# ANTH 459: EVOLUTIONARY BIOLOGY FOR ANTHROPOLOGISTS

THE UNIVERSITY OF TENNESSEE – KNOXVILLE
SPRING 2015

**Instructor: Dr. Benjamin M. Auerbach**
Contact information

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| Office: | 229 South Stadium Hall |
| Office hours: | Walk-in hours: Wednesdays, 2:30 – 3:30 |
| | By appointment (sign up via direct e-mail to Dr. Auerbach) |
| E-mail: | auerbach@utk.edu |
| | (Dr. Auerbach does not read e-mails after 8:00 P.M.) |
| **Time:** | Tuesdays and Thursdays, 3:40 – 4:55 P.M. |
| **Location:** | 427 Hesler Biology Building |


***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. Thus, any person planning to pursue anthropology—especially biological anthropology—as a professional should possess a background in evolutionary biology.

This lecture course provides advanced undergraduate students with a fundamental background in evolutionary biology, both from historical and modern theoretical perspectives. 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, systematics, variation, forces of evolution, evolution in the fossil record, species & species concepts, pattern and process, and EvoDevo. While none of these topics will be explored exhaustively, students 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 objectives***

By the end of this course, students will:

- develop an appreciation for the historical progression of thought 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 an upper-division lecture. 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.

Please note that Dr. Auerbach will be away at professional conferences (the American Association of Anatomists and the American Association of Physical Anthropology annual conferences) at the end of March. You will be expected to watch a documentary (*Your Inner Fish*) outside of class in lieu of lecture and write a critical response paper (see the Evaluation section below).

***Course textbook***
Students should procure a copy of the course textbook, which is available for purchase from the UT Vol Bookstore or from online retailers:

**Futuyma, Douglas J. 2013. *Evolution*. Third Edition. Sunderland, MA: Sinauer Associates, Inc. ISBN: 978-1-60535-115-5.**

Additional readings posted on Blackboard will supplement assigned reading from the textbook. A full bibliography of these additional readings may be found at the end of the syllabus.

***Attendance policy***
Students 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 *before* class, preferably at least twenty-four hours before class meetings. **Students who have more than three unexcused absences from class will be docked one letter grade for the final course grade.**

***Course web site***
Outside of the textbook, all course materials, including supplemental readings, will be available online from the course Blackboard site (http://bblearn.utk.edu). **Please do not submit any assignments to Dr. Auerbach via Blackboard.** All assignments should be turned into Dr. Auerbach via e-mail.

***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***

Students in this course 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 and the completion of two in-class exams, in addition to the final exam.

**PARTICIPATION (15%)**

Students 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.

**RESPONSE PAPER (10%)**

When Dr. Auerbach is away at the end of March, you are required to critically watch Neil Shubin's *Your Inner Fish* three-part (and three hour) documentary outside of class. This series covers many basic principles of modern evolutionary thought, including how developmental models and genotype-phenotype mapping have allowed a more complete understanding of organismal morphology. After watching the series, you should write a brief (up to four page) argumentative response paper in response to one of a choice of prompts provided by Dr. Auerbach. Dr. Auerbach will explain this paper in more detail in class.

**IN-CLASS EXAMINATIONS & FINAL EXAM (25% each)**

Three in-class short answer and essay exams will be administered during the semester, taking the full class time on those days. In these, you will need to be able to identify key concepts and individuals in evolutionary theory. The exams will only cover the information for that section, though be aware that many concepts (e.g., forces of evolution) will be emphasized throughout the course. Each exam will also have one or two brief essay questions, which will ask you to synthesize the ideas that you have encountered through lectures and reading. Grading guidelines may be found on the course Blackboard web site.

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

***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 textbook and papers you read. 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. Dr. Auerbach is also available to point you toward additional resources as specific questions arise.

# COURSE SCHEDULE: ANTH 459 – "Evolutionary Biology for Anthropologists"

Readings should be completed *before* each assigned class meeting. Readings are in Futuyma's *Evolution* unless otherwise specified.

| WEEK | DATE | LECTURE TOPIC | READINGS |
|---|---|---|---|
| 1 | 8 January | Introduction to the course & ideas about evolution | Syllabus |
| 2 | 13 January | A brief history of evolutionary thought: Before the Modern Synthesis | Futuyma: Chapter 1 (to page 10)<br>Little & Kennedy: Chapter 2<br>Carroll (2009): Chapters 2 – 4 |
| | 15 January | A brief history of evolutionary thought:<br>The Modern Synthesis & New Physical Anthropology | Futuyma: Chapter 1 (remainder)<br>Washburn (1951)<br>Little & Kennedy: Chapters 9 & 10 |
| 3 | 20 January | Phylogeny: cladistics and the importance of parsimony | Futuyma: Chapter 2<br>Trinkaus (1990) |
| | 22 January | The fossil record | Futuyma: Chapter 4 |
| 4 | 27 January | Patterns of evolution | Futuyma: Chapter 3 |
| | 29 January | Endless forms most beautiful | Carroll (2005): Selections |
| 5 | 3 February | **EXAM 1** | |
| | 5 February | The origin (and importance) of genetic variation | Futuyma: Chapter 8<br>Bowler (2005) |
| 6 | 10 February | Variation: Part 1 | Futuyma: Chapter 9 (to page 234) |
| | 12 February | Variation: Part 2 | Futuyma: Chapter 9 (remainder) |
| 7 | 17 February | Genetic drift | Futuyma: Chapter 10 |
| | 19 February | Genetic drift and human evolution | Ackermann and Cheverud (2004)<br>Roseman and Weaver (2007) |
| 8 | 24 February | Selection and adaptation | Futuyma: Chapter 11 |
| | 26 February | Critiques of the adaptationist program | Gould and Lewontin (1979)<br>Pigliucci and Kaplan (2000)<br>Pigliucci (2009) |

(Course schedule for ANTH 459 – "Evolutionary Biology for Anthropologists")

| WEEK | DATE | LECTURE TOPIC | READINGS |
|---|---|---|---|
| 9 | 3 March | The genetic theory of natural selection | Futuyma: Chapter 12 |
| | 5 March | Modeling natural selection and genetic drift | Roseman and Auerbach (2015) |
| 10 | 10 March | **EXAM 2** | |
| | 12 March | Phenotypic evolution | Futuyma: Chapter 13 |
| **SPRING BREAK** | | | |
| 11 | 24 March | Evolution and development | Futuyma: Chapter 21 |
| | 26 March | Watch *Your Inner Fish* (3 episodes) | **Response paper due to Dr. Auerbach on 3 April by 5:00** |
| 12 | 31 March | **No lecture – Dr. Auerbach is away at conferences** | |
| | 2 April | Epigenetics and modularity | Hallgrímsson et al. (2009) |
| 13 | 7 April | What is a species? | Futuyma: Chapter 17 |
| | 9 April | Modes of speciation | Futuyma: Chapter 18<br>Kramer (2005) |
| 14 | 14 April | Evolution of biodiversity | Futuyma: Chapter 7 |
| | 16 April | Niches and life history | Futuyma: Chapters 14 & 19 |
| 15 | 21 April | Evolution above the species level | Futuyma: Chapter 22 |
| | 23 April | Evolution and society | Futuyma: Chapter 23<br>Ayala (2010): Chapter 6 |
| | 5 May | **FINAL EXAM** | |

***Additional readings (available as PDFs on the course website)***


Ackermann RR, Cheverud J. 2004. Detecting genetic drift versus selection in human evolution. P Natl Acad Sci Usa 101:17946–17951.

Ayala, FJ. 2010. *Am I a Monkey? Six Big Questions about Evolution*. Baltimore: Johns Hopkins University Press.

Bowler PJ. 2005. Variation from Darwin to the Modern Synthesis. In Hallgrímsson B & Hall BK, editors: *Variation: A Central Concept in Biology*. New York: Elsevier Academic Press. p. 9-27.

Carroll SB. 2005. *From DNA to Diversity: Molecular Genetics and the Evolution of Animal Design*. Second edition. New York: Blackwell Publishing.

Carroll SB. 2009. *Remarkable Creatures: Epic Adventures in the Search for the Origins of Species*. Boston: Houghton Mifflin Harcourt.

Gould SJ, Lewontin RC. 1979. The spandrels of San Marco and the Panglossian paradigm: a critique of the adaptationist programme. Proc R Soc Lond B 205:581-598.

Hallgrimsson B, Jamniczky H, Young NM, Rolian C, Parsons TE, Boughner JC, Marcucio RS. 2009. Deciphering the Palimpsest: Studying the Relationship Between Morphological Integration and Phenotypic Covariation. Evol Biol 36:355–376.

Kramer A. 2005. Biospeciation versus morphospeciation in the later human fossil record: Lessons learned from non-human primate socioecology. Anthropologie 43:213–220.

Little MA, Kennedy KAR. 2010. *Histories of American Physical Anthropology in the Twentieth Century*. New York: Lexington Books.

Pigliucci M. 2009. Down with natural selection? Perspect Biol Med 52:134–140.

Pigliucci M, Kaplan J. 2000. The fall and rise of Dr Pangloss: adaptationism and the Spandrels paper 20 years later. Trends Ecol Evol 15:66–70.

Roseman CC, Auerbach BM. 2015. Ecogeography, genetics, and the evolution of human body form. J Hum Evol.

Roseman CC, Weaver TD. 2007. Molecules versus morphology? Not for the human cranium. Bioessays 29:1185–1188.

Trinkaus E. 1990. Cladistics and the hominid fossil record. Am J Phys Anthropol 83:1–11.

Washburn SL. 1951. The new physical anthropology. Trans NY Acad Sci 13:298-304.