

*thoracic*. Air-breathing was another new feature; and for this purpose parts of the body had air-vessels or tracheæ which opened by breathing holes, or *spiracles*, on the under side of four of these "thoracic" segments. In the later true Spiders the body had lost its Eurypteroid abdomen, but had still, in Paleozoic species, its distinctly segmented thorax; and this thorax is the abdomen of Arachnology. (It is segmented in some modern species, while in others the subdivisions have become obsolete or are but faintly indicated.) The abdomen of the Eurypterid, however, exists as a slender jointed thread in *Geralinura* of Scudder, of the Carboniferous, which has its Illinois and also Bohemian species, and has survived till now in the modern *Thelyphonus*.

**10. Derivation of Myriapods and Insects.**—*Myriapods*, although inferior to Insects, are as yet known only from the early Devonian. The Devonian species, and also those of the Carboniferous, are of the Milleped, or lower, doubly-multiply section of Myriapods, with one exception, that of the remarkable few-jointed, caterpillar-like *Palæocampa* of Meek and Worthen.

The fact of a line of succession from Worms to Myriapods and from Myriapods to Insects has not been proved by geological discovery. The derivation of Myriapods from some type of Annelids is zoologically suggested, as long since recognized, by the apparently transitional form of *Peripatus*, a low-grade Myriapod resembling much the larve of some Insects, and by the like multiply structure of Annelids and Myriapods. It might be inferred also from the resemblance of the *Palæocampa* of the Illinois Carboniferous to the caterpillar of an Insect of the genus *Arctia*, as remarked by Scudder.

Myriapods are regarded as the precursors of Insects, on account of their approximate resemblance to the latter in antennæ and the appendages of the mouth, and because also of the worm-like form of most Insect larves, these larves appearing to be survivals of the Myriapod stage. In the change from an Annelid and Myriapod to an Insect, the *multiply* feature disappeared, and the number of parts became essentially the fixed normal number of the type, both as regards the body segments and their jointed appendages.

The rise of grade from the Myriapod to the Insect involved the appropriation of the three body segments of the Myriapod bearing the three anterior pairs of feet (which correspond normally to half the body segments of the head of an Isopod Crustacean) for forming the isolated middle section of the body called the thorax, and the suppression of all the other pairs of feet. In both Spiders and Insects, the change involved also a general concentration of the structure toward the cephalic nervous center; that is, a shortening of the range of cephalic control, and especially the distance to the posterior limits of locomotive action.

While in the Cockroach, and related low-grade species, there is no proper metamorphosis, in higher Insects, as they rise in grade, the larval stage is lower and lower in embryonic level, becoming, in the highest, destitute of locomotive organs; and this fact suggests that the larval stage results from an attendant *retrograde* embryonic change toward, and to, a line parallel with