

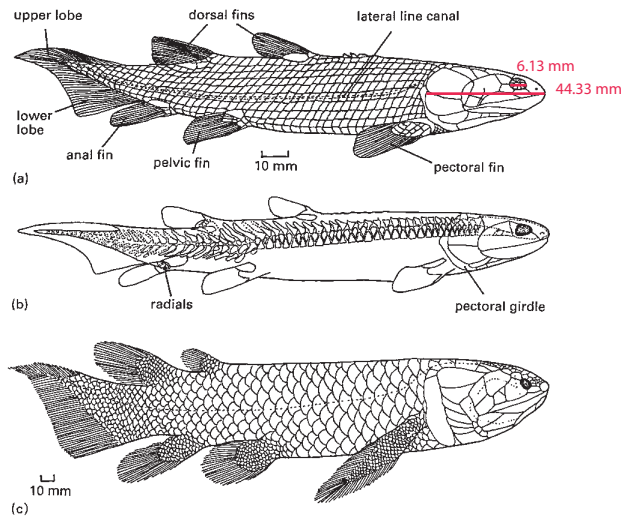


#### EARLY FISHES

*Osteolepis* from the Middle Devonian of Scotland and elsewhere (Andrews & Westoll 1970b) has a long slender body with large midline fins (two dorsals, one anal), and lobed paired fins (pectoral and pelvic). The tail is heterocercal, with fins above and below (Fig. 2.19a & b).

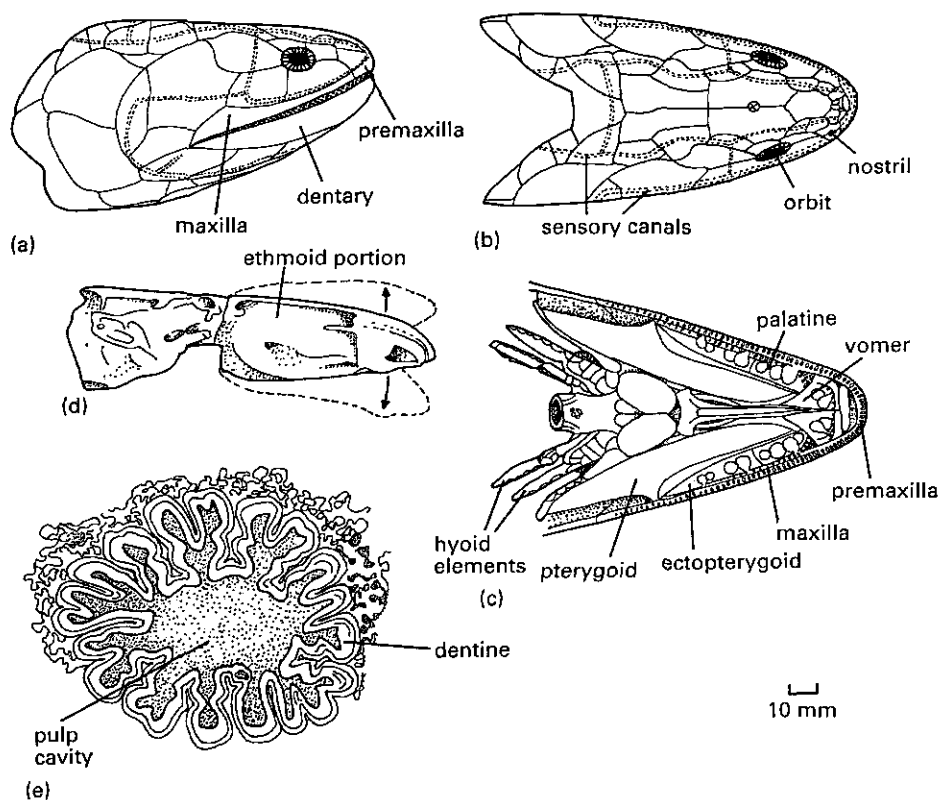
The porolepiforms, represented by *Holoptychius* (Fig. 2.19c), generally have larger rounded scales, and longer pointed pectoral fins with more extensive lobed portions. The body shape is different, with porolepiforms being deeper and shorter than osteolepiforms, and having a shorter skull and a smaller eye.

The head of sarcopterygians is generally like that of early actinopterygians. The osteolepiform *Eusthenopteron* (Fig. 2.20a & b) has a complex of thin dermal bone plates covering the outer portions of the head, gill region, and attached shoulder girdle. Small teeth are borne on the maxilla, premaxilla, and dentary, as well as on several bones of the palate



**Figure 2.19** Diversity of the osteolepiforms (a) & (b) and porolepiforms (c): (a) & (b) lateral views of *Osteolepis*, with and without scales, (c) lateral view of *Holoptychius*, with scales. (Fig. (a) after Moy-Thomas & Miles 1971; (b) after Andrews & Westoll 1970a; (c) after Andrews 1973.)

## THE LOBEFINS

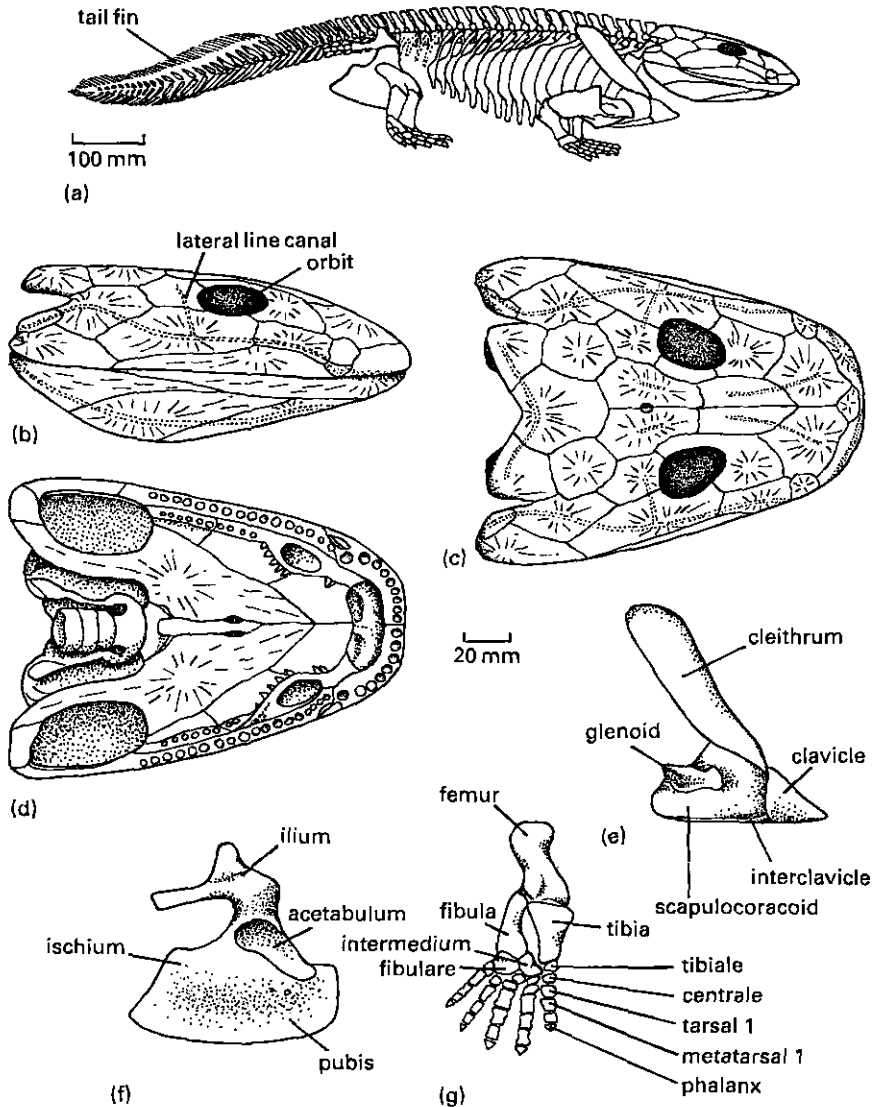


**Figure 2.20** The skull of the osteolepiform *Eusthenopteron* in (a) lateral, (b) dorsal, and (c) ventral views; (d) lateral view of the braincase, showing the postulated range of movement about the middle joint; (e) cross-section of a tooth to show the labyrinthine infolding of the enamel (tooth diameter, 5 mm). (After Moy-Thomas & Miles 1971.)

(Fig. 2.20c). Some of the palatal teeth are heavy, and they have complex, or labyrinthine, internal patterns of infolding (Fig. 2.20e), the so-called labyrinthodont type of tooth, found also in early tetrapods. As in early actinopterygians, the skull is highly kinetic, being jointed in order to allow the mouth to open wide. Even the braincase (Fig. 2.20d), deep within the skull, is jointed in order to permit greater flexibility.

The coelacanths arose in the Middle Devonian, and are represented by fossils up to the Late Cretaceous, when it was thought they had died out. Of course the discovery of *Latimeria*, a living coelacanth, in 1938 is now well known. Typical coelacanths (Fig. 2.21) have short bodies with large dorsal, anal, and paired fins, all of which are lobed except for the anterior dorsal. The tail is characteristically divided into three parts – a dorsal and ventral portion separated by a small middle lobe at the end of the notochord. The skull is short overall, although the snout portion is longer than in the osteolepiforms. *Latimeria* (Forey 1988) lives in deep oceans off

## THE AMPHIBIANS



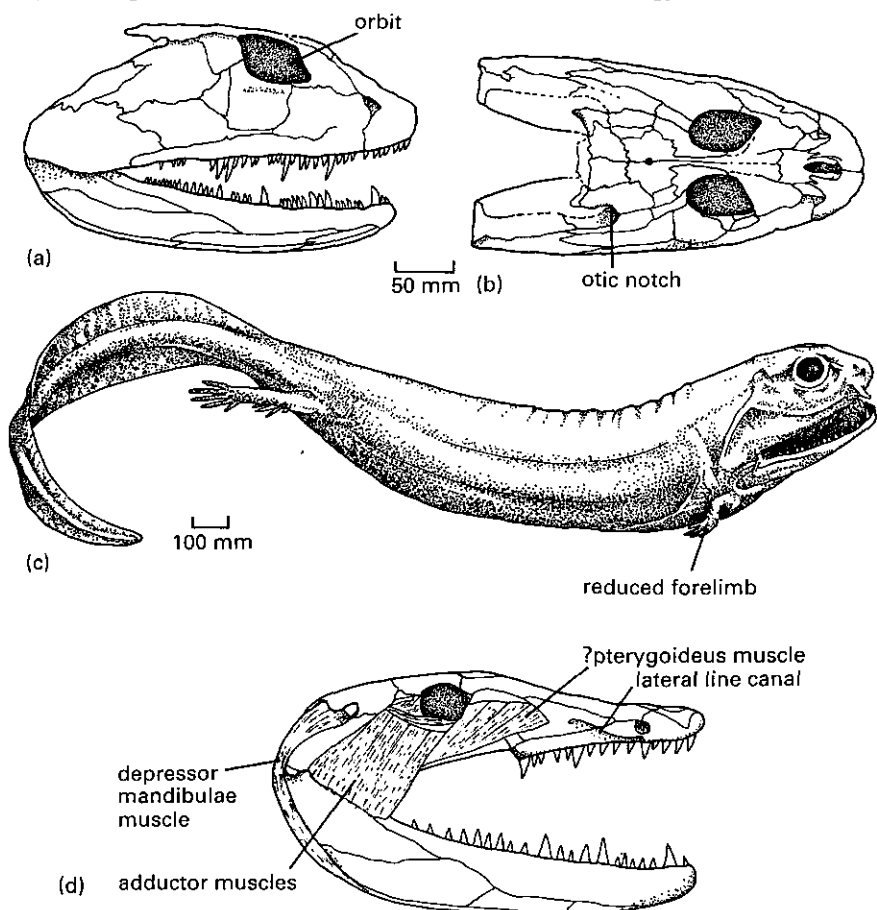
**Figure 3.4** The anatomy of *Ichthyostega*, an early amphibian: (a) body; (b)–(d) skull in lateral, dorsal, and ventral views; (e) shoulder girdle in lateral view; (f) pelvic girdle in lateral view; (g) leg and foot in anterior view. (After Jarvik 1955.)

The pectoral girdle of *Ichthyostega* (Fig. 3.4e) is separate from the skull, and it is simplified in some respects when compared with that of an osteolepiform. In *Ichthyostega*, there are four main elements; a **cleithrum** above and a **scapulocoracoid** below, the latter bearing the joint surface or **glenoid** for the humerus, and a **clavicle** and **interclavicle** in front of and below the scapulocoracoid respectively. The pelvic girdle (Fig. 3.4f) shows

however, that the 'Labyrinthodontia' and 'Lepospondyli' are not monophyletic groups (Panchen & Smithson 1988). The major Carboniferous amphibian groups will be introduced in approximate order of their appearance in the fossil record, and their relationships will be considered later.

### Family Crassigyrinidae

*Crassigyrinus* from the Early Carboniferous of Scotland (Panchen 1985) has a large skull (Fig. 3.6a-c) with heavily sculptured bones. The deep embayments in the side of the skull at the back just behind the eyes are generally called otic notches, and it has been assumed that these accommodated a **tympanum**, or ear drum, which was linked to the inner ear by the stapes. However, in primitive forms such as *Crassigyrinus*, this space



**Figure 3.6** Early amphibians: (a)–(c) *Crassigyrinus*; (a) & (b) skull in lateral and dorsal views; (c) whole-body restoration, based on new Scottish material, but the tail is imaginary; (d) skull of *Megalocephalus* in lateral view, with a tentative restoration of the main jaw muscles (Figs (a) & (b) after Panchen 1985; (c) after Milner *et al.* 1986; (d) after Beaumont 1977.)

### Suborder Anthracosauroidae

The anthracosauroids, a group that arose in the Early Carboniferous, and survived into the Late Permian, include some 15 genera of moderate-sized fish-eaters. Some were apparently terrestrial, while others became secondarily adapted to life in the water.

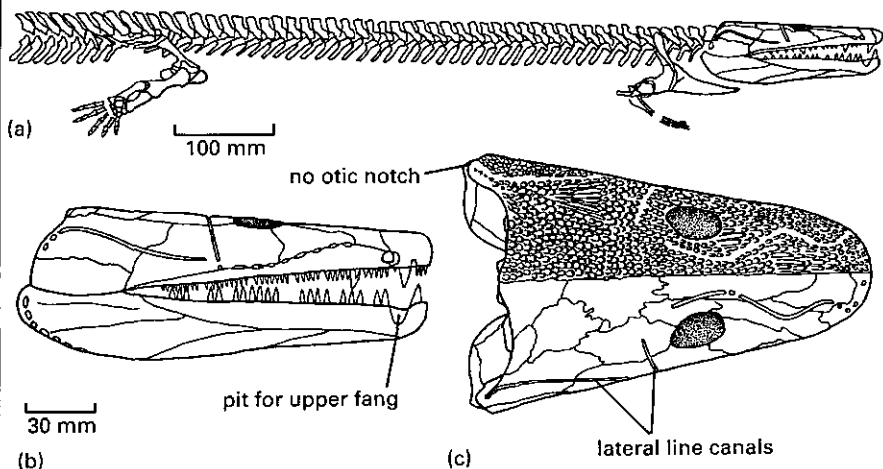
*Proterogyrinus*, from the Early Carboniferous of West Virginia, USA (Holmes 1984) and Scotland, is about 1 m long and has an elongate skull (Fig. 3.7a & b). The skull table, the square area at the back of the skull (Fig. 3.7a), is set off from the cheek area, and there is a line of weakness between the two units which presumably allowed the skull to flex during jaw opening, as in osteolepiforms. There is a moderate notch at the back which may have accommodated an ear drum. *Proterogyrinus* (Fig. 3.7c) has large vertebrae, a short neck, and a flat-sided tail. The limbs are well developed for moving rapidly on land, but the flattened tail shows that *Proterogyrinus* could swim well.

### Family Colosteidae

The colosteids, such as *Greererpeton* from the Early Carboniferous of West Virginia, USA (Smithson 1982), have an elongate body with 40 vertebrae in the trunk and neck, a broad tail, and short limbs (Fig. 3.8a). The skull (Fig. 3.8b & c) is very different from that of anthracosaurs: the eyes are placed further forward, the skull and lower jaw are lower and flatter, and there is no otic notch. The lateral line canals are also well developed, suggesting an aquatic lifestyle.

### Order Temnospondyli

The temnospondyls are the main Carboniferous amphibians, a group that survived in abundance through the Triassic, and with much reduced



**Figure 3.8** The colosteid *Greererpeton*: (a) whole-body restoration; (b) & (c) skull in lateral and dorsal views, showing the sculpturing of the skull bones on the left side of the dorsal view (c) only. (Fig. (a) after Godfrey in Carroll 1987; (b) & (c) after Smithson 1982.)