Many disputes have taken place as to what cranial bones (both cartilage and membrane bones) of one group of animals correspond with those of other groups. Such disputes, still exist in certain cases, and it would be unwise to positively assert more than the existence of a general cor­respondence between the cranial bones of widely different Vertebrates—such, for example, as between Teleostean Fishes and Reptiles or Mammals.

Beneath the occipital foramen the basioccipital bone arises, and it may, as in Birds and Reptiles, develop a posterior prominence which joins with contiguous promi­nences of the exoccipitals to form a single “ condyle ” for articulation with the spine. On the other hand, there may be, as in Mammals and Amphibians, two lateral exoccipital condyles unaccompanied by any median basi­occipital prominence. In most Fishes we find only a concave articular surface behind the basioccipital, which thus resembles in form the vertebral centra, the anterior posterior surfaces of which are concave. A fourth bone, the supraoccipital, generally bounds the occipital foramen above.

In front of this occipital segment the auditory capsule, on each side, generally ossifies from three centres of ossifi­cation, which form the prootic, opisthotic, and epiotic bones respectively. Of these the first is the most constant, and is the only one which ossifies in the Frog. When all three are present, the prootic is anterior in position, the opisthotic inferior and posterior, and the epiotic posterior and superior. Sometimes, as in Fishes, two other supero- external bones may be formed in the auditory capsule, the more anterior of which is the sphenotic and the more posterior the pterotic.

The base of the cranium, in front of the basioccipital, generally ossifies as the basisphenoid, and a depression on its upper surface is known as the sella turcica or pituitary fossa. In front of the basisphenoid there may be, as in Mammals, another azygous bone, the presphenoid. The skull’s lateral walls (in front of the auditory capsule) ossify as the alisphenoid and orbitosphenoid on each side, the latter forming the antero-lateral wall of the cranium. The optic capsule or sclerotic may be merely membranous, as in Mammals, or may ossify, as in Birds, but it never forms any solid connexion with the cranial walls.

The olfactory region very often ossifies as a median vertical bone (the mesethmoid) and two lateral ones (the lateral ethmoids or prefrontals). These ethmoidal ossifica­tions may close the cranial cavity anteriorly, or may be altogether anterior to it. The olfactory and presphenoidal region may ossify very exceptionally as one bone. Such a condition we find in the Frog and its allies. These bones vary greatly in different classes of Vertebrates as to the degrees in which they anchylose together or remain dis­tinct, and also as to the order in which those unite which ultimately coalesce. Similar differences occur with respect to the remaining skull bones. Speaking generally, we find the greatest amount of distinctness in the Osseous Fishes, and the greatest amount of coalescence in the class of Birds.

The membrane bones of the cranium are most con­spicuous and constant on its roof. In Fishes we find every grade of transition between simple dermal scutes and true subdermal bones of the internal skeleton. Well- developed dermal cranial scutes are to be found in the Sturgeon and some Siluroids. Where the membrane bones still retain the character of dermal plates, those on the dorsal surface of the cranium are usually arranged in a series of longitudinal rows, continuing in the region of the head the rows of dermal scutes of the trunk. The dorsal cranial dermal bones differ in different Fishes as regards arrangement and number as well as size. Owing, how­

ever, to their linear arrangements, they usually receive corresponding names, though it is very doubtful whether they can be considered as truly homologous.@@1 In most Bony Fishes, as in higher animals, we may generally dis­tinguish in the cranial roof one or two parietals, with an interparietal or upper (or upper part of a) supraoccipital behind the parietals, and a frontal or pair of frontals in front of them. A bone called the squamosal may also form part of the cranial roof, as in Mammals, and may send forwards and outwards a process which unites with another form, a preorbital bone, to form a zygomatic arch. In front, above, behind, and beneath the orbit (in which lies the sclerotic) bones may arise termed malars and lachrymals, supraorbitals, and post-frontals respectively, and the zygomatic process of the squamosal may unite with a corresponding process from the malar or the post-frontal. The malar bone, or (as it is often called) the jugal, rather belongs, however, to the third category of cranial skeletal parts. The olfactory or ethmoidal region becomes roofed over in part by the frontals, in part by the lateral bones (belonging to the third category of cranial parts to be presently noticed) called the maxilla?, but it is mainly roofed over by two bones (sometimes one bone) called nasals, which bound the posterior surface of the external nasal opening on each side of the skull. In Bony Fishes, Amphibians, and Serpents almost the whole cranium is invested below by a large membrane bone called the parasphenoid.

The nervous centres within the cranial cavity send forth nerves through certain definite small apertures or foramina, which show much constancy of position. As a rule, and in the highest class of Vertebrates, the olfactory nerves pass out medianly in front to the ethmoids, between the orbitosphenoids or the membranous parts which may re­present them. The optic nerves perforate the orbito­sphenoids, but may pass out behind them. In Lizards *(e.g., Hatteria, Anguis,* and many others) an aperture is left in the roof of the skull which is called the “ parietal foramen. ” It serves for the reception of a third and rudi­mentary eye, the existence of which in Lizards was before referred to in noticing the cartilaginous cranium. It is a structure of great morphological interest. The nerves of the muscles of the eye, as well as the first of the three divisions of the fifth nerve, pass out in the interval between the orbito and ali-sphenoids. The two other divisions of the fifth, as a rule, perforate the alisphenoid, the third the more constantly, the aperture for it being known as the foramen ovale, the less constant aperture for the second branch being called the foramen rotundum. The auditory nerve enters the auditory capsule (whether ossified or not) on its inner side, and does not pass out from it, but the facial nerve both perforates and traverses it. The glos­sopharyngeal, pneumogastric, and spinal accessory nerves pass out between the auditory capsule and the exoccipital, which latter bone is perforated and traversed by the hypo­glossal nerve.

Thus the osseous cranium (apart from the sense-cap­sules) consists of three arched segments : of these the hindmost is formed by the basi-, ex-, and supra-occipitals, the median by the basisphenoid, alisphenoids, and parietals, and the anterior by the presphenoid, the orbitosphenoid, and the frontals. These have been called “cranial vertebræ,” and certainly if the essence of vertebræ consists in their being a series of solid rings, fitted together and enclosing a tract of the nervous centres, then it must be admitted that the cranium—of the highest class of animals at least—is made up of three such vertebræ. Their development, however, is altogether different from that of true vertebræ, and no such resemblance to vertebræ

@@@1 Balfour, *loc. cit.,* p. 486.