

Struthionidae, it is not the strongest example of what a Bird's skull may be. In a bird's-eye view we see the separate-ness of the nasals, the nasal processes of the premaxillaries, the fore-end of the frontals, the top of the ethmoid, and the lacrymals (fig. 19, *n.px., n., f., eth., l.*). Below (fig. 20), the premaxillaries still have sutures with the palatines and maxillaries, and the latter has its jugal process, the jugal itself, and the quadrato-jugal, all distinct (*px., pa., mx., j., qj.*)

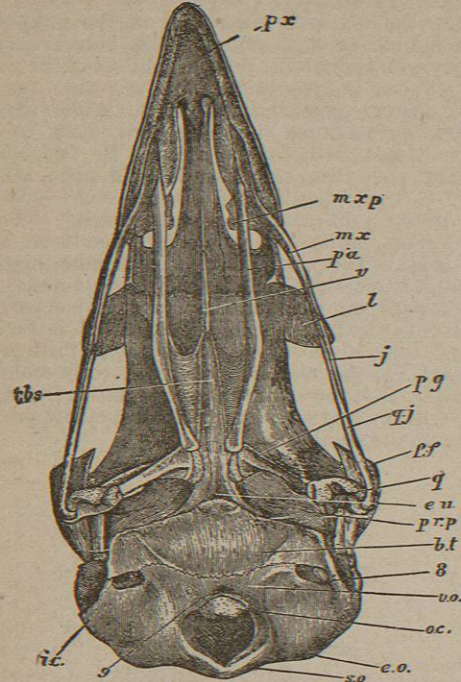


Fig. 20.—The same skull, basal view. Here the slenderness of the upper facial rods is in strong contrast with the massiveness of the skull itself. This skull is unusually schizognathous, the vomer (*v.*) being very small, and the maxillo-palatine processes (*mx.p.*) much aborted.

Moreover, the quadrate (*q.*), pterygoid (*pt.g.*), the palatines, and of necessity the mandible—all these retain their joints, and traces of the union of the mandibular splints are long retained (fig. 21, *d., ar.*). So also do the elements of the hyoid arch, soon to be described, remain separate.

The whole cranial box, and all the inter-orbital region, have become one bone, whilst the various fontanelles are filled in. In the specimen which has been figured the inter-orbital fenestra (*i.o.f.*) is partly open, but it is often obliterated. Also we see that free periosteal bony growths have bridged over the temporal fossa, the post-frontal or "sphenotic" having met and coalesced with a zygomatic process of the squamosal (*p.f., sq.*). In the lower view we still see the notochordal dimple on the transverse occipital condyle (*o.c.*), and the hinder margin of the basi-temporal plate is still traceable in front of the passages for the vagus and the internal carotid burrows (*i.c.*) This thick bony mass is totally ankylosed to the basi-sphenoidal region above. The prootic and alisphenoidal regions are land-marked below by the foramen ovale (5), which is sometimes, as in Fishes, divided into two by a bony bar. So free is the bony growth that the basi-temporal has coalesced with the temporal wing of the exoccipital (*b.t., e.o.*), and in front of this bridge we see a number of passages, burrows, galleries, windows, &c., leading above to the upper tympanic recess, in front to the anterior tympanic recess, below that to the eustachian opening, and on the middle of

the inner face of the drum cavity a large hole which leads to the two fenestra. The various bones of the palate are

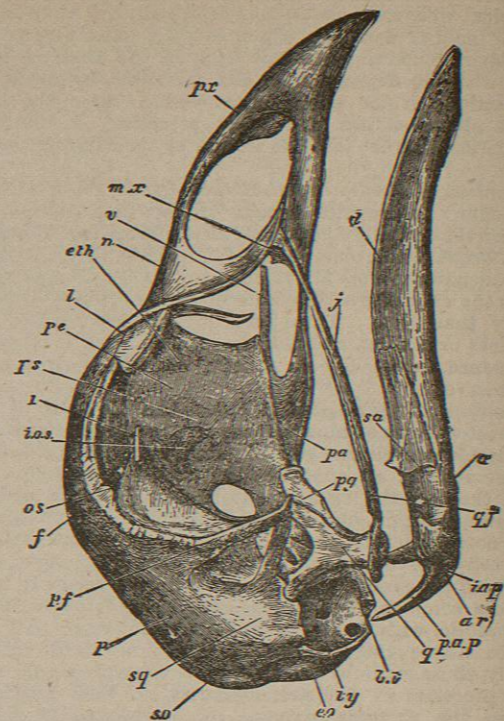


Fig. 21.—The same skull, side view, with the mandible a little dislocated. Here the temporal fossa is bridged over by the junction of the post-frontal and squamosal processes (*p.f., sq.*). The processes of the mandible (*i.a.p., p.a.p.*) are characteristic of this type, and of the *Anserinae*.

scarcely in the least changed in form or relative size since the time of hatching (fig. 20), and the copious growths of cartilage belonging to the nasal labyrinth are always soft; these are not figured in the adult skull. There are, however, a few bony centres, the feeble representatives of the ossifications found amongst higher birds in this region. Thus, close in front of the broad wall-top of the ethmoid, in the substance of the septum nasi, there are two small ossicles, and on each side a similar bony point; the rest remained unossified, all save a small part of the attached margin of the pars plana.

The attenuated remains of the second post-oral, and the larger third post-oral arch, contain persistent cartilage. The elegant "columella auris" (fig. 22) is bony where it fits into the fenestra ovalis (*st.*), and the shaft, up to its rays (*m.st.*), also; but the short, notched supra-stapedial (*s.st.*), the tongue-shaped and fenestrate extra-stapedial (*e.st.*), and the slender, combined infra-stapedial and stylo-hyal (*i.st.*), all these are still cartilaginous.¹ The rest of the second post-oral is reduced to the arrowhead-shaped lingual bone, the coalesced and partly ossified cerato-hyals (*c.h.*), and an elegant ridged phalangiform basi-hyal (*b.h.*) The free end of the combined glossal piece is soft. There is no tympanic in the Fowl; only in the Peafowl have we found one, and it is behind the membrane. The next arch, the thyro-hyal (first branchial in *Ichthyopsida*), is composed of two almost equal rods; the upper is only ossified in its

¹ Sometimes, even in the Fowl, the infra-stapedial has a spatulate stylo-hyal at its free end (see Professor Huxley's figure, *Proc. Zool. Soc., Mar. 27. 1869. p. 399, fig. 5 B, I. S.*)

distal third, and the lower is mainly bony; their basal piece is largely soft behind (fig. 15, *e.br., c.br., b.br.*)

The skull of the Fowl, and of the *Alectoromorpha* generally, differs in certain respects from that of other *Schizognathae*. In the *Gallinaceae*, as in the desmognathous *Rapaces*, the vomer is single; in Pigeons and Sand-Grouse it is absent; in all the others with open palates it is composed of two halves soldered more or less together. Some of the *Schizognathae* possess an "os uncinatum"—as the Albatross and the Gull—a bone to be described hereafter; and others possess a pair of bones attached to the double vomer, namely, the "septo-maxillaries," known in Reptiles as the so-called "inferior turbinals." These bones, very small in all Birds, have been found by Mr Parker at the top and the bottom, as it were, of the schizognathous series; that is, in the Humming-bird (*Patagona gigas*), and in the Kagu (*Rhinocetus jubatus*). The latter is a Gruine bird, lying on the margin of the group towards the Night-Herons, whilst the Humming-birds are certainly amongst the most specialized types. All the *Schizognathae*, except the Fowl tribe, have "meso-ptyergoids." In certain *Schizognathae* there is an "inferior labial" on the edge of the mandible, namely, in the *Rallidae* (e.g., *Fulica atra* and *Gallinula chloropus*). These were found by the writer many years ago.

Upper labials have not as yet turned up in these types, although they have been figured carefully in the Rhea (*Phil. Trans., 1866, plate 10, fig. 14*, on each side of *r.b.s.*, close under the inferior turbinal *i.t.*), and the Rhea is a much lower type than the birds under notice. As in the *Gallinaceae*, the *Schizognathae* generally have little development of the tympanic ring, but in *Agialitis hiaticula* there is one large and three or four lesser bones on each side; they occur in *Numenius arquata*.

A full and adequate idea of the degree of the metamorphosis of a Vertebrate skull attained to in Birds can only be obtained by observation of what is to be seen in that of the higher arboreal types. But some of the *Carinatae* are half Struthious, and they possess that low kind of skull which is called "Dromæognathous," best seen in *Dromæus*, the Emeu.¹ This kind of skull once understood, the relation of that of the Fowl to that of types far above and far below it will be clearly seen; for we must describe the Desmo-

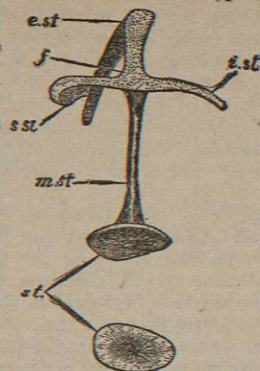


Fig. 22.—Auditory "columella" of Chicken, ninth stage, X 6 diameters; lateral and basal views. *st.*, stapes; *m.st.*, medio-stapedial bar; *e.st.*, super-stapedial; *s.t.*, extra-stapedial; *i.st.*, infra-stapedial; the end of this latter process is the stylo-hyal, often more dilated than in this specimen; *f.*, fenestra in extra-stapedial plate.

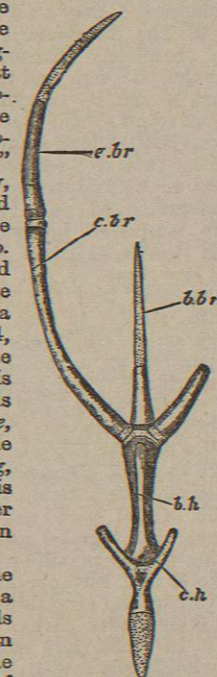


Fig. 23.—Os hyoides of adult Fowl, tenth stage, X 1 1/2 diameters. *c.h.*, cerato-hyals (confluent); *d.h.*, the so-called basi-hyal, answering to the first basi-branchial of a Fish; *b.br.*, basi-branchial, or uro-hyal, answering to the rest of the basi-branchial series of a Fish; *c.br., e.br.*, together form the thyro-hyal, answering to the first cerato- and epi-branchials of a Fish.

¹ *Phil. Trans., 1866, plates 11-13.*

gnathous, *Ægithognathous*, and *Saurogathous* varieties also.

The *DROMÆOGNATHOUS* Type—Cranium of *Tinamus variegatus*.—Professor Huxley (*Clas. of Birds, p. 425*) says, "The *Dromæognathous* birds are represented by the single genus *Tinamus*, which (as Mr Parker has shown)² has a completely struthious palate. In fact, the vomer is very broad, and in front unites with the maxillo-palatine plates, as in *Dromæus*, while behind it receives the posterior extremities of the palatines and anterior ends of the pterygoid bones, which thus are prevented, as in the *Ratitæ*, from entering into any extensive articulation with the basi-sphenoidal rostrum. The basi-ptyergoid processes spring from the body of the sphenoid [they are not segmented plates of cartilage attached to the parasphenoid, as in the true *Carinatae* (see above)], not from the rostrum, and they articulate with the pterygoid very near the distal or outer ends of the latter bones." In the Fowl, as we have just seen, the fore-end, or main part of the pterygoid, glides on the rostral plate. "The head of the quadrate bone is single, as in the Struthious Birds (Parker, *l.c.*)" To this we may add that the basi-temporals are very feebly developed, as we find from examination of three adult species:—*T. robustus*, *T. variegatus*, and *T. brasiliensis sive major*.³

If Professor Huxley's description be compared with the accompanying figure (24) of the *Tinamine* skull this variety will be easily understood; the lettering is the same as in the figures of the Fowl's skull. For further details the reader is referred to Mr Parker's *Memoirs* above referred to, especially that on the Struthious types (*Phil. Trans. 1866, plates 7-15*).

The *DESMOGNATHOUS* Type of Skull.—This kind of skull occurs in such a variety of families that, notwithstanding its importance to the morphologist, it is not of so great a value to the zoologist. Nor indeed is it quite equal to some of the groups in value, being due to a

² A note is given below as follows:—"On the Osteology of Gallinaceous Birds and *Tinamus* (*Transactions of the Zoological Society, vol. v. 1864*). Sundevall, however, had already said of *Tinamus, Rhynchotus*, and *Crypturus*, 'Struthiones parvos referunt.' The last two are merely sub-genera of *Tinamus*."

³ The writer hopes to show the development of this type of skull at some future time; an embryo of *Rhynchotus rufescens* is treasured up for this purpose.

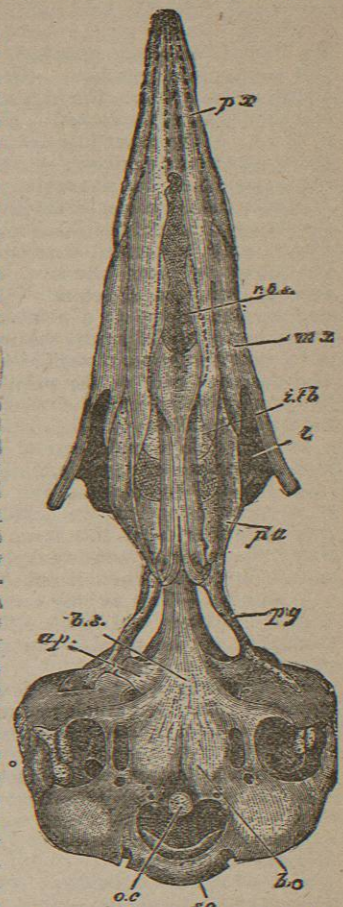


Fig. 24.—Skull of *Tinamus variegatus*, adult, palatal view, X 2 diameters. The greater part of the jugal bars and the quadrate bones have been removed. *r.b.s.*, fore-end of parasphenoidal rostrum; *a.p.*, anterior pterygoid process (basi-ptyergoid).

