

that, with this admission, the thorax and head of an Insect are essentially homologous with the head of a Tetradeapod Crustacean.

VERTEBRATES.

1. **Fishes.** — The Pteraspid section of the Placoderms, having long vertebrated tails fitting them to be fleet scullers, commenced (according to the present state of the facts) in the Lower Silurian (page 509). Contemporaneously (the same locality attesting) there were normal Ganoids, the Crossopterygian, which till recently were supposed to have made their first appearance in the Devonian. Along with these there probably existed also the Chimæroids, precursors of the Selachians, — a type of primitive features now almost extinct.

The Devonian adds to these paleozoic tribes the *Brachiate Placoderms*, admirably armor-clad fishes. But they were short in body, and hence poor at sculling, but were furnished with pectoral limbs in the shape of arms that were seemingly fitted for crawling and grubbing over muddy or sandy bottoms rather than for swimming. Although the appendages are called "arms," and the Fishes were in appearance "brachiate" (Fig. 982, page 624), the pectoral fins (to which they correspond) are homologous with the *hands* in Vertebrates and not with the arms. They were a poor equipment for either aquatic or terrestrial service, and the species end with the Devonian.

At the same time the Devonian waters were full, as has been shown, of Selachians, Dipnoans, and typical Ganoids, of great diversity in characters, and many of them unsurpassed at any later time in magnitude.

Fishes appear to have reached their highest grade of vertebrate structure, and thus to have culminated in the Dipnoans, — species that have not only lungs for breathing, as well as gills, but also, in the *Ceratodus*, a genus dating from the Carboniferous, a finger-like jointed midrib to the pectoral fin (Archipterygian), with jointed branches diverging from either side of it.

No records of the precursors of Placoderms, Ganoids and Sharks have yet been found in the rocks. The little *Amphioxus*, of existing seas (page 418), is supposed to represent one of the early forms, because, while having the general characteristics of the class, it is strikingly like an Invertebrate in part of its embryological development. The Ascidians are probably degenerate forms, as held by Lankester, derived from some species of still lower grade.

All Fishes are in several ways eminently *multiplicate* species. This is seen in the number of vertebræ; of articulations in the limbs when articulations exist; of teeth, and of tooth-bearing parts in the mouth.

2. **Amphibians and Reptiles.** — The line from the Fishes to the Amphibians is supposed to have been from the Dipnoan section. The resemblance in Amphibians to the Ganoids generally is in many respects close, it extending even to the form and structure of their labyrinthine teeth; and the Dipnoans