

An 15: Human Evolution Fall 2020 Virtual



Instructor: Dr. Bridget Alex

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Office Hours:

Starting Week 2, Weekly drop in Zoom session 1 – 2 pm Thursdays
Or schedule a phone or Zoom appointment at another time by emailing me

Hours: T / Th 2:30 – 4 pm

Units: 3-0-6

How do we know how humans evolved? This course will investigate evidence and methods used to reconstruct human evolution. We will review 8 million years of evolutionary history, focusing on the origins of defining features of our species such as bipedalism, tool use, cumulative culture, and language. We will evaluate interpretations of the past using different lines of evidence including genetic and fossil data, the archaeological and ethnographic records, and comparisons with living primates. Theoretically, we will rely on concepts from evolutionary biology and anthropology, like adaptation, phylogenetics, life history theory, behavioral ecology, and gene-culture coevolution. The course will end with modern human diversity and recent evolution.

Course goals and learning outcomes:

Content:

- Identify traits that distinguish humans from other primates
- Evaluate hypotheses for when and why these traits evolved using evidence from fossils, genetics, archaeology, ethnographic studies, and primatology
- Summarize key biological/behavioral transitions in human evolution
- Recognize major hominin taxa, artifact types and paleoanthropological sites

Skills:

- Interpret evidence and evaluate hypotheses in paleoanthropology
- Read and critique scientific research
- Distinguish, comprehend, and evaluate different sources including research papers, reviews, commentaries and news
- Propose future research

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Format: We'll meet "live" on Zoom Tuesdays and Thursdays at 2:30 pm for approximately 1 hour. Tuesdays will comprise a lecture and discussion led by Dr. Alex. On Thursdays we'll have Journal Club, in which students will lead discussion of research papers. If you cannot attend the live session you can watch a recorded video *and* post to a discussion board.

There are also Weekly Modules on Canvas with asynchronous work that you are expected to complete that week at your own pace. Several larger assignments are spaced throughout the term.

Grading policy: Letter or pass/fail

Required reading: No textbook. Readings and resources will be posted on Canvas site.

Assignments & Grading

Summary:

Pre-course survey	1 point
Introductory meeting	3
Weekly module work	40
<i>(10 modules, 8 graded, 5 points each)</i>	
Journal club leader	20
Problem sets	20
<i>(10 pts each, 2 sets)</i>	
Graphical abstract	10
Mock Research proposal	
Draft	10
Pitch	10
Final	20
Post-course survey	1
Participation	5
Total	140

Assignment Details:

1) Pre/post course surveys: Before the second and after the last class meetings students will complete a survey about your understanding of course concepts. Neither survey is graded for accuracy. You will receive full credit for completing them. [1 point each]

2) Instructor meeting: During the first two weeks of class you will schedule a 10-minute meeting with Dr. Alex to introduce yourself and discuss course goals. [3 points]

3) Weekly Module Work: Each week you will have a series of formative assignments posted on Canvas to complete at your own pace. They will include readings, videos, short quizzes, discussion boards, and short reflections. Each weekly module will be posted after class on Tuesday and is due the following Monday at 5 pm. Weekly modules submitted late will be docked 1 point. **Only your highest scoring 8 out of 10 possible Weekly Modules will be included in your grade.** In other words, your 2 lowest module grades will be dropped. If you entirely skip 2 weeks, those modules will receive zeros and be the ones dropped. [10 total, 8 counted, 5 points each]

4) Journal club leader: Every Thursday four students will facilitate a one-hour discussion about a recent scientific article and associated publications. Modeled after j-clubs common in research groups. [20 points]

5) Graphical abstract: You will create an image that visually summarizes a research paper. [10 points]

6) Problem sets: You will answer research questions by analyzing virtual 3D models of fossils and paleoanthropological data. Collaboration permitted but not required. [2 sets, 10 points each]

7) Mock Research Proposal: You will conceive a research project, which you would conduct if freed of limitations imposed by time, resources, and expertise. It should be your dream project in paleoanthropology, considering all the approaches and topics we have discussed in class. Still, it must be feasible with state-of-the-art methods and samples that are existing or obtainable. The proposal will be 2 pages single-spaced, including background, question, proposed methods and significance. You will be provided feedback on a draft due earlier in the semester. You will also create a roughly 5-minute video pitching your project to the class for fictitious funding. The final written proposal is your culminating assignment for class. [draft 10 points, pitch 10 points, final 20 points]

8) Participation: Throughout the semester you attend or watch our virtual meetings, prepared to engage with the material. When you are attend “live” you respectfully listen to classmates and contribute thoughtful comments. When you watch recorded sessions you contribute to a follow-up discussion board [5 points].

Expectations & Policies

Attendance: We will generate knowledge and build community during our virtual class meetings. **Attending will enhance your enjoyment and mastery of course material.** Attendance is expected and will be reflected in your class participation points. If you cannot attend “live,” you can attend afterwards by watching the recorded video and posting to that day’s Discussion Board.

Late assignments: I know it will be challenging to meet deadlines this semester. Unanticipated trials will affect us variably at different times.

Weekly Module work is due Mondays at 5 pm. Late Weekly Modules will be docked 1 point, but accepted anytime in the term. Only 8 out of 10 modules will be included in your grade. Your two lowest scoring weeks will be dropped.

Larger assignments (graphical abstract, problem sets, research proposal) have deadlines spaced throughout the term. **If you turn these assignments in by the deadline you will receive +0.5 bonus on each.** You can receive full credit for assignments submitted between the deadline and 48 hours after it. Assignments submitted between 48 hours and one week post-deadline will lose 1 point. Assignments submitted over one week post-deadline will be docked half credit.

Flexibility is built into the syllabus to accommodate your lives and priorities. If you anticipate trouble meeting assignment deadlines, contact your professor as soon as possible. **Please prioritize the health and wellbeing of yourself and your loved ones. This class is NOT that important!**

Academic Integrity: You are expected to abide by the Caltech Honor Code: “No member of the Caltech community shall take unfair advantage of any other member of the Caltech community.” In An 15, discussion and the exchange of ideas are encouraged. However, written work should reflect your own thoughts, inspired by class readings and lectures. **Assignment instructions will specify outside sources that are permitted or prohibited. You may collaborate with others, but the submitted document must be written independently. You must also state your collaborators.** You must also adhere to standard citation practices in this discipline. Properly cite any books, articles, websites, lectures, etc. that have helped you with your work.

Accessibility and accommodations: I am committed to providing an accessible academic setting. The Accessibility Office offers a variety of accommodations and services to students with documented disabilities. Please visit <http://cass.caltech.edu/>

SUN	MON Week Module Work DUE 5 pm	TUES <i>Class Meeting Module Posted</i>	WED	THURS <i>Journal Club</i>	FRI	SAT
Sep 27 Week 1 Evolution	28	29 First Zoom class	30	Oct 1	2	3
4 Week 2 Primates	5	6	7	8	9	10
11 Week 3 Hominin divergence	12 Graphical Abstract DUE	13	14	15	16	17
18 Week 4 Hominin radiation	19 P-set 1 DUE	20	21	22	23	24
25 Week 5 <i>Homo</i>	26	27	28	29	30	31
Nov 1 Week 6 Late Pleistocene	2 P-set 2 DUE	3	4	5	6	7
8 Week 7 Modern behavior	9	10	11	12	13	14
15 Week 8 Global dispersals	16 Proposal draft DUE	17	18	19	20	21
22 Week 9 Settling down	23 Proposal Pitch DUE	24	25	26 Thanksgiving	27	28
29 Week 10 Diversity today	30	Dec 1	2	3	4	5 Study period →
6	7	8	9 Final exams →	10 Proposal final DUE	11	12

Course Schedule

Subject to change. Consult Canvas for up-to-date schedule.

Week 1 – How Evolution Works

KEY CONCEPTS: theory of evolution, evolutionary forces (selection, mutation, gene flow, genetic drift), adaptation, speciation, phylogenetics, geologic timescale

KEY QUESTIONS:

- What is the theory of evolution?
- What types of evidence are used to study evolution?
- How does speciation occur?
- How are phylogenies constructed?

Week 2 – Meet the Primates

KEY CONCEPTS: primate phylogeny, social structure, life history theory, ancestral/derived, homoplasy/homology

KEY QUESTIONS:

- Why study primates to understand human evolution?
- What are the major clades of primates?
- What is unique about humans compared to other primates?

Week 3 – Hominin divergence: From what to what in human evolution

KEY CONCEPTS: forager ecology, last common ancestor, genetic dating, chronometric dating, hominin divergence, bipedalism

KEY QUESTIONS:

- What characterizes human socioecology?
- What features were likely present in our last common ancestor with chimpanzees and the earliest hominins?
- How do we date evolutionary events?
- What are evolutionary hypotheses for the origins of bipedalism?

Week 4 – Hominin radiation

KEY CONCEPTS: Australopiths, paleodiet, isotopic analysis, lithic analysis, Lower Paleolithic

KEY QUESTIONS:

- Who were the Australopiths?
- How do we reconstruct lifestyles of Australopiths?
- What can we learn about human evolution from stone tools?

Week 5 – The Genus *Homo*, the first hunter-gatherers

KEY CONCEPTS: *Homo erectus*, *Homo heidelbergensis*, *Homo floresiensis*, *Homo naledi*, dispersal, glacial periods, paleoenvironmental reconstructions

KEY QUESTIONS:

- How did *Homo erectus* double in body and brain size ~2 Ma?
- What new behaviors emerged with *Homo erectus*?
- What evolutionary changes occurred during the Middle Pleistocene?
- How do we reconstruct paleoenvironment?

Week 6 – Late Pleistocene Contemporaries

KEY CONCEPTS: *Homo neanderthalensis*, Denisovans, *Homo floresiensis*, ancient DNA, hybridization, Middle Paleolithic

KEY QUESTIONS:

- Which other lineages of humans coexisted with *Homo sapiens*?
- How did modern humans compare to Neanderthals and Denisovans in terms of morphology, behavior, and genetics?
- What questions can and cannot be answered by aDNA?

Week 7 – Modern Human Origins and Spread

KEY CONCEPTS: *Homo sapiens*, Upper Paleolithic, dispersals, population history

KEY QUESTIONS:

- What morphological, behavioral or genetic traits distinguish *Homo sapiens*?
- How do we define modern humans?
- When did modern humans spread to different parts of the planet? What biological and cultural adaptations were necessary?
- What are hypotheses for the extinctions of non-*sapiens* human lineages?

Week 8 – Modern behavior

KEY CONCEPTS: modern behavior, cumulative culture, gene-culture coevolution, cooperation, language, art, religion

KEY QUESTIONS:

- When and why did humans gain the capacity for symbolic thought?
- How does human language differ from animal communication systems? How can we study the evolution of language?
- How has culture shaped human evolution?
- What are evolutionary explanations for art and religion?

Week 9 – Settling down: agriculture and civilizations

KEY CONCEPTS: domestication syndrome, cultivation, agriculture, civilization

KEY QUESTIONS:

- What changes do species undergo during the domestication process?
- What were the causes and consequences of humans adopting agriculture?

Week 10 – Human diversity today

KEY CONCEPTS: genetic ancestry, race, population genetics, recent evolution, evolution understanding/acceptance in America

KEY QUESTIONS:

- What traits are shared by all living humans?
- How do living human populations differ at a biological level?
- Do ethnicity, ancestry, and race have biological meanings?
- What are examples of recent human adaptations?
- What are barriers to understanding and accepting human evolution?