

BOT/MBIO/ZOO 1005 – Concepts of Biology

Outline of topics covered for Midterm III (Nov. 25, 2008) – *final version! posted 20 Nov., 2008*

DISCLAIMER: This outline is meant to help you organize your lecture notes. It is not intended to be a substitute for your lecture notes! Furthermore, it is NOT EXHAUSTIVE. Just because a word or phrase does not appear on this study guide, doesn't mean you "don't have to know it." In general, you are best off studying your lecture notes and letting this outline serve as a guide to help you get your notes organized.

Overriding topic for this portion of the class: the history and diversity of life

I. Natural selection and evolution

- A. Evolution: biological definition
- B. Darwin's contribution to scientific thought about the diversity of life: the two main ideas in *The Origin of Species*
- C. How various lines of evidence are consistent with each other and with evolutionary thought: (1) fossil record and how radiometric dating attaches dates to fossils; (2) biogeography; (3) comparative anatomy (including "homologous" and "vestigial" structures); (4) molecular biology; (5) experimental evidence. What specifically do each of these lines of evidence tell us about evolution in general and human evolution in particular?
- D. Natural selection as an important mechanism of evolution
 1. Requirements for natural selection to occur
 2. How artificial selection is similar to and different from natural selection
 3. Examples of natural selection
 4. What do biologists mean by "fitness" and "unequal reproductive success"?
 5. How natural selection selects for adaptations to the prevailing environment
 6. Sexual selection as a variation on the theme of natural selection by resulting in adaptations that enhance reproduction (but not always survival)
- E. Genetic drift as another mechanism of evolutionary change; two types of genetic drift (bottleneck effect and founder effect). Why is genetic drift most important in small populations?
- F. Why is evolution inevitable in every population; that is, what conditions must be met for a population NOT to evolve?
- G. Speciation = development of new species
 1. Definition of the "biological species" concept
 2. How reproductive barriers (prezygotic and postzygotic) keep closely related species from interbreeding. What are examples of each type of barrier?
 3. How geographic barriers plus different selective forces (or sudden genetic changes) can produce the reproductive barriers that lead to speciation
 4. Gradualism vs. punctuated equilibrium as two hypotheses for the pace of speciation over long periods of time.

II. Origin and History of Life

- A. Timeline of the major events in the evolution of life (how do we know Earth's age?)
- B. Probable stages in the development of the first life forms; what evidence do we have for the events at each stage?

III. Diversity of Life

- A. Prokaryotes: domains Bacteria and Archaea
 1. Examples of, and reason for, the enormous metabolic diversity among prokaryotes
 2. Similarities/differences between domains Archaea and Bacteria

3. Groups of Archaea (not by name, but by preferred habitat)
 4. Importance of bacteria to humans, ecosystems, and history of life
- B. Kingdom Protista
1. Evolution of eukaryotes: membrane infolding to yield internal membranes; endosymbiosis to yield chloroplasts and mitochondria; evidence for each theory
 2. Characteristics that organisms in kingdom Protista share
 3. Examples of metabolic diversity among Protista
 4. Characteristics and examples of protozoans, slime molds, and algae
 5. Differences between unicellular, colonial, and multicellular organisms. How might multicellularity have evolved, and what evidence supports the hypothesis?
- C. Kingdom Plantae
1. Characteristics of land plants, and evidence supporting the hypothesis that plants descended from green algae
 2. How selective forces in water are different from selective forces on land
 3. How each of the following land plant adaptations contributes to survival and/or reproductive success: cuticle, stomata, vascular tissue (xylem and phloem), lignin, roots, pollen, seeds, fruits
 4. Four major developments in the evolutionary history of land plants: vascular tissue, pollen, seeds, and flowers/fruits. Which plants have each adaptation?
 5. Four major groups of plants: mosses, ferns, gymnosperms (conifers), angiosperms. What are the characteristics, adaptations, reproductive features, and habitats of each? (Be sure to use the table I handed out in class to help you see the patterns in characteristics)
 6. Why animals need plants and why many plants need animals. Why are pollination and seed dispersal important to reproductive success?
- D. Kingdom Fungi
1. Characteristics of fungi
 2. How fungi acquire their food; the role of hyphae
 3. Asexual and sexual phases of fungal reproductive cycles; what mushrooms are for
 4. Why fungi are important: decomposition; symbiosis (mycorrhizae and lichens – what are they?); cause disease (in plants and animals); commercial uses
- E. Kingdom Animalia
1. Characteristics of animals
 2. Embryonic development in animals: blastula, gastrula
 3. Major developments in the evolutionary history of animals: true tissues, radial vs. bilateral symmetry, complete digestive tract, pseudocoelom/coelom, segmentation. How is each feature adaptive?
 4. Characteristics and examples of, and evolutionary relationships among, animals in nine phyla: sponges, cnidarians, flatworms, mollusks, annelids, nematodes, arthropods, echinoderms, chordates (be sure to use the table I handed out in class to help you see the patterns in characteristics)
 5. Major characteristics of, and evolutionary relationships among, the classes of chordates (invertebrate chordates plus fishes, amphibians, reptiles, birds, and mammals). You might want to make your own chart that includes features like vertebrae, gills, limbs, type of egg (if any), distinctive characteristics, and examples. It'll help you learn!

*Remember, my office hours are Tues./Thurs. 8:30-10:00 a.m. and Wed. 2:00-3:00 p.m.
And don't forget the Action Centers, Monday nights from 5:00-7:00 p.m.*