ANTHROPOLOGY 150: EVOLUTION AND HUMAN EMERGENCE
NM HED Area III: Laboratory Science Competencies
UNM Core Area 3: Physical and Natural Sciences

Student Learning Objectives:
At the end of the course, the student will be able to:
1. Identify scientific hypotheses, and distinguish between falsifiable hypotheses and non-scientific conjecture
2. Define the forces of evolution and explain their effects on levels of variation within and between populations
3. Use Mendel's laws to predict offspring genotypes and phenotypes from parental genotypes and phenotypes
4. Generate amino acid sequences from DNA sequences
5. Define biological species, allopatric speciation, and adaptive radiation
6. Place prosimian, monkey and ape taxa on a phylogenetic tree, and list the derived traits associated with each taxa
7. Identify primate social structures and mating systems based on the degree of sexual dimorphism and the ecological setting
8. Define sexual selection and the four types of altruism
9. List the hypotheses for why primate brains are large compared to other mammal species
10. List the evolutionary advantages of bipedal locomotion, and list the features of the skull and postcranium that distinguish bipeds from quadrudepal apes
11. List the derived anatomical and behavioral traits of the genus *Homo*
12. List the derived anatomical and behavioral traits of *Homo heidelbergensis* and Neandertals and explain the theories for why Neandertals disappeared
13. List the derived anatomical and behavioral traits of *Homo sapiens* and explain where and when these features appeared
14. Distinguish between evolutionary and non-evolutionary hypotheses for the causes of variation in human mate choice, parenting, and cultural institutions
15. Explain why the structure of human genetic and phenotypic diversity is inconsistent with the existence of biological races, and describe the evolution of human culture

Assessment Procedure:

Competency 1. Describe the process of scientific inquiry.

Which of the following is NOT a testable hypothesis?
a.   The amount of sugar that can be dissolved in water increases as the temperature of the water increases
b.   A divine creator is responsible for the origin of life
c.   All biological organisms arose in their present form and have never changed
d.   Some biological variation arose through a process of adaptation of individual organisms to their environments
e.   There is water on Mars

The definition of "theory" included which of the following ideas?
a.   A provisional conjecture that guides investigation
b.   A set of statements or principles devised to explain a group of facts or phenomena
c.   A set of statements or principles for which there is no evidence
d.   A thing that is indisputably the case
e.   A set of statements that do not allow to make predictions about natural phenomena

Which of the following is NOT one of the steps of the Scientific Method?
a.   Identify a single explanation for observed phenomena
b.   Design experiments to falsify predictions
c.   Generate predictions of hypotheses
d.   Observe the natural world
e.   All of the above are steps of the Scientific Method

True/False
The scientific method can be used to examine religious questions.

Competency 2. Solve problems scientifically.

Huntington's disease is an autosomal dominant disorder, meaning that only one copy of the abnormal allele is required in order for an individual to have the disease. If an individual that is heterozygous for the disease mates with an individual that is homozygous for the normal allele, what proportion of their offspring will have the disease?
a.   0%
b.   25%
c.   50%
d.   75%
e.   100%

If AAA AAA AAA is on one strand of a DNA double helix, what DNA sequence is on the other stand (the bottom strand is the "compliment" of the top strand)?
a.   TTT TTT TTT
b.   GGG GGG GGG
c.   CCC CCC CCC
d.   UUU UUU UUU
e.   WTF WTF WTF

What mRNA sequence will be transcribed from the DNA sequence AAA AAA AAA?
a.   TTT TTT TTT
b.   CCC CCC CCC

c.   UUU UUU UUU
d.   GGG GGG GGG
e.   WTF WTF WTF

If two individuals that are heterozygous for the sickle cell allele (Aa) mate with one another, what is the chance that their child will have sickle cell anemia ?
a.   0%
b.   25%
c.   50%
d.   75%
e.   100%

On a trip to the Albuquerque zoo, if you see a primate with outward pointing nostrils, you know that it is native to _____.
a.   Africa
b.   Asia
c.   Europe
d.   North America
e.   South America
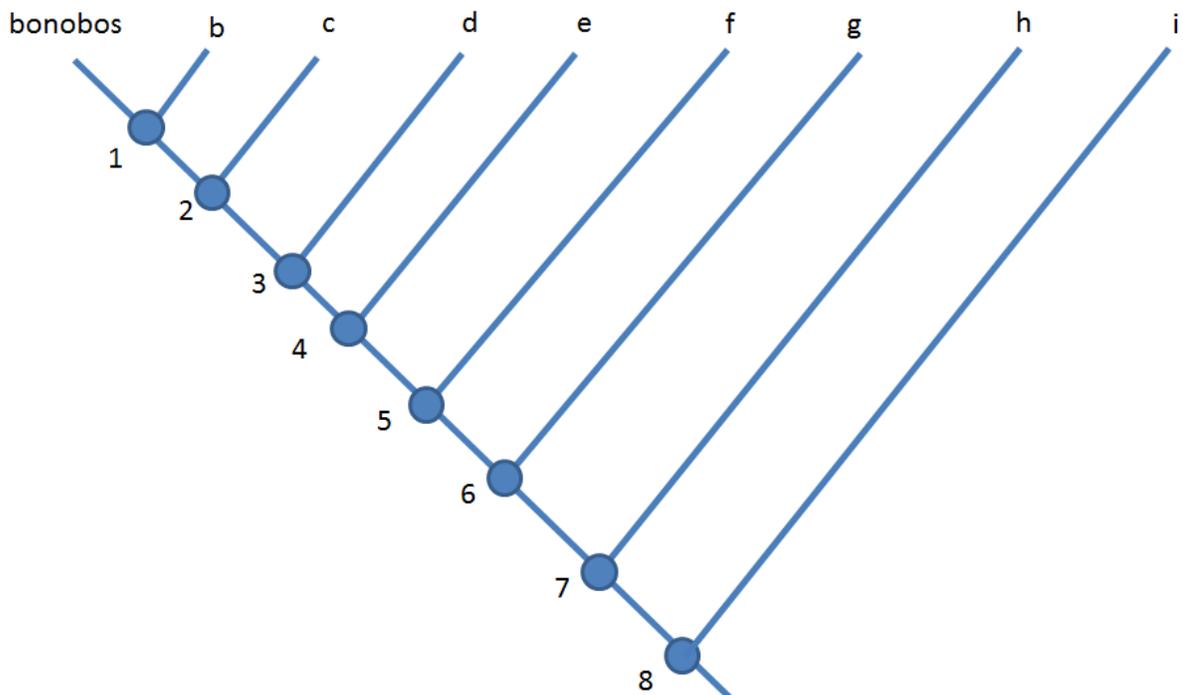
The above phylogeny of the primates includes chimpanzees, gibbons, gorillas, humans, new world monkeys, old world monkeys, orangutans, prosimians

In the above phylogeny, what species belongs at position 'b?'

a. chimpanzees
b. humans
c. gorillas
d. prosimians
e. gibbons

In the above phylogeny, what species belongs at position 'c?'

a. chimpanzees
b. humans
c. gorillas
d. prosimians
e. gibbons

In the above phylogeny, what species belongs at position 'f?'

a. chimpanzees
b. humans
c. gorillas
d. prosimians
e. gibbons
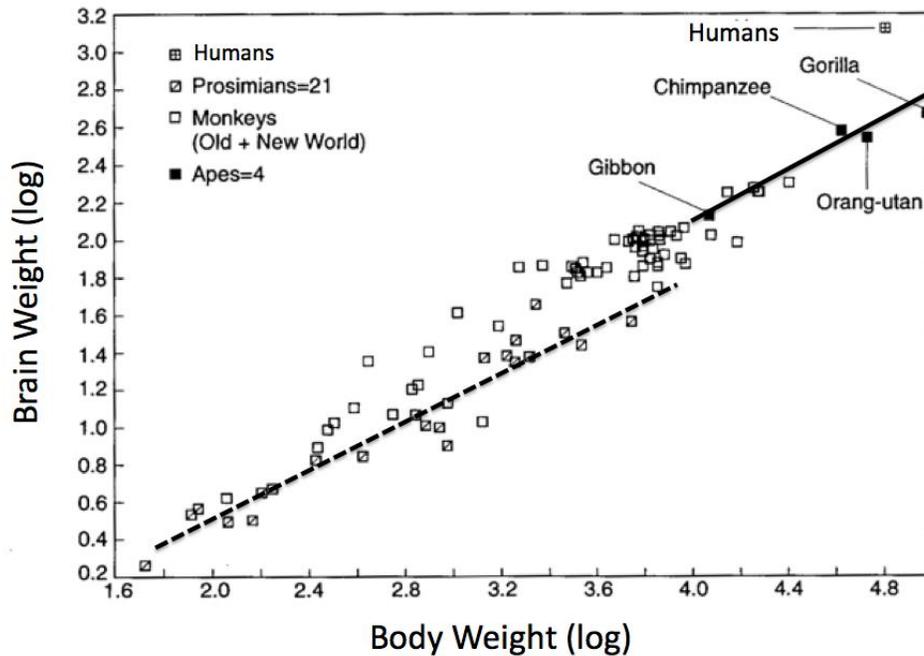
In the above phylogeny, what species belongs at position 'i?'

a. chimpanzees
b. humans
c. gorillas
d. prosimians
e. gibbons

Competencies 3 & 4.
Communicate scientific information
Apply quantitative analysis to scientific problems.

The dotted line in this graph shows the relationship between brain weight and body weight for prosimians (a primitive primate group). The solid line shows the same relationship for apes.

How would you interpret the relationship between brain weight and body weight?
a. brain and body weight are negatively correlated
*b. brain and body weight are positively correlated
c. humans have lower than expected brain size for their body weigh
d. gorillas have higher than expected brain size for their body weigh
e. monkeys have larger relative brains sizes than apes

According to this graph comparing mtDNA from humans, Neanderthals, and chimpanzees:
a.   Humans are genetically more similar to chimpanzees than to Neanderthals
b.   Humans are genetically more similar to Neanderthals than to chimpanzees
c.   Humans and Neanderthals are indistinguishable from one another
d.   Genetic differences between humans and chimpanzees are three times higher than differences between humans and Neanderthals
e.   The average number of differences between any two humans is 10

According the graph:

a.   Suspensory primates have relatively short arms compared to quadrupeds and bipeds
b.   Homo erectus body shape suggests suspensory behavior
c.   Bipeds and suspensory primates are similar in arm to leg length ratios
d.   Bipeds have relatively long legs compared to suspensory primates
e.   Australopithecines are indistinguishable from apes

In the above phylogeny, at what point do small canines evolve?
a. A
b. B
c. C
d. D
e. E
f. F

In the above phylogeny, at what point does obligate bipedalism evolve and suspensory behavior disappear?
a. A
b. B
c. C
d. D
e. E
f. F

In the above phylogeny, at what point do encephalization quotients similar to our own evolve?
a. A
b. B
c. C
d. D
e. E
f. F

Australopithecine faces and body sizes are highly sexually dimorphic. What reproductive strategy do these traits suggest?
a.   monogamy
b.   polygyny
c.   polyandry
d.   asexual
e.   these traits are uninformative

Homo erectus teeth are significantly smaller than those of earlier hominids. What does that suggest about its diet?
a.   H. erectus at tougher foods than earlier hominids

b.   H. erectus ate harder foods than earlier hominids
c.   H. erectus ate softer foods than earlier hominids
d.   H. erectus ate more leaves than earlier hominids
e.   Tooth size and diet are unrelated

If you find a fossil in South Africa that is 2 Ma with a sagittal crest, large teeth, and large mandible, it is likely to be:
a.   Ardipithecus ramidus
b.   Australopithecus afarensis
c.   Australopithecus robustus
d.   Homo erectus
e.   Homo neanderthalensis

You have found a fossil locality in Central Africa that is probably at least one million years old. There are no volcanic tuffs in the area, but there are iron-rich sediments. What dating technique would work best for assigning an age to your site?
a.   paleomagnetism
b.   potassium-argon dating
c.   oxygen-18 isotope dating
d.   carbon-14 isotope dating
e.   carbon-13 isotope dating

You find a fossil hominid skeleton and determine that is was bipedal. What features could have led you to this conclusion?
a.   anterior placement of the foramen magnum
b.   curved toes
c.   valgus knee (angled femur)
d.   A and C only
e.   All of the above

True/False
- The relationship the same for both taxonomic groups.
- Humans have larger brains that predicted by their body weight
- Orangutan brains are larger than chimpanzee brains
- Orangutan body weight is greater than gibbon body weight

Competency 5. Apply scientific thinking to real world problems.

The instructor will identify a popular media story about human evolution and write 2-3 multiple choice or true false questions that gauge student ability to determine whether the inferences from the story are supported by evidence and application of the scientific method.

Action:

At the end of each term, all students in each section of Anthropology 150 will take an online exam consisting of 2-3 questions randomly drawn from each of the five competencies, for a total of 10 questions. The average grade for each competency will be collated by members of the undergraduate committee. The committee will report the grades to the Anthropology 150 professors, who will meet to evaluate the results. The professors will identify the competency with the lowest average score, and will develop curricular changes to improved performance on the competency.