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The skeleton and the muscular system

7.1 The cranial skeleton

7.1.1 The neurocranium

In comparison with the difficulties that we face when attempting to relate the splanchnocranium of the cyclostomes to that of the gnathostomes, the neurocranium presents relatively few problems of interpretation and, in its broad outlines, this structure conforms to a pattern that is readily recognizable in the skull of higher vertebrates, consisting essentially of the sense capsules, parachordals and trabeculae (Fig. 7.1). In its simplest form, in the ammocoete, the brain is supported ventrally by a cartilaginous framework attached to the cranial extension of the notochord, with paired parachordals continuing forwards as the ‘trabeculae’. The latter diverge again in the midline to form a hypophysial fenestra at the site of the pituitary and where the trabeculae and parachordals meet, there is a small, basitrabecular process. The ear capsule is united to the parachordals, but the small olfactory capsule is connected to the membranes covering the brain only by fibrous tissue. In the course of metamorphosis, the trabeculae extend to form lateral cranial walls and the auditory capsules are united by a cartilaginous bridge (tectum synoticum). The anterior part of the hypophysial fenestra is reduced by the development of an intertrabecular plate and the developing eye becomes supported by a massive sub-ocular arch formed from an extension of the basitrabecular process (Fig. 7.2).

In the myxinoids, the trabeculae arise from the front of the otic capsule rather than directly from the parachordals. Below the pituitary there is a subhypophysial plate, connected anteriorly to the nasal capsule. The latter is a hemicylindrical framework of longitudinal rods, joined in front and behind by half hoops of cartilage. Peculiar to the hagfishes is an elongated cylindrical framework supporting the nasohypophysial canal and below this is a massive sub-nasal cartilage. The homologies of these specialized structures remains obscure and their inclusion in the neurocranium is quite arbitrary.
The precise homologies of the cyclostome trabeculae have been disputed, but it now seems probable that at least a part of these structures may correspond to the gnathostome polar cartilages, lying between the cranial end of the parachordals and the trabeculae (Section 3.2). An alternative view is that the true trabeculae of the lamprey may be represented by the transverse commissure linking the cranial ends of the ‘trabeculae’ and which are also present in the myxinoid embryo. This interpretation is strengthened by the claim that at least in the lamprey, this commissure is ectomesenchymal in origin. Jarvik (1964) believes that as in the gnathostomes, the cyclostome