

Comparative Anatomy

Adapted from Robin Ikeda, Chaffey College.

Objectives

Get comfortable with bone names, and how to interpret bone features.

Instructions

1. First, review the names of bones in the human skeleton.

Bone names we'll use:

- In skull: frontal, parietal, nasal, occipital, zygomatic, temporal, and sphenoid bone; foramen magnum, optic foramen, mandible, maxilla, palatine, and hyoid
- Vertebrae: cervical, thoracic, lumbar; sacrum, coccyx
- Ribs, sternum
- Pectoral girdle: scapula, spine of scapula, clavicle
- Pelvic girdle: os coxa (ilium, ischium, pubis)
- Humerus, ulna, radius, carpals, metacarpals, phalanges
- Femur, tibia, fibula, patella, tarsals, calcaneus, metatarsals, phalanges

2. Next learn how to interpret the following:

- position of the foramen magnum
- function of ridges of bone
- articulation of mandible
- eye orientation

Homologies

Homologous structures have common embryonic origins, although they may develop into different body parts, with very different functions. For example, a bat's wing and your hand are homologous. In the first part of this lab, you will examine the limbs of a number of various animals, and identify homologous structures in the skeleton.

Recall that a vertebrate forelimb (like your arm) is made of:

Humerus Radius and Ulna Carpals Metacarpals Phalanges

A vertebrate hindlimb is made of:

Femur Tibia and Fibula Tarsals Metatarsals Phalanges

Instructions

1. Look at the limbs available. Are they forelimbs, or hindlimbs?
2. Carefully draw each of the limbs. Be sure to label which animal each is from, and label each of the bones (or groups of bones, for foot/hand and finger/toe bones).
3. Compare the bones making up the limbs of each animal. What is similar? What is different? Consider both structure and function.
4. What scientific explanation can you think of for their similarities? Explain.
5. What scientific explanation can you think of for their differences? Explain.

Some Broader Comparisons

Some 350 million years ago, animals with bony skeletons first appeared in the fossil record. All living vertebrate animals (fish, amphibians, reptiles, birds, and mammals) share a common ancestry to those primitive fishes. The degree to which any vertebrate resembles any other depends upon several factors:

- how long ago their respective branches of the genetic tree diverged from the main stem
- similarity of habitats and behavior
- peculiar specializations
- random events in each group's history

Systematic genetic change occurs only in response to evolutionary mechanisms such as mutation, genetic drift, and, most importantly, natural selection. By deduction then, comparative observations of vertebrate animals can lead to some understanding of the forces (selective pressures) that produced such remarkably diverse beasts. Detailed studies of the ancient climates are the background of these observations.

Have a look at

1. In terms of food type, compare...
 - Skulls, for example: adult human, bear, sheep, deer, horse, coyote, cat, crabeater seal (eats krill, which are just a few centimeters long), snake, turtle, woolly monkey, pigeon
 - Teeth, for example: bear, sheep, horse, coyote, cat, human, *Archaeopteryx*
2. In terms of function and habitat, compare...
 - Pectoral girdles, for example: bird, cat, human (Note particularly the position and form of the clavicle and the changing relationships of the bones involved.)
 - Pelvic girdles, for example: cat, bird, human, bat
 - Limbs, for example: adult human, horse, cat, pig

Ponder

1. What might account for the striking differences in tooth type, number, and form among either herbivores or carnivores?
2. What might lead to differing numbers of toes?
3. Why are there so many flexions in the leg of a frog, and so few in a horse?
4. What do ribs do? There are none in frogs, zillions in snakes, yours are mobile, and they're fused in birds and turtles.
5. What might behavioral differences be? Deer have no upper incisors, while horses have them.
6. What are the relative advantages of walking on tiptoe (horse), on the flats of toes (cat, birds), or on the flats of the feet (you)?

Lab 10 Assignment

Reflect

Above, I've suggested some questions to direct your thinking. As you ponder these questions, consider what main themes emerge in your mind. Carefully compose a brief (one page or less) reflective essay which addresses (1) your observations, (2) the lessons you infer from your observations about the history of animals, and (3) the impacts of environments upon the animals. Attach your drawings of the limbs to your essay.