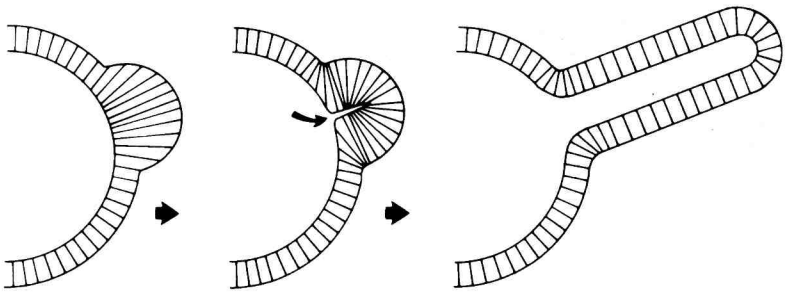

Figure 10.12. Changes from the pattern of an apical ectodermal ridge to an ectodermal fold in modern bony fish. This is accompanied by a shift in developmental processes from formation of the endodermal bones of the proximal radials of the fin to formation of dermal lepidotrichia. The origin of the digits of tetrapods may be attributed to the prolongation of the apical ectodermal ridge throughout limb development. From Thorogood (1991).

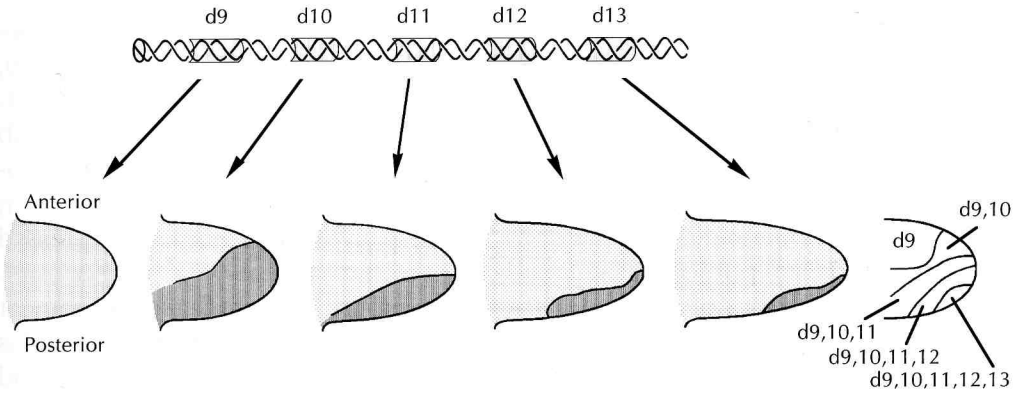

Figure 10.13. Expression of the *Hoxd* gene series in the developing chick limb bud. In the most proximal portion of the limb, which develops first, only *Hoxd-9* is expressed. More distally, successive genes are expressed until the last areas to be formed show overlapping areas of expression of all five *Hoxd* genes.

most of the length of the limb, but in the area of the wrist and ankle, the axis of development angles anteriorly, so that development of the distal carpals, tarsals, and digits proceeds in a posterior-to-anterior direction. This is reflected in the distribution of *Hox* genes, specifically *Hoxd-9–13,* which are expressed primarily in the posterior distal portion of the limb (Fig. 10.13).

Osteolepiform sarcopterygians exhibit branching on the anterior but not the posterior surface of the limb axis. Lungfish, in contrast, have branching radials from both sides of the limb axis. The way in which the digits develop in modern tetrapods suggests that they evolved in the manner of posterior radials, but the anterior bending of the developmental axis would result in their extending laterally; they would hence develop in a posterior to anterior sequence. Coates (1994) suggested that the number of postaxial radials may not initially have been fixed, so that there was considerable latitude in the number of digits in the Devonian tetrapods. Only subsequently were they restricted in all groups to no more than five.