Outline 17: Vertebrates

I. Phylum Chordata

   A. The phylum Chordata includes three subphyla, the vertebrates and two phyla of invertebrates

   B. Four derived characters define the phylum Chordata

      1. Notochord

      2. Dorsal, hollow nerve cord

      3. Pharyngeal slits

      4. A muscular, post-anal tail
II. Invertebrate Chordates

A. Subphylum Urochordata

B. Subphylum Cephalochordata

C. Invertebrate chordates may provide clues to the evolution of chordates

III. Craniates Are Chordates with a Head

A. Living craniates have a set of derived characters

1. HOX genes

2. Neural crest

3. Gill slits
B. Primitive Craniates

1. Class Myxini: Hagfishes

IV. Vertebrates Are Craniates with a Backbone

A. Evolution and Characteristics of Vertebrates

B. Class Cephalaspidomorphi: Lampreys
V. Gnathostomes Are Vertebrates with Jaws

A. Gnathostomes have a number of shared, derived characters

1. HOX genes

2. lateral line system

3. paired appendages

B. Class Chondrichthyes: Sharks and rays

1. Cartilaginous skeletons

2. Shark eggs are fertilized internally
   i. Oviparous
   ii. Ooviviparous
   iii. Viviparous
C. Osteichthyes: The extant classes of bony fishes are the ray-finned fishes, the lobe-finned fishes, and the lungfishes

1. Ossified endoskeleton

2. Class Actinopterygii: ray-finned fishes

3. Lobe-finned fishes and lungfishes

VI. Tetrapods Are Gnathostomes with Limbs and Feet

A. Evolution of Tetrapods and the move to land

B. Class Amphibia

1. Types of amphibians

2. *Amphibian* means “two lives”
3. Paedomorphosis in amphibians

4. Amphibians are dependent on moist environments because…

5. Amphibians are declining worldwide

VII. Amniotes Have Amniotic Eggs

A. Evolution of the amniotic egg expanded the success of vertebrates on land
   1. Extraembryonic membranes
   2. The egg as an adaptation to life on land
B. The Reptile Clade
   1. Organisms in the reptile clade
   2. Reptiles have several adaptations for terrestrial life
   3. Ectothermic reptiles
   4. Endothermic reptiles

C. Archosaurs vs Lepidosaurus

D. The evolution of Birds from Dinosaurs
VIII. Mammals
   A. Mammals have a number of derived traits

   B. Modern mammals are split into three groups:
      1. Monotremes
      2. Marsupials
      3. Eutherian mammals (placentals)

IX. Primates and the Evolution of Homo sapiens
   A. Characteristics of Primates

   B. Primate characteristics that are adaptations for tree-dwelling

   C. Humans are bipedal hominoids