that you regularly check your Canvas-linked email account.**

Required Readings

- *My Beautiful Genome: Exposing Our Genetic Future, One Quirk at a Time* by Lone Frank (2011; available at the Duckstore).
- A Nature Scitable online textbook designed for this class (<http://www.nature.com/scitable/group-join/genomics-and-anthropology-2017-154493324/12944>). Instructions for how to register and where to find the course materials will be given during the first week of class.
- All other readings will be available online (Canvas). Please see **Pages** for weekly reading assignments. Readings should be completed before arriving to class on the day they are listed unless otherwise noted.

Classroom Etiquette

Help make this an intellectually safe and friendly environment by respecting others in the class. Along these lines, please:

- arrive for class on time and read all articles before the start of each class.
- do not interrupt someone speaking in class.
- silence or turn off your cell phone during class.
- never text, instant message or surf the web during class. In addition to being disrespectful and distracting to others, it will cost you participation credit.
- never record (audio or video) any part of the lectures or discussions unless you have my permission.

Accommodations

Appropriate accommodations will be provided for students with documented disabilities. Please make arrangements to meet with me to discuss these accommodations.

Evaluation Criteria

Regular attendance at lectures and participation in discussion sections are required. Course readings are required and are essential to passing exams, completing reaction papers, and participating in discussion sections. Grades are based on two in-class exams, a final exam, 3 reaction papers, and weekly discussion section attendance and participation (including a few short assignments/activities, see **Discussion Section Pages**).

Exam 1 (covers weeks 1-3)	15%
Exam 2 (covers weeks 4-6)	15%
Final Exam	20%
Reaction Papers	30% (10% each)
Discussion Section Attendance	10%
Discussion Section Participation	10%

Exams

Exams will test student comprehension of the fundamental concepts covered in this class and will include multiple choice, matching, fill-in-the-blank, and short answer. Exams 1 and 2 will cover lecture materials and readings for weeks 1-3 and 4-6 respectively. The final exam will cover lecture materials and readings for weeks 7-10 as well as the major concepts and themes from the entire course. The exams must be taken during the scheduled time - under **no circumstances will make-up exams be given without a documented excuse**. If you will not be able to take an exam you **must** notify me in advance (preferably by e-mail).

Reaction Papers

During the quarter, each student will write three short (2-3 page) reaction papers on topics provided by the instructor. These response papers provide opportunities for discussion and critical analysis of current biological and social issues related to human genetics/genomics. Reaction papers are only 2-3 pages long so writing should be concise and focused around a couple of main points. Reaction papers should be typed, double-spaced, using 12-point font with 1" margins. Papers are due when listed on the course schedule (below) – **extensions will not be given without a documented excuse**. If you will not be able to turn in your paper on time you **must** notify me in advance (preferably by e-mail). See the **Guideline for Reaction Paper** handout for tips on writing an effective reaction paper.

Discussion Sections

This class has required weekly discussion sections. During these sessions, students will have an opportunity to discuss and critically analyze current biological and social issues related to human genetics/genomics in small groups. It is important that students read over the week's discussion topic ahead of time and come to the section prepared to contribute. A more thorough description of the discussion component of this class and all related assignments is provided in the **Discussion Section Pages** on Canvas.

Grading Statement

Grades will be assigned as follows: A = 90-100%, B = 80-89%, C = 70-79%, D = 60-69%, F < 60% (with minus and plus grades assigned at appropriate cutoffs).

A+ Quality of student's performance significantly exceeds that of an A. Very few, if any, students receive this grade in a given course.

A Outstanding performance relative to that required to meet course requirements; demonstrates both mastery of course content & coursework quality at the highest level.

B Performance that is significantly above that required to meet course requirements; demonstrates both mastery of course content & coursework quality at a high level.

C Performance that meets the course requirements in every respect; demonstrates adequate understanding of course content and coursework quality.

D Performance that is at the minimal level necessary to pass the course but does not fully meet the course requirements; demonstrates marginal understanding of course content and coursework quality.

F Performance in the course, for whatever reason, is unacceptable and does not meet the course requirements; demonstrates inadequate understanding of the course content and coursework quality.

Course Schedule

Unit 1 The Basics

Week	Day	Topics & Assignments
1	Jan 9	Course Introduction The Basics: Genetics Part 1
	Jan 10	Discussion Section
	Jan 11	The Basics: Genetics Part 2
2	Jan 16	No Class
	Jan 17	Discussion Section Movie <i>Gattaca</i>
	Jan 18	Movie <i>Gattaca</i> (cont.) Human Genome Project
3	Jan 23	The Basics: Inheritance
	Jan 24	Discussion Section Reaction Paper 1 Due
	Jan 25	Molecular Methods: Gene to Genome

Unit 2 Genomics & Health

4	Jan 30	Exam 1 (Weeks 1, 2, 3) Genomics, Health & Disease
	Jan 31	Discussion Section
	Feb 1	Genomics, Health & Disease
5	Feb 6	Direct-To-Consumer Genetic Testing (e.g. 23&Me)
	Feb 7	Discussion Section
	Feb 8	Guest Lecture: Sarah Ryan (Genetic Counselor)
6	Feb 13	Genes, Race & Identity Reaction Paper 2 Due
	Feb 14	Discussion Section
	Feb 15	Genes & Behavior

Unit 3 Evolutionary Genomics

7	Feb 20	Exam 2 (Weeks 4, 5, 6) Evolutionary Genomics
	Feb 21	Discussion Section
	Feb 22	Human Evolutionary Genomics; Ancient DNA
8	Feb 27	Genetic Switches (Transcriptomics)
	Feb 28	Discussion Section
	Mar 1	Gene X Environment Interactions (Epigenomics)
9	Mar 6	Connecting Genotypes to Phenotypes
	Mar 7	Discussion Section
	Mar 8	The Microbiome
10	Mar 13	Future Directions: Gene-Editing (e.g., CRISPR)
	Mar 14	Discussion Section Reaction Paper 3 Due
	Mar 15	Genomics & Society Review for Final
Exam Week		Exam 3 is on Monday, March 20th at 10:15am