Chapter 5-3: Evidence for Evolution

According to the theory of evolution, all existing biological species are derived from previous ones; that is, all organisms, past and present, share a common ancestry. Data derived from various fields including paleontology, genetics, biochemistry, anatomy, and embryology provide an overwhelming mass of evidence consistent with evolutionary theory. Two important pieces of evidence for evolution are found in comparative anatomy and comparative embryology, as we see in this plate.

As you look over the plate, you will notice that it has two sections: one devoted to comparative anatomy and one to comparative embryology. Read about comparative anatomy below, and focus your attention on the upper portion of the plate.

Comparative anatomy is basically the science of comparing the physical features of present-day organisms. The plate presents the forelimb of a human, dog, bird, and whale. The upper forelimb in the human is the humerus (A), which is also found in the forelimb of the dog, bird, and the flipper of the whale. The same dark color should be used for each. Below the humerus is the radius (B), and similar bones are found in the dog, bird, and whale. Parallel to the radius is the ulna (C), and again, we find the same bone in all four animals.

Next come a set of small bones in the human wrist called carpals (D), similar bones are found in the other three species. The carpals are followed by the metacarpals (E), and all four creatures have the same bones. In the human, the metacarpals are found in the palm of the hand. The forelimb is completed with a set of phalanges (F), which are also found in all four species.

The science of comparative anatomy shows us that homologous structures composed of the same bones are found in four different animals. At first glance, the forelimbs of humans, dogs, birds, and whales appear to have little in common. But from an evolutionary standpoint, the similarity of these homologous structures shows that the basic structure of the forelimb has been modified through natural selection into arms in humans, front legs in dogs, wings in birds, and flippers in whales. These anatomical similarities provide evidence for the evolutionary descent of the four animals from a common ancestor. Modifications for different purposes have occurred through time, but the supporting bones remain very similar.

We now turn to the second piece of evidence for evolution; comparative embryology. Your focus should be on the lower half of the plate, where you will see columns of embryonic, fetal, and newborn illustrations. As you read about comparative embryology, color the appropriate structures in the plate.

Evidence for evolution can also be seen by comparing the embryos of different animals. Looking across the first row from left to right, the plate shows the embryos of a fish, tortoise, chick, and human (G1-J1). The same color can be used for each. Note the great similarity between the four embryos. (The embryo is the name of the structure from the early hours after fertilization until the point at which the organs are fully formed.)

After the embryonic stage comes the fetal stage. The fetuses (G2-J2) of the four animals are shown in the second row. The same color may be used for the four to indicate the fetal stage. Notice that the fetuses appear different from one another. The fetal stage extends from the time that the organs are fully formed to the time of birth.

In the bottom row, we see the newborn state of the fish, tortoise, chick, and human (G3-J3). The same light color may be used for all four. At this point we can see how extremely different the newborns are from one another.

Early embryos of fish, tortoises, chicks, and humans all display fishlike structures, including arches blood vessels and gill slits. In fish, these gill slits develop to gills, while in animals such as humans, the gill slits never become functional.

The similarities of these embryos demonstrate that certain developmental processes remain constant during the evolution of animals. The similarities show that in the process of evolution, pre-existing structures were adapted to serve new functions. The parallels in embryonic structures would be difficult to account for in any way except through evolution.
Evidence for Evolution

Comparative Anatomy
- Humerus .......... A
- Radius ............ B
- Ulna ............... C
- Carpals ........... D
- Metacarpals ..... E
- Phalanges .......... F

Comparative Embryology
- Fish Embryo ..... G₁
- Tortoise Embryo . H₁
- Chick Embryo ..... I₁
- Human Embryo ..... J₁
- Fish Fetus ....... G₂
- Tortoise Fetus .... H₂
- Chick Fetus ....... I₂
- Human Fetus ........ J₂
- Fish Newborn ..... G₃
- Tortoise Newborn . H₃
- Chick Newborn ..... I₃
- Human Newborn ...... J₃

Fish
Tortoise
Chick
Human