

# ANTHROPOLOGY 596: EVOLUTIONARY BIOLOGY

---

THE UNIVERSITY OF TENNESSEE – KNOXVILLE  
FALL 2019

**TIME:** MONDAYS AND WEDNESDAYS, 12:00 – 1:15 P.M.

**LOCATION:** 512 STRONG HALL

**INSTRUCTOR:** DR. BENJAMIN M. AUERBACH

**CONTACT INFORMATION**

OFFICE: 416 STRONG HALL

OFFICE HOURS: WEDNESDAYS, 11:00 A.M. – 12:00 P.M. OR BY APPOINTMENT

E-MAIL: AUERBACH@UTK.EDU

(DR. AUERBACH DOES NOT READ E-MAILS BETWEEN 7 P.M. AND 8 A.M.)

---

**COURSE AT-A-GLANCE**

- The course emphasizes literacy and conversancy in fundamental concepts of evolutionary theory and its applications to anthropological inquiry.
- Students will learn about current topics in the application of evolutionary theory to anthropological topics, including morphological integration, species concepts, hybridity, and modelling pattern versus process in evolution.
- Students are expected to engage in classroom discussions and develop critical evaluation skills concerning scientific studies.
- Evaluation takes the form of a regular class participation and two take-home essay exams.

**IMPORTANT SUBMISSION DEADLINES**

Note that late submissions will not be graded.

**Fridays at 2:00 P.M. (with some exceptions):** Submit Two Questions [via e-mail](#)  
about the *next week's* readings

**17 October at 5:00 P.M.:** Take-home midterm exam [via e-mail](#)

**9 December at 5:00 P.M.:** Take-home final exam [via e-mail](#)

**COURSE DESCRIPTION**

Evolutionary studies are fundamental to biological anthropology, and anthropological disciplines have used concepts derived from evolutionary theory to develop a variety of approaches to research questions. Research from paleoanthropology to modern human ecology relies on a thorough understanding of evolutionary theory and modeling. Any person planning to pursue anthropology as a professional should possess a background in evolutionary biology.

This lecture and discussion course provides you, as graduate students in anthropology, with a fundamental background in evolutionary biology, especially with a focus on modern theoretical perspectives and applications. (You are encouraged to read beyond these assigned readings.) Students are expected to bring critical, well-argued evaluations of the concepts presented in papers and in conversations, with an ultimate objective of building knowledge to be able to

include an evolutionary component in independent research. Whenever possible, examples from anthropology are used to illustrate ideas and processes. Concepts covered (see the course schedule below) include the history of evolutionary theory, variation, forces of evolution, evolution in the fossil record, species & species concepts, pattern and process, quantitative genetics, and evo-devo. While none of these topics will be explored exhaustively, you will learn about fundamental concepts for each subject and be provided with the tools with which to investigate them further, both independently and in more advanced graduate studies.

### **COURSE PREREQUISITES**

Evolutionary Biology is an advanced course intended for graduate students. While the course does not have any listed prerequisites, students enrolling in the course should have a basic background in statistics, in biology, and in human evolution. Some mathematical background (especially linear algebra and basic calculus) will be advantageous as well.

### **COURSE OBJECTIVES**

By the end of this course, you will:

- develop an appreciation for the scientific inquiry that led to major developments in evolutionary biology;
- procure a thorough understanding of basic evolutionary theory, including mechanisms and the origins of biological diversity;
- appreciate the scales at which evolutionary biology operates, from the molecular level to the fossil record;
- pursue critical application of evolutionary processes to understanding of human evolution and cultural history.

### **COURSE STRUCTURE**

Classes will meet twice each week unless noted otherwise in the Course Schedule (see below). The course is structured as a lecture with an associated informal discussion. Dr. Auerbach will formally introduce major themes and subjects, but you are expected to contribute to the class by participating in discussions about those ideas. On all meeting days of the course, Dr. Auerbach will lecture on the main points of the topic(s) covered by the readings (though not necessarily on all the details of the readings). **It is in your interest to take notes.** Dr. Auerbach *will not* make lecture notes available. Exams are take-home.

*Your participation in class is mandatory.* This means that 1) you have completed all of the readings before class each week, and 2) you engage in classroom discussions about the papers. You are required to submit two questions to Dr. Auerbach via e-mail **no later than 5:00 P.M.** on Friday about the readings to be discussed the next week, **so you will need to make time to read for the next week during the week before.** These questions will be used to help guide each subsequent week's discussion. In addition to weekly participation, you will have two take-home exams, the details of which are provided below.

### **COURSE READINGS**

All course readings will be made available via PDFs on Canvas. You may wish to look into acquiring a copy of Futuyma & Kirkpatrick's *Evolution*, though this is not required.

- Ackermann RR. 2019. Reflections on the history and legacy of scientific racism in South African paleoanthropology and beyond. *Journal of Human Evolution* 126:106-111.
- Ackermann RR, Mackay A, Arnold ML. 2016. The hybrid origin of “modern” humans. *Evolutionary Biology* 43:1-11.
- Ackermann RR, Arnold ML, Biaz MD, Cahill JA, Cortés-Ortiz L, Evans BJ, Grant BR, Grant PR, Hallgrímsson B, *et al.* 2019. Hybridization in human evolution: Insights from other organisms. *Evolutionary Anthropology*. <https://doi.org/10.1002/evan.21787>
- Agosto ER, and Auerbach BM. In review. Evolvability and constraint in the primate basicranium, shoulder, and hip and the importance of multi-trait evolution. *Evolutionary Biology*.
- Agosto ER. In review. Evolutionary potential of the primate shoulder: variation among taxa and implications for genetic covariance with the basicranium, pelvis, and arm. *Journal of Human Evolution*.
- Auerbach BM. 2012. Skeletal variation among early Holocene North American humans: implications for origins and diversity in the Americas. *American Journal of Physical Anthropology* 149:525-536.
- Black E. 2003. *War Against the Weak*. New York: Dialog Press.
- Boughner JC, and Rolian C (editors). 2016. *Developmental Approaches to Human Evolution*. New York: Wiley-Blackwell.
- Browne J. 2006. *Darwin's Origin of Species: A Biography*. New York: Atlantic Monthly Press.
- Cheverud JM. 1996. Developmental integration and the evolution of pleiotropy. *American Zoologist* 36:44-50.
- Futuyma DJ, and Kirkpatrick M. 2017. *Evolution*. Fourth edition. Sunderland, MA: Sinauer Associates, Inc.
- Green RM, Fish JL, Young NM, Smith FJ, Roberts B, Dolan K, Choi I, Leach CL, Gordon P, Cheverud JM, Roseman CC, Williams TJ, Marcucio RS, and Hallgrímsson B. 2017. Developmental nonlinearity drives phenotypic robustness. *Nature Communications* 8:1970.
- Hansen TF, and Houle D. 2008. Measuring and comparing evolvability and constraint in multivariate characters. *Journal of Evolutionary Biology* 21:1201-1219.
- Hunley KL, and Cabana GS. 2016. Beyond serial founder effects: the impact of admixture and localized gene flow on patterns of regional genetic diversity. *Human Biology* 88:219-231.
- Kuljian C. 2017. *Darwin's Hunch: Science, Race, and the Search for Human Origins*. Cape Town: Jacana.
- Laland K, Matthews B, and Feldman MW. 2016. An introduction to niche construction theory. *Evolutionary Ecology* 30:191-202.
- Lewontin R. 2000. *The Triple Helix: Gene, Organism, and Environment*. Cambridge, MA: Harvard University Press.
- Marks J. Ten facts about human variation. In: *Human Evolutionary Biology* (Muehlenbein MP, editor). Cambridge: Cambridge University Press. pp. 265-276.
- Rolian C. 2009. Integration and evolvability in primate hands and feet. *Evolutionary Biology* 36:100-117.
- Rolian C. 2014. Genes, development, and evolvability in primate evolution. *Evolutionary Anthropology* 23:93-104.
- Roseman CC. 2014. Troublesome reflection: racism as the blind spot in the scientific critique of race. *Human Biology* 86:233-240.
- Roseman CC. 2016. Random genetic drift, natural selection, and noise in human cranial evolution. *American Journal of Physical Anthropology* 160:582-592.

- Roseman CC, and Auerbach BM. 2015. Ecogeography, genetics, and the evolution of human body form. *Journal of Human Evolution* 78:80-90.
- Ruff CB. 1994. Morphological adaptation to climate in modern and fossil hominids. *Yearbook of Physical Anthropology* 37:65-107.
- Savell KRR, Auerbach BM, and Roseman CC. 2016. Constraint, natural selection, and the evolution of human body form. *Proceedings of the National Academy of Sciences USA* 113:9492-9497.
- Savell KRR. In review. Evolvability in human postcranial traits across ecogeographic regions. *American Journal of Physical Anthropology*.
- Schroeder L, and Ackermann RR. 2016. Evolutionary processes shaping diversity across the *Homo* lineage. *Journal of Human Evolution* 111:1-17.
- Shanker K, Vijayakumar SP, and Ganeshiah KN. Unpacking the species conundrum: philosophy, practice and a way forward. *Journal of Genetics* 96:413-430.
- Teixeira JC, and Cooper A. 2019. Using hominin introgression to trace modern human dispersals. *Proceedings of the National Academy of Sciences USA* 116:15327-15332.
- Weiss KM, and Buchanan AV. 2004. *Genetics and the Logic of Evolution*. New York: Wiley-Liss.
- Zelditch ML, Wood AR, and Swiderski DL. 2009. Building developmental integration into functional systems: function-induced integration of mandibular shape. *Evolutionary Biology* 36:71-87.

#### ATTENDANCE POLICY

You are expected to attend all lectures barring legitimate professional, athletic, religious, legal or medical reasons. If lectures must be missed, Dr. Auerbach should be contacted at minimum 24 hours before class meets. **Students who have more than four unexcused absences from class will be docked one letter grade for the final course grade.**

#### COURSE WEB SITE

All course materials, including supplemental readings, will be available online from the course Canvas site (online.utk.edu). **Please do not submit any assignments to Dr. Auerbach via Canvas. All questions should be turned into Dr. Auerbach via e-mail. Exams will be submitted to Dr. Auerbach by e-mail and checked with iThenticate for plagiarism.**

#### STUDENTS WITH SPECIAL NEEDS

If you require accommodation because of special needs in learning, please contact the Office of Disability Services at 2227 Dunford Hall (974-6087). Please also contact Dr. Auerbach immediately via e-mail after you register with the Office of Disability Services. Arrangements will be made to adjust the course to fit your needs.

#### EVALUATION

You should expect to engage topics with critical thinking, in addition to developing a fundamental understanding of key evolutionary concepts. You are expected to synthesize information presented in readings and in class, in order to develop well-supported arguments about the primary ideas introduced throughout the course. Evaluation of your performance will rest on participation in class, submission of substantive questions each week, and the completion of two take-home exams.

See the first page of the syllabus for the directions and deadlines for submitting questions and examinations to Dr. Auerbach.

***PARTICIPATION AND WEEKLY QUESTIONS (56 POINTS; 30% OF TOTAL GRADE)***

You should come to class fully prepared. This means that all of the readings provided must be read before coming into class, so that you benefit from lectures to gain a deeper understanding of the material covered. Your participation—asking questions and contributing information in class—is encouraged throughout the course. Your participation will require you to be able to develop informed arguments based on the information you have read.

You are responsible for submitting two *substantive* questions to Dr. Auerbach via e-mail each Friday about the readings for the next week. For example, on August 23<sup>rd</sup>, you will submit questions about the readings for the 26<sup>th</sup> and 28<sup>th</sup> of August. Substantive questions should be synthetic or deeply consider the context of the research, and must go beyond inquiries about definitions or simple clarifications. **You should develop your questions independently, but you are allowed to discuss the concepts with other students in the course. However, do not write your questions collaboratively.** These reflect what you are learning in the course, and will help Dr. Auerbach address areas of misunderstanding or knowledge gaps throughout the semester.

You will not need to submit weekly questions on **November 29<sup>th</sup>**, but all other weeks will require questions to be submitted. Thus, you will submit 14 sets of questions over the course of the semester.

***TAKE-HOME EXAMINATIONS (65 POINTS; 35% OF TOTAL GRADE EACH)***

Two short answer and essay exams will be administered during the semester, which you will complete outside of class. In these, you will need to be able to identify key concepts and notable citations in evolutionary theory. The exams will only cover the information for that section of the course, though be aware that many concepts (e.g., forces of evolution) will be emphasized throughout the course. Each exam will have:

- 10 short definitional questions (2 points each)
- 3 short response questions (4-5 sentence answers; 5 points each)
- 2 argumentative essays that should be no more than two pages double-spaced (10 points each)

The two argumentative essays will ask you to synthesize the ideas that you have encountered through lectures and reading. Synthesizing knowledge will be given priority on all exam questions. Grading guidelines are found at the end of this syllabus in the Appendix.

As these are take-home exams, you are expected to be able to look up and draw on sources to fully respond to questions. **UNLIKE WEEKLY QUESTIONS, THESE ARE NOT COLLABORATIVE.** You must complete the exams independently; if you collaborate with other students, or if you plagiarize your responses, you will receive a score of zero on the exam.

**FINAL GRADES ARE NOT NEGOTIABLE.  
NO EXTRA CREDIT IS AVAILABLE.**

**Academic honesty:** Simply, don't cheat. Evolutionary knowledge is an awesome asset, and it is hoped that you will find the discovery of this information extremely rewarding. Follow the guidelines for each of the assignments and you'll reap long-term benefits. Assignments or exams found to be plagiarized or resulting from academic dishonesty will assigned a grade of zero.

#### **ATTENDANCE, SUBMISSION AND MAKE UP POLICY**

Short of legitimate athletic, religious, legal or medical reasons, you will not be eligible to take examinations at any time other than those that are officially designated. Exams and assignments **must** be submitted at the deadline time. Late submissions (without prior permissions for extensions from Dr. Auerbach) will be assigned a grade of zero. Dr. Auerbach is often willing to give deadline extensions for legitimate causes.

#### **TIPS FOR GETTING THE MOST OUT OF THE COURSE**

As a crucial part of this course is keeping up with the reading before class meetings, you need to give ample time to reflect on the perspectives presented in the chapters and papers you read. On average, you are expected to read between 100 and 150 pages a week in assigned chapters and articles. You are *strongly* encouraged to read broadly, looking into additional sources to help you better develop an understanding of the topics covered. An excellent place to start is always in the references cited within the assigned readings. I am also available to point you toward additional resources as specific questions arise. However, you should use this course as an opportunity to develop skills at independently locating and reading relevant sources to supplement those that are assigned.

## COURSE SCHEDULE: Evolutionary Biology (ANTH 596) – FALL 2019

DATE	TOPIC	READINGS
21 August	Introduction to the course Colonialism in Evolutionary Theory	Kuljian 2016 Ackermann 2019
<b>PART ONE</b>		<b>FUNDAMENTALS OF EVOLUTION</b>
26 August	Getting started: Concepts and analytic approaches	Weiss & Buchanan, Chapter 2
28 August	A brief history of evolution	Futuyma & Kirkpatrick, Chapter 1 Browne 2005
2 September	NO CLASS ( <i>Labor Day</i> )	
4 September	What evolves: phenotypic evolution	Weiss & Buchanan, Chapter 3 Futuyma & Kirkpatrick, Chapter 6
9 September	How genes relate to phenotypes & the importance of variation	Weiss & Buchanan, Chapter 4 Futuyma & Kirkpatrick, Chapter 4
11 September	Natural selection	Futuyma & Kirkpatrick, Chapter 3 Gould and Lewontin 1979
16 September	Genetical theory of evolution	Futuyma & Kirkpatrick, Chapter 5
18 September	Perverting evolution: Eugenics	Black, Chapters 3-5 Marks 2012 Roseman 2014 <i>Supplementary Video: Eugenics Crusade</i>
23 September	Genetic drift	Futuyma & Kirkpatrick, Chapter 7
25 September	Evolution in space	Futuyma & Kirkpatrick, Chapter 8
30 September	How to be fit, and why is there sex?	Futuyma & Kirkpatrick, Chapters 10 & 11
2 October	Origins of diversity: gene evolution	Weiss & Buchanan, Chapter 5 Futuyma & Kirkpatrick, Chapter 14

<b>DATE</b>	<b>TOPIC</b>	<b>READINGS</b>
7 October	Defining boundaries: genes, organisms and environments	Lewontin, Chapters 1 & 2
9 October	The triple helix & niche construction	Lewontin, Chapters 3 & 4 Laland et al. 2016
10 October	Midterm Take-Home Examination posted	
14 October	Species and species concepts	Futuyma & Kirkpatrick, Chapter 9
16 October	Phylogenetics	Futuyma & Kirkpatrick, Chapter 16
17 October	Midterm Take-Home Examination due by 5:00 P.M. <b>via e-mail</b>	
<b>PART TWO</b>	<b>APPLYING EVOLUTIONARY THEORY TO ANTHROPOLOGICAL QUESTIONS</b>	
21 October	Patterns in evolution: climate and human variation	Ruff 1994 Auerbach 2012
23 October	Dismantling patterns Introduction to modern evolutionary modelling	Roseman and Auerbach 2015 Savell et al. 2016 Savell in review
28 October	Modern ideas about evo-devo	Boughner & Rolian, Chapters 1 & 13
30 October	Morphological integration: myths, misunderstandings, & meaning	Cheverud 1996 Zelditch et al. 2009
4 November	Evolvability	Hansen and Houle 2008 Rolian 2009, 2014 <i>Optional: Lande 1979, Lande &amp; Arnold 1983</i>
6 November	Toward a more complete understanding of the origins of variance	Hallgrimsson et al. 2009 Green et al. 2017
11 November	Evolution and evo-devo of the cranium	Boughner & Rolian, Chapter 2 Roseman 2016
13 November	Evolution and development of the limbs	Boughner & Rolian Chapters 6 & 7

<b>DATE</b>	<b>TOPIC</b>	<b>READINGS</b>
18 November	Nothing evolves in a vacuum: problems in parcellation of the organism	Agosto and Auerbach in review Agosto in review
20 November	The hybrid origins of hominids	Ackermann et al. 2016 Schroeder & Ackermann 2017 Teixeira & Cooper 2019
25 November	Unpacking the problem of defining species	Shanker et al. 2017 Ackermann et al. 2019
26 November	Final Take-Home Examination posted	
2 December	Future horizons: DNA, definitions, and ethics	Kaestle & Horsburgh 2002 Horsburgh 2015 Hunley and Cabana 2016
4 December	Democratizing science and evolutionary thinking	Athreya & Ackermann 2019
9 December	Final Take-Home Examination due by 5:00 P.M. <b>via e-mail</b>	

## APPENDIX: Grading Guidelines for Exams

There are two take-home examinations administered in Evolutionary Biology. Each of these consists of questions that collectively test knowledge covered during one of the two sections of the course. You should type your answers to questions on individual pages, and exam answers should be submitted to Dr. Auerbach via e-mail to [auerbach@utk.edu](mailto:auerbach@utk.edu).

Exams will be worth a total of 65 points.

All questions will be definitions (2 points each), short answers (5 points each), or argumentative essays (10 points each). Each argumentative essay question may earn up to ten points; these points are awarded using the following criteria:

Criterion	Description	Points awarded
Key concepts	The answer correctly includes key concepts addressed in readings and in lectures, and uses these to best support the thesis statement. For example, a question asking for the student to identify the forces of evolution would award full points if the student cited natural selection, mutation, random genetic drift, and gene flow.	4
Logic	The answer provides a logical structure, wherein a thesis statement that argues the position of the writer is set out, and subsequent statements provide evidence and support for that thesis statement.	2
Completeness of answer	The answer demonstrates the student has a complete understanding of the basic concepts asked. For example, a question asking about the actions of evolutionary processes on variation would address how each process increased or decreased variation, as well as what variation means in relation to these different processes (e.g., selection generally decreases phenotypic variation, while mutation will increase novel genetic and possibly phenotypic variation).	2
Accurate sourcing	The answer provides correct citations and attributions for important concepts. For example, a student citing the development of natural selection will cite both Charles Darwin and Alfred Wallace.	1
Grammar and spelling	The answer is written using grammatically correct sentence structure and correct spelling.	1
<b>TOTAL</b>		<b>10</b>