

#### 4. Taxonomy and Structural Similarity

**"Vertebrate Characters** -- If certain groups be omitted from consideration, the vertebrates are characterized by an internal bony skeleton, a hollow nervous system located all on one side of the digestive tract (usually to be described as the upper or dorsal side), and gill slits opening from the throat to the outside or touching the outside well in at least the developmental stages. These characters are found in no other phylum. In the fishes, the gill slits persist throughout life and between them the gills are developed as respiratory organs; the limbs are in the form of fins; the skin usually contains scales; and the heart consists of only two chambers. In the amphibia (frogs, toads, salamanders), gills are present and functional in the larval or tadpole stage and in some kinds they persist throughout life. The amphibian skin is devoid of any hard structures, and the heart has three chambers (two auricles and one ventricle). The reptiles never have gills in any stage, and the gill slits are open only in the embryo; in this respect they are like birds and mammals. The heart is generally three-chambered, though the ventricle is partially divided, and in crocodiles it is completely divided so that the heart is four-chambered. The body of a reptile is covered with scales or hard plates. Birds possess feathers, wings (functionless in some), a four-chambered heart, and air cavities in some of the bones, and are devoid of teeth. Mammals have hair, a diaphragm separating the chest from the abdomen, and a four-chambered heart. Embryonic development of mammals takes place as a rule within the body of the female, and the young are nourished with milk. The fishes, amphibia and reptiles are cold-blooded, while birds and mammals are warm-blooded.

"The vertebrate characters which remain to be described are not advantageously referred to as taxonomic distinctions. Instead of pointing out the differences among various animals with respect to them, more is to be gained by emphasizing their similarities. The brain is an example. While some brains are long and narrow, others short and wide, some flat and others high, they all possess the same principal features. Cerebrum, cerebellum, optic lobes, pituitary body, and the crossed optic nerves are readily discernible notwithstanding their variable forms.

"The nerves that emerge from the central nervous system within the skull show likewise great similarity. They arise from the same part of the brain, and most of them pass to the same organs and serve the same function. The first of these nerves, counting from the front, is the nerve of smell, the second is the optic nerve, and the eighth is the nerve of hearing in all vertebrate animals. The third, fourth and sixth are distributed to the muscles which move the eye. The remaining cranial nerves -- there are 10 of them in the lower vertebrates, 12 in the higher -- go to various regions of the face, throat and organs of the chest, and among them there are some differences in both distribution and function in the several vertebrate classes.

"The highly developed sense organs show equally great similarities. In the eye there is in all, the same general arrangement. The eyeball may be of somewhat different shapes, but the transparent cornea in front, the iris and pupil, the lens, the retina and the choroid and sclerotic coats are present and in the same general relations to one another in all of them.