

Evolution of CHORDATE

Chordate evolved a unique body plan within deuterostomes, and are considered to share five morphological characters, a muscular postanal tail, a notochord, a dorsal neural tube, an endostyle and a pharyngeal gill slits. The phylum chordata typically includes three subphyla, Cephalochordata, Vertebrata and Tunicata.

Chordate evolution, includes major habit transitions. The earliest chordates were all marine animals like fish, tunicates and lancelets. As chordates continued to evolve, they spread to freshwater habitats and ultimately to land.

The tunicates lives in Ocean & looks very much like a spouting pouch & the lancelet, looks like a knife blade floating through the water. The lancelet does have a small brain at the end of its nerve chord, neither of these animals has an actual head or a vertebral column. However they are still chordates becoz they possess four special features that define the phylum. The next step in evolution of chordates was the craniates. Next to craniates are vertebrates. The earliest fossil evidence for members of the vertebrates subphylum also dates back roughly 530 million years. This is when fossils of the jawless fish first appeared. And from fish structure the amphibians represent an intermediate phase in the water to land transition of chordates. The evolution of birds further increased the distribution of chordates by expanding their popⁿ into ~~an~~ aerial habitats.

The evolution of chordates led to a variety of specialized structural features and behavioral modification that were necessitated by environmental pressure imposed on diff gps within the phylum.

Many evolutionary adaptations in vertebrates are related to increased size, relative to earlier chordates, and an increased level of activity. The evolution of the large brain and a centralized nervous sys accomodated ~~the~~ ~~and~~ various adaptations.

PHYLOGENY OR EVOLUTIONARY HISTORY OF CHORDATES / VERTEBRATES

The evolutionary history of a gp of organisms is termed phylogeny. The concept of phylogeny is used to place animal gps in proper evolutionary sequence.

Early Cambrian - As the most acceptable theory that the remarkable similarities b/w the echinoderm (bipinnaria) and hemichordate (tornaria) larvae is taken as good evidence for common ancestry. So,

Echinodermata, Hemichordata and Chordata show common ancestry on embryological and biochemical evidences. The protochordates provide the connecting link b/w early chordate ancestors and vertebrates.

The earliest chordate may be appear much earlier than cambrian-period. It may be larvae/juvenile like body with notochord like rod on dorsal side, gills slits were present.

Cambrian and Ordovician periods - The first fossils of vertebrates were found in the rocks of the ordovician period in the form of the ostracodermis.

They were small jawless, bony fish like forms, related to the cyclostomes, that lived some 480 million years ago. This shows that chordate ancestors must have existed much before in the late Cambrian. The Ostracodermi became extinct but some cyclostomata are still with us.

Silurian & Devonian periods - Some fossil fish are found in the Silurian period, but far more are present in the succeeding Devonian period which is known as the Age of fishes. During Devonian the first jawed fish, the placoderms, arose. The placoderms became extinct without leaving representatives. It is likely that early placoderms were ancestors of cartilaginous and bony fishes.

Carboniferous period - In late Devonian or early Carboniferous period, the lobe-finned bony fish (Crossopterygii) gave rise to labyrinthodonts or primitive stem Amphibia. They were first vertebrates to walk on land. Amphibia became abundant during Carboniferous usually known as Age of Amphibia.

Mesozoic Era — In the early Carboniferous, the very primitive amphibians gave rise to the primitive reptiles. They reached their peak during Mesozoic era, known as Age of Reptiles. They included the famed dinosaurs & dominated the world for nearly 130 m.y., until the end of the Mesozoic most of them suddenly became extinct.

The ancestral mammals were derived from the primitive reptiles during Triassic period. The first bird also appeared in the late Jurassic period and one of their fossils the Archaeopteryx, had both reptilian as well as avian characteristics.

Cenozoic era — Following the declines of the reptiles during the late Mesozoic, both birds and mammals start flourishing. The mammals become the most diversified during Cenozoic era, also known as Age of Mammals. This era is divided into two periods Tertiary and Quaternary. After reaching peak in Tertiary the mammals are steadily declining in numbers & sp. now the man the dominant form of life on earth today.

ORIGIN OF VERTEBRATES

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Like most of the animal phyla, the origin of vertebrates also remain obscure. Over the years, several hypotheses have been proposed to explain the origin of vertebrates.

Time of origin - The earliest known truly vertebrate animals were freshwater forms, abundant during the late Silurian and Middle Devonian periods. Their fossils are collectively known as Ostracoderms. They lack jaws and teeth and paired appendages.

The oldest fragmentary fossils belonging to ostracoderms occur in the late Cambrian and middle Ordovician. Absence of any vertebrates fossils in rocks older than the Cambrian, permits only speculation about the earlier history of the vertebrates.

Place of origin - The American geologist Cambrian gave the idea of freshwater origin of vertebrates. They argued that dilute body fluids, compared to sea water and the glomerular kidney to get rid of excess water evolved as adaptation to a freshwater condition.

However, evidence for a marine origin of vertebrates is also overwhelming. The protochordates and deuterostome invertebrate phyla are exclusively marine forms. All known Cambrian and Ordovician vertebrates also occur as marine fossils.

Whatever the ancestral vertebrate ~~type~~ may have been there ~~is~~ are no fossils records to show. There is reason to believe that it was soft bodied, without any hard exo or endoskeleton, which could be fossilized. The simplest chordate living today are the invertebrate chordates or protochordate. They possess the notochord, dorsal nerve cord, pharyngeal gill slits and post anal tail. Therefore it seems most reasonable and logical to draw inferences about the imaginary generalized or ancestral vertebrate among them.