

cated so plainly by the very gradual steps in the successional lines; the progress of rudimentary organs may so often be traced from an early condition of good size to that of rudiments, and variations in existing species are so often wide and perplexing to the systematist, that the evidence in favor of evolution by variation is now regarded as essentially complete.

The argument from the facts presented on page 929, respecting the descent of the Horse, is strengthened by the occurrence among modern horses occasionally of a small pair of hoofs growing from the extremity of the splint bones of each foot—the old toes lost by descent back again; and more rarely by the growth of a full-sized toe from one of these bones, on all the feet, approximating thus to horses of the later Tertiary (Marsh, *Am. Jour. Sc.*, xliii. 1892). Birds, now standing apart from other Vertebrates so stiffly, as animals with feathers, short tails, and bills without teeth, in former times had teeth in their jaws, and long tails, like Reptiles. Moreover, in the Reptilian age, there were biped Reptiles, with the hollow bones and some other characteristics of Birds; and also Mammals that laid eggs like Birds and Reptiles,—as they continue now to do in Australia.

There are, however, some large blanks in the series which are yet unexplained, although investigators have been at work over the subjects for scores of years. One of these is the apparently sudden appearance of plants of the tribe of Angiosperms, the most common kind of Recent time, in the Lower Cretaceous; another, the still more remarkably abrupt introduction of ordinary or placental Mammals as successors to the Marsupials at the commencement of the Tertiary; another, the introduction of well-characterized Fishes, without the discovery of their precursors. Such facts excite, at the present time, interest in further study, but not doubts as to the general system of progress. Already a small slender fossil, with a blade-like sculling tail and terminal mouth,—the *Palæospondylus Gunni*, from the Devonian of Caithness, Scotland,—has been described as probably a primeval Lamprey (an eel-like Cyclostome, page 403). But, if correctly referred, there is still a very wide interval between it and the early Placoderms.

Some other general facts respecting successional lines, are the following:

The lines of succession seldom connect the grander divisions of classes or tribes. None lead directly from Macrural to Brachyural Crustaceans, or from Amphipod to Isopod kinds. Instead, the group of Anomourans, intermediate between the two tribes first mentioned, was the course of successional lines in geological history, and of branches to both the Macrurans and Brachyurans. In a similar way the Anisopods, intermediate between the Isopods and Amphipods, or the typical Tetracapods, were the source of branches to these tribes. The principle is in accordance with that respecting comprehensive or synthetic types, for the Anisopods and Anomourans are of this nature. A line leads direct from the higher Ganoids to the Amphibians; but, instead of lines from Amphibians to Reptiles, and thence to Birds or to Mammals, all three groups—Reptiles, Birds, and Mammals—were probably derived directly from the Amphibians. Instead of successional lines between Ungulates, Carnivores, and Quadrumana, these three groups were probably derived, as Cope has remarked, from some common tribe in the earliest Eocene. No successional lines among Insects appear to have passed between the higher tribes of