

Anthropology 102

Introduction to Human Evolution

II. Criteria for Perspectives Courses

Justification

Please describe how the course will address criteria for Perspectives on the Liberal Arts courses. Be sure to include an explanation of the course's specific learning goals for students to make a connection between these and the general criteria for Perspectives courses.

1. Be designed to introduce students to how a particular discipline creates knowledge and understanding.

This course introduces the students to the scientific method and its role in developing our understandings of how evolution has shaped our species and produced biological variation among modern humans. This course aims to make students aware of the investigative roles of observation, construction and testing of research hypotheses, experimental design, and data analysis. The course also introduces students to the core methods used in the investigation of human evolution, including analysis of the fossil record, relative and absolute dating, molecular systematics, cladistics, and ethology.

2. Position the discipline(s) within the liberal arts and the larger society.

Liberal arts refers to a college or university curriculum aimed at imparting general knowledge and developing general intellectual capacities in contrast to a professional, vocational, or technical curriculum. Using human evolution as a central theme, this course illustrates how core biological concepts relate to our understanding of the origins of our species, as well as exposing the connections between humans and non-human primates. Bridges to chemistry and the environmental sciences are illuminated by showing how dating methods, attention to stratigraphy, and the modeling of paleoenvironments all contribute to our understanding of human origins. Introducing the mechanics of upright walking (bipedality) allows us to create links to the physical sciences in discussing levers and mechanical advantage. The quantitative and population genetics component of this class gives the instructor an opportunity to illustrate the relevance of quantitative reasoning and mathematical analysis for the study of human evolution. The course situates the study of human evolution in the context of the four subfields of anthropology: biological anthropology, cultural anthropology, archaeology, and linguistics. As a link to the humanities, the course considers the origins of language and the human capacity for culture from the perspective of biological evolution. Of particular relevance to the larger society, the course treats modern human variation in relation to the concept of race, considers the long-term impact of global environmental changes, pollution, and emergent pathogens on human society, and explains the unscientific basis of anti-evolution arguments.

3. Address the goals defined for the particular Area(s) of Knowledge the course is designed to fulfill.

In 1973, Theodore Dobzhansky, one of the most influential figures in evolutionary biology, wrote "Nothing in biology makes sense except in the light of evolution." The proposed course introduces students to a body of knowledge at the core of the life sciences: the biological basis of life, the basics of cell biology and molecular genetics, Mendelian genetics, population genetics, systematics, molecular phylogeny, cladistic analysis, behavioral studies, biomechanics, and analysis of the fossil record. This body of knowledge is introduced in relation to the central theme of human evolution. The theory of evolution is examined in historical perspective, beginning with early theories on the emergence of biological diversity, including those of Cuvier, Lamarck, and Buffon. The works of Charles Darwin and Alfred Russel Wallace, who are credited with original formulation of the theory, are given detailed reading. We further discuss the impact of this theory as originally presented on late 19th century society and the trajectory of theoretical change during the 20th century with the further development of genetics and molecular genetics in particular. The significance of evolutionary theory in modern society is discussed in connection to research in biotechnology and understanding human biological variation.

As mentioned above, particular attention is given to the role of the scientific method in understanding human evolution, specifically to the meaning of observation in studying the fossil record, the morphology of extinct and extant primates, in research on human and non-human primate behavior and other related topics. Considerable attention is given to how research hypotheses about specific aspects of evolution can be tested and the role of experimentation in research on human evolution. Throughout the course we discuss how our understandings of human evolution impacts human society on different levels, from our ability to respond to environmental change and novel pathogens, to discussion of biological differences between human groups from different parts of the world.

In addition, a Perspectives course will, where appropriate to its discipline(s) and subject matter:

4. Be global or comparative in approach.

The course compares and contrasts knowledge about human evolution as generated by different approaches and according to the perspectives of related disciplines: molecular biology, geology, and primatology. The course relates human morphology, ecology, and behavior to those characteristics in other mammals, with particular emphasis on differing groups of primates. Furthermore, human morphology and behavior are compared to what we know of those characteristics among extinct humans. In discussing human biological variation, the genetic, developmental, and behavioral adaptations of human populations residing in tropical forests, deserts, arctic environments, temperate climates, and high altitudes are compared and contrasted.

5. Consider diversity and the nature and construction of forms of difference.

This course will discuss how the forces of evolution have shaped biological variation in modern humans and examines how environmental variation around the world, as well as the distribution of pathogens, has affected stature and body proportions, pigmentation, and the distribution of other heritable traits in different human populations. As mentioned above, the morphological, behavioral, genetic, and ecological variation of modern humans and non-human primates is examined in this course via the framework of evolution.

6. Engage students in active inquiry.

Students will be engaged in active inquiry through activities and assignments such as solving genetics problems, participating in simulations of evolution, observing primate behavior either in a zoo or on film, and examining fossil casts. In large classes, active inquiry will be facilitated by dividing the class into smaller groups so that students can work together.

7. Reveal the existence and importance of change over time.

The natural processes involved in generating biological change over time are the primary focus of this course. The course discusses how natural selection, mutations, gene flow, and genetic drift result in biological change over time. The course also examines the fossil record as a direct source of evidence of biological change. The fossil record is employed to examine the origin of human upright walking, increase in brain size, the capacity for language and culture, as well as importance of these changes for the lives of ancient humans.

8. Use primary documents and materials.

Demonstration of casts of relevant fossils, which are primary materials for the study of the morphology of extinct human forms, allows students to evaluate for themselves the relevance of specific morphological features in reconstructing changes in the behavior and ecology of extinct humans.

Criteria Checklist

Please be sure that your justification addresses all three criteria 1-3, below. For criteria 4-8, please check all that apply and discuss these in your justification.

A Perspectives course must:

1. Be designed to introduce students to how a particular discipline creates knowledge and understanding.

2. Position the discipline(s) within the liberal arts and the larger society.

3. Address the goals defined for the particular Area(s) of Knowledge the course is designed to fulfill.

In addition, a Perspectives course will, where appropriate to its discipline(s) and subject matter:

4. Be global or comparative in approach.

5. Consider diversity and the nature and construction of forms of difference.

6. Engage students in active inquiry.

7. Reveal the existence and importance of change over time.

8. Use primary documents and materials.

III. Course Materials, Assignments, and Activities

Please provide an annotated list of course readings and descriptions of major assignments or exams for the course, as well as distinctive student activities that will engage students in working toward the course goals discussed in the course description and/or justification.

Please include the author and title for each reading or text, along with a short description providing information about how the reading will contribute to course goals.

Textbook:

Biological Anthropology (2005) by Craig Stanford, John S. Allen, Susan C. Anton. Prentice Hall.

or

Introduction to Physical Anthropology (2007) by Robert Jurmain, Lynn Kilgore, Wenda Trevathan. Wadsworth Publishing.

These are two widely used textbooks that introduce students to the basics of human evolution and a related body of knowledge.

Additional papers are assigned to introduce students to original publications on human evolution:

- Charles Darwin (1859), *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*. Chapters 3 “struggle for existence” and 4 “natural selection”
- Kevin N. Laland, William Hoppitt (2003) Do animals have culture? *Evolutionary Anthropology* 12: 150-159.
- Bernard Wood (2002) Palaeoanthropology: Hominid revelations from Chad. *Nature* 418: 133 – 135.
- Erik Trinkaus, Pat Shipman. (1993) Neandertals: Images of ourselves. *Evolutionary Anthropology* 1: 194-201.

Depending on the size of the section (in larger sections, pairs of sequent assignments are conflated into one), students will be given 4 to 8 take-home assignments to reinforce the material covered, enhance quantitative reasoning, and encourage active inquiry on the part of the students.

Assignments 1-2 are designed as problem sets on Mendelian and population genetics, to familiarize students with the Punnett square, pedigree analysis, allele frequencies, and applications of the Hardy-Weinberg theorem. As a consequence, these assignments introduce students to basic methods in population genetics and enhance quantitative reasoning and understanding of the role of data analysis in biological research.

Assignments 3-4 are problem sets focused on the forces of evolution, familiarizing students with the effects of natural selection, mutation rates, gene flow, and genetic drift on allele frequency. This creates a conceptual foundation for students to think about human variation and biological change over time.

Assignments 5-6 are focused on primate behavior and morphology, requiring students to relate their observations to theoretical knowledge. At the discretion of the instructor, students are shown video-clips illustrating specific aspects of primate behavior, assigned to take a fieldtrip to a zoo/AMNH, or read short descriptions and examine charts or diagrams illustrating aspects of primate behavior and morphology in order to answer a set of relevant questions. Consequently, students are introduced to the methods used in behavioral studies by zoologists and enhance their understanding of primate variation.

Assignments 7-8 require students to examine casts illustrating specific morphological features of extinct humans and relate their observations to their understanding of human evolution. The students are asked to evaluate whether those fossils display features typical for human adaptations to upright walking and to suggest possible taxonomic affinities of the hominids represented by each fossil. In a larger classroom, the casts can be replaced by charts, slides, or diagrams at the discretion of the instructor. These assignments are designed to enhance student understanding of the role of observation in hypothesis testing and illustrate change over time in relation to human origins.

Exams. Student performance is assessed based on three in-class exams: two midterms and a final. Exam one covers material related to the biological basis of life, molecular genetics, population genetics and the forces of evolution acting on a population level, as well as biological variation in modern humans as an outcome of the synergy among the four evolutionary forces. Exam two tests understanding of macroevolution and the mechanisms of speciation, taxonomy and phylogeny, as well as the place of humans in the Primate Order, along with primate behavior, ecology, and morphology in relation to that of humans. Exam 3 evaluates student understanding of the fossil record in relation to human origins and different models of human evolution.

IV. Assessment

Perspectives courses must be recertified every five years, and we are seeking ideas for how to best carry out this assessment. What forms of evidence that the course is meeting its goals as a Perspectives course would be appropriate to collect for this course during the next five years? How would you prefer assessment to be conducted? How might evidence of effective teaching and student learning be collected and evaluated?

Examination of syllabi, assignments, activities and exams might be a way to determine whether the course is meeting its goals as a Perspectives course. Effective teaching is already evaluated through the departmental teaching observations and the student course evaluations.

A set of simple fill-in-the-blank questions could be developed, to be given at the beginning and at the end of the course, thus monitoring teaching effectiveness and the acquisition of key concepts by students. In developing this test, we aim to have a comprehensive set of questions covering the core concepts and also relevant for evaluating understanding as opposed to memorization.

V. Administration

What process will your department develop to oversee this course, suggest and approve changes, and conduct assessment? Who will be in charge of this process? Also indicate whether the course will be primarily taught by full-time or adjunct faculty, or by a combination of the two types of instructor.

Our department already has established several procedures to ensure that this course is taught in accordance with accepted guidelines. All new faculty members are given a package of course materials from earlier sections that they can draw upon. They are required to discuss their syllabus and the proposed content of the course with a senior faculty member teaching the course on a regular basis. New faculty members are strongly encouraged to attend at least one class session taught by a senior faculty member. We also conduct required peer-reviews of all instructors, during which a senior faculty member attends a section taught by a junior faculty member and writes a detailed review, followed by discussion on possible strategies for improvement.

A set of simple fill-in-the-blank questions will be developed, to be given at the beginning and at the end of the course, thus monitoring teaching effectiveness and the acquisition of key concepts by students. In developing this test, we aim to have a comprehensive set of questions covering the core concepts and also relevant for evaluating understanding as opposed to memorization

The departmental Curriculum Committee will review the course syllabi of different sections every few years; full-time faculty teaching the course will meet yearly to reevaluate the course content.