

**Anth 305**  
**Human Evolutionary Developmental Biology**  
Spring 2020



Professor: Zachary Cofran  
Meetings: Blodgett Hall 101, Thursdays 3:10-6:10 pm  
Email: [zcofran@vassar.edu](mailto:zcofran@vassar.edu)  
Office: Blodgett Hall 323  
Office hours: Tuesday 1–3 pm, or by appointment

What literally makes us human? This class examines how growth and development were modified over the course of human evolution, to create the animals that we are today. Human anatomy is placed in an evolutionary context by comparison with living primates and the human fossil record. The first half of the course focuses on theory, namely evolution, genetics and life history. The second half examines evidence for the development and evolution of specific parts of the body, from head to toe. Through lab activities and a term project, students draw on different types of data to test hypotheses about evolution and development.

### **Course objectives**

- Understand evolutionary theory
- Appreciate the interrelationship between ontogeny and phylogeny
- Become familiar with the human fossil record
- Learn to set up a testable research question
- Collect anatomical data in order to test a hypothesis
- Conduct original study about human evolution and development

### **Readings**

There is no assigned textbook: instead, journal articles and other materials are posted to the Moodle page. All readings should be completed for the week in which they are

posted/assigned, before coming to class.

## Assignments and Grading

### Participation = 10%

Discussion is a critical part of any seminar, and so you are expected to participate in activities and discussions. Frequent active (but not overbearing) participation earns the full 10%, and sporadic contribution earns 5%. You completely forfeit your participation score if you have miss more than one class session (see “Attendance” below), or if you rarely or never participate in class activities.

To facilitate participation, each session you are required to bring in (at least) one discussion question about the week’s readings, which we may discuss in class.

### Lab = 10%

Most class sessions will have a laboratory component in which we examine skeletal/fossil materials, with activities related to the week’s readings. You will record your observations, results, etc. for each lab activity on a handout and submit it when you come to class the following week. Be sure to complete all activities in a session and record all requested information.

Each missed lab entry will reduce the Lab grade by 1% percentage point, and incomplete entries will cost 0.5%.

### #FossilFriday = 5%

Using Twitter, *before 5 pm on each Friday of the semester* (except Week 1 and Spring Break) you will show and tell the world something interesting about a specific, non-adult hominin fossil, which tells us something about the evolution of development. The purpose of this assignment is to practice extremely concise writing and dissemination of paleontological data.

Your post must state the specimen’s ID number (e.g., SKW 5) and species (e.g., *Australopithecus robustus*), and include either a picture from a) a peer-reviewed journal article, or b) a physical or virtual specimen and some kind of ontogenetic information. Be sure to use the hashtag #FossilFriday. Students must write about different specimens.

You may miss/skip/forget one #FossilFriday without penalty. From there, each missed post will cost 1/5 points; missing 6 or more results in a grade of 0 for the #FossilFriday series.

### Exam 1: Fossil Hominins = 10%

In class February 27

### Discussion Leading = 15%

During Weeks 6 through 10, groups of 2–3 of students are responsible for leading discussion relating the week’s ontogenetic topic with an empirical study of human

evolution (e.g., comparisons across primates and humans, or the hominin fossil record. Discussion-leaders are responsible for 1) finding an appropriate article and providing it a week before their discussion, and 2) fostering class discussion, activity, debate, etc. about the topic, for roughly an hour.

### **Project = 40%**

Your course project will be an original study in which you address a research question about ontogeny and phylogeny, gather and analyze data to test a hypothesis, and write up the results in the style of an article for [\*American Journal of Physical Anthropology\*](#). This cumulative project involves several parts:

- **Brainstorming meeting (5%)**  
Before the end of week 5 you must meet with me to discuss potential topics. Meetings will be distributed across office hours as well as the regularly scheduled class time.
- **Project proposal (10%)**  
Before investing completely in a research project, you must write a brief (~3 page) proposal, describing the research question(s) and including a literature review or annotated bibliography including at least ten peer-reviewed references.  
Due in class March 26
- **Podium Presentations (10%)**  
You will present your preliminary findings to the class at the end of the semester, and I will provide any last comments and suggestions for your write-up. Talks will be in the style of podium presentations at the annual meetings of the American Association of Physical Anthropologists, lasting for 10–12 minutes each with time for questions after.  
Presentations will be in class on April 30
- **Write-up / final paper (15%)**  
You will present your research in a ~10 page paper, including a 100-200 word abstract which does not contribute to the page count.  
Due later than Friday May 08.

### **Paper in lieu of final exam (10%)**

Short reflection essay about development in human evolution

- Given the last day of class, and due in the middle of Finals Week per the Academic Calendar and College rules.

### **Extra credit opportunity (+2%)**

Help me figure out how to incorporate a Virtual Reality activity...

## Schedule of topics, readings & assignments\*

---

\* Schedule and content subject to change at professor's discretion.

### **Week 1 (January 23): Intro to human evo & devo**

#### Readings

Dart 1925. *Australopithecus africanus*: The man-ape of South Africa. *Nature* 115: 195–199.

Schultz 1960. Age changes in Primates and their modification in man. In JM Tanner, (Ed.), *Human Growth*. Pergamon Press, Oxford, pp. 1–20.

### **Week 2 (January 30): Evolution & hominin origins**

#### Readings

Gould & Lewontin, 1979. The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme. *Proceedings of the Royal Society of London. Series B* 205: 581.

Lovejoy CO, Cohn MJ, and White TD, 1999. Morphological analysis of the mammalian postcranium: a developmental perspective. *Proceedings of the National Academy of Sciences* 96:13247–13252. *Focus only on Table 1: Proposed analytical trait types*

Pontzer, 2012. Overview of hominin evolution. *Nature Education Knowledge* 3: 8. (<http://bit.ly/homeevol>).

Harcourt-Smith, 2010. The first hominins and the origins of bipedalism. *Evolution Education Outreach* 3:333–340.

Su, 2013. The earliest hominins: *Sahelanthropus*, *Orrorin*, and *Ardipithecus*. *Nature Education Knowledge* 4:11. (<https://go.nature.com/2R9t48M>)

### **Week 3 (February 06): Australopiths**

#### Readings

Schrein, 2015. Lucy: A marvelous specimen. *Nature Education Knowledge* 6:2. (<https://go.nature.com/2FXR0Xy>)

Ward & Hammond, 2016. *Australopithecus* and kin. *Nature Education Knowledge* 7:1. (<https://go.nature.com/2T7Nu4O>)

Cofran Z. 2018. Robust australopithecines (including *Paranthropus*). In *The International Encyclopedia of Biological Anthropology*, Wenda Trevathan (ed). John Wiley and Sons, Inc.

Strait, 2010. The evolutionary history of the australopiths. *Evolution Education Outreach* 3:341–352.

### **Week 4 (February 13): Pleistocene *Homo***

#### Readings

Dunsworth, 2010. Origin of the genus *Homo*. *Evolution Education Outreach* 3:353–366.

Van Arsdale, 2013. *Homo erectus* – A bigger, smarter, faster hominin lineage. *Nature Education Knowledge* 4:2. (<https://go.nature.com/37S5uEk>)

Bae, 2013. Archaic *Homo sapiens*. *Nature Education Knowledge* 4:4.  
(<https://go.nature.com/2FU9fgA>)

**Week 5 (February 20): Recently extinct humans** [Neandertals, Denisova, Xuchang]

**Project brainstorm – individual meetings**

Baab, 2012. *Homo floresiensis*: Making sense of the small-bodied hominin fossils from Flores. *Nature Education Knowledge* 3:4. (<https://go.nature.com/360UnaE>)

Anonymous. *Homo neanderthalensis*. Smithsonian Institute website.  
(<http://s.si.edu/2xo2JJE>)

Something for Denisova and naledi...? or just Denisova?

**Week 6 (February 27): Development 1—Teeth**

**Mio-Plio-Pleistocene hominins exam**

Readings

Cofran 2018. Ontogeny. In *The International Encyclopedia of Biological Anthropology*, Wenda Trevathan (ed). John Wiley and Sons, Inc.

Rolian and Boughner 2016. Forward and Chapter 1. Introduction to Evo-Devo-Anthro. In Boughner and Rolian (eds). *Developmental Approaches to Human Evolution*. Wiley Blackwell, Hoboken, pp. 1–15.

Boughner 2016. Chapter 3. The Tooth of the Matter. In Boughner and Rolian (eds). *Developmental Approaches to Human Evolution*. Wiley Blackwell, Hoboken, pp. 35–51

**Week 7 (March 05): Development 2—Bones**

Readings

Scheuer and Black, 2000. Chapter 3: Bone Development. In *Juvenile Developmental Osteology*. Elsevier Academic Press, New York, pp. 18–31.

Moss and Young, 1960. A functional approach to craniology. *American Journal of Physical Anthropology* 18:281–292.

Ruff et al., 2006. Who's afraid of the big bad Wolff? Wolff's Law and bone functional adaptation. *American Journal of Physical Anthropology* 129:484–498.

**\*\*\* SPRING BREAK March 09–24 \*\*\***

**Week 8 (March 26): Pattern formation**

**Project proposals due in class**

Readings

Green and Sharpe, 2015. Positional information and reaction-diffusion: two big ideas in developmental biology combine. *Development* 142:1203–1211.  
(<http://bit.ly/30ljPB2>)

Young et al. 2015. Shared rules of development predict patterns of evolution in vertebrate segmentation. *Nature Communications* 6:6690.

*Supplemental: Turing, 1952. The chemical basis of morphogenesis. Philosophical Transactions of the Royal Society of London B* 237:37–72. (<http://bit.ly/36aTzQC>)

**Week 9 (April 02): Integration & modularity**

## Syllabus – Anth 305 – Spring 2020

### Readings

Cheverud, 1996. Developmental integration and the evolution of pleiotropy. *American Zoologist* 36:44–50.

Goswami et al., 2015. The fossil record of phenotypic integration and modularity: A deep-time perspective on developmental and evolutionary dynamics. *Proceedings of the National Academy of Sciences* 112:4891–4896.

### **Week 10 (April 09): Heterochrony and allometry**

Alberch et al. 1979. Size and shape in ontogeny and phylogeny. *Paleobiology* 5:296–217.

Godfrey & Sutherland, 1996. Paradox of peramorphic pedomorphosis. Heterochrony and human evolution. *American Journal of Physical Anthropology* 99:17–42.

Somel et al., 2012. The role of neoteny in human evolution: From genes to the phenotype. In Hirai et al., eds, *Post Genome Biology of Primates*, Springer, Tokyo, pp. 23–41.

### **Week 11 (April 16): Films & Projects**

[AAPA Conference – Prof Cofran in LA](#)

Watch documentaries, answer questions and be ready to discuss next week:

- On your own: *What Darwin Never Knew*  
(<https://www.youtube.com/watch?v=kNPbjtej1Hk>)
- In Class: *Your Inner Fish, Episode 3: Your Inner Monkey*

### **Week 12 (April 23): Self-domestication**

Hare, 2017. Survival of the friendliest: *Homo sapiens* evolved via selection for prosociality. *Annual Review of Psychology* 68:155–186.

Zanella et al., 2019. Dosage analysis of the 7q11.23 Williams region identifies *BAZ1B* as a major human gene patterning the modern human face and underlying self-domestication. *Science Advances* 5:eaaw7908.

### **Week 13 (April 30): Presentation symposium**

[Final reflection prompt given \(paper in lieu of final exam\)](#)

[Term papers due before Friday May 08.](#)

## Course Policies

---

### **Territory Acknowledgement**

The Vassar campus exists on lands that were once home to the [Delaware](#) Nation, the Delaware [Lenape](#) Tribe, and the [Stockbridge-Munsee](#) Band of Mohican Indians. Although many sources reference the Wappingers as the indigenous peoples of our campus, they were a confederacy of Native peoples who organized at one time in response to Euro-American incursions into the area.

### **Attendance**

You are allowed one excused, penalty-free, no-questions-asked absence throughout the semester. The exception to this is that you must be in attendance for research presentations at the end of the semester. Exceptions to this rule can only be made with appropriate documentation from Health Services or the Dean of Students.

### **Assignment submission and late work policy**

Assignments must be completed and submitted on time – however, you are allowed one amnesty day, for you to use (or not use) at your discretion for the term project components. If you think you will need a little more time to complete a given report, let me know before it is due, and you can submit it a day later free of penalty. This does not apply to the glossaries, midterm exam, or final paper!

Barring amnesty, late work will be reduced by 10% for each day that it is late. The only other time I will accept late work without penalty is if it is accompanied by documentation from Health Services or the Dean of Students.

### **Disability accommodation**

Academic accommodations are available for students registered with the Office for Accessibility and Educational Opportunity (AEO). Students in need of disability (ADA/504) accommodations should schedule an appointment with me early in the semester to discuss any accommodations for this course that have been approved by the Office for Accessibility and Educational Opportunity, as indicated in your AEO accommodation letter.

### **Academic Integrity**

All work you submit must be your own. You may discuss assignments with colleagues, but you may not turn in the same work. When you use references, other people's ideas, and especially other people's direct words, you absolutely must cite them. For more information, see pages 82–83 of the Vassar College Regulations (<http://bit.ly/2bMuogv>) and “Going to the Source” (<http://bit.ly/2bMuNQ8>). Plagiarism and other academic misconduct will result in a grade of 0 on the assignment and referral to the College's Academic Panel.

### **Technology**

Turn your phones off (or at least put on silent) when you come to class. I can and will

confiscate phones if I find them distracting. Phones may only be used in class to access course materials (e.g., readings). You may take notes on a computer if you wish, however, if you become distracting to myself or other students I will confiscate the computer for the duration of class as well. I reserve the right to ban all technology from the classroom at any point in the semester.

### **Title IX Responsibilities**

Vassar College is committed to providing a safe learning environment for all students that is free of all forms of discrimination and sexual harassment, including sexual assault, relationship abuse, and stalking. If you (or someone you know) has experienced or experiences any of these incidents, know that you are not alone. Vassar College has staff members trained to support you in navigating campus life, accessing health and counseling services, providing academic and housing accommodations, helping with legal protective orders, and more.

Please be aware all Vassar faculty members are “responsible employees,” which means that if you tell me about a situation involving sexual harassment, sexual assault, relationship abuse, or stalking, I **must** share that information with the Title IX Coordinator. Although I have to make that notification, the Title IX office will only provide outreach by email. You will control how your case will be handled — you don’t have to read or respond to the email, and it is completely up to you whether to pursue a formal complaint. Our goal is to make sure you are aware of the range of options available to you and have access to the resources you need.

If you wish to speak to someone privately, you can contact any of the following on-campus resources:

- Counseling Service ([counselingservice.vassar.edu](http://counselingservice.vassar.edu), 845-437-5700)
- Health Service ([healthservice.vassar.edu](http://healthservice.vassar.edu), 845-437-5800)
- Nicole Wong, SAVP (Sexual Assault and Violence Prevention) director ([savp.vassar.edu](http://savp.vassar.edu), 845-437-7863)
- SART (Sexual Assault Response Team) advocate, available 24/7 by calling the CRC at 845-437-7333 and asking for SART

The SAVP website ([savp.vassar.edu](http://savp.vassar.edu)) and the Title IX section of the EOAA website ([eoaa.vassar.edu/title-ix/](http://eoaa.vassar.edu/title-ix/)) have more information, as well as links to both on- and off-campus resources.