

sweeps round and round in wide circles on out-stretched motionless pinions.

The full-grown feather does not look much like the hard rough scale of the snake or other reptiles, yet biologists tell us that in point of

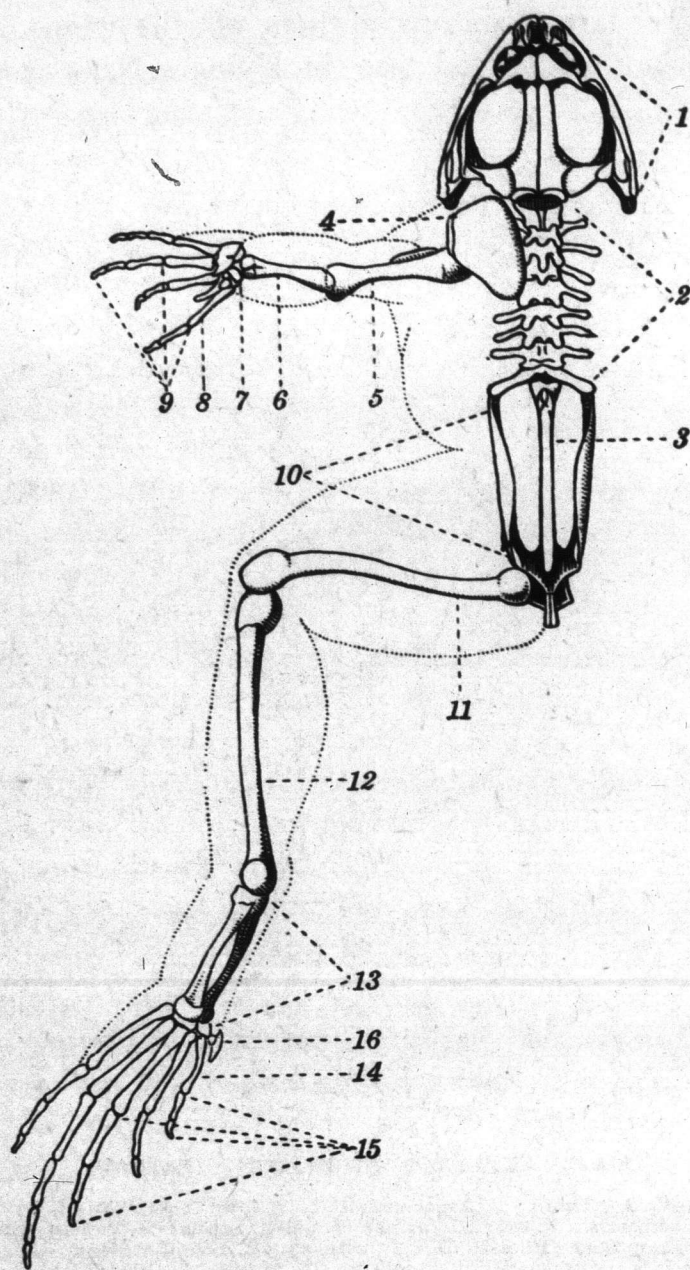


Fig. 3.—SKELETON OF FROG. (Natural size).

1, skull; 2, vertebral column; 3, urostyle; 4, scapula; 6, radius and ulna; 7, carpus; 8, Metacarpals; 9, phalanges of fore leg; 10, pelvic girdle; 11, femur; 12, tibia and fibula; 13, tarsus; 14, metatarsals; 15, phalanges of hind leg; 16, rudimentary toe.

origin, arrangement and growth, they are quite identical. In other words, feathers are modified scales. What has brought about this modification?

The fossil remains of flying reptiles are frequently found in the strata of the earth. These creatures were peculiarly bird-like in form, and without doubt mark early stages in the evolution of birds. Note that the feet of modern birds are still covered with scales.

Figure 1 shows an early fossil form with true feathers, but the tail is long and made up of many vertebrae, similar to the tails of lizards, and of the flying reptiles which preceded it. Compare this structure with the skeletal part of the tail of the modern bird, as shown in Figure 2. How are modern birds compensated for this loss of the long vertebral tails?

Study the skeleton of the pigeon, as shown in Figure 2, and compare it with the live birds, locating the parts named. This is a good exercise, especially in studying the wings and legs.

Note the location of the humerus, the radius, the ulna, the thumb, and the fingers of the hand (the distal part of the wing). Compare these and other bones with the corresponding parts in the human skeleton and the skeleton of the frog. This is a good exercise in the study of homologies.

Study the breast-bone, sternum, with its broad keel for the attachment of the thick muscles of the breast. Why are such large muscles needed at this particular place? What parts do they move? In birds that have lost the power of flight by taking to some other method of locomotion, such as swimming or running, we find a corresponding loss in the keel of the sternum, e. g. the ostrich.

Locate the little wing, thumb, on the wing of the pigeon or hen, and compare the whole wing with that of the Archæopteryx. Note that there were several free fingers in the wing of the latter, and each was made up of two or more joints, and ended in a claw. Do you find parts homologous to these in our modern birds?

In a similar way study the bones and joints of the leg and foot. Note especially the position of the knee, and the ankle joints.

"The earliest remains of birds of which we have any knowledge come from the Age of Reptiles. The oldest of these remains is the famous fossil known as Archæopteryx, two specimens of which have been found in Bavaria.

* * The Archæopteryx was a land bird about the size of a crow, probably arboreal in its habits, though not necessarily a good flier. It had true feathers, but it was very different from the birds of today in that it possessed teeth and a long, lizard-like tail of about twenty vertebrae. These last characteristics are strikingly reptilian, and such considerations point to the fact that