THE ANATOMY OF *HYLA CÆRULEA* WHITE.

II.—THE SKULL.

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With Two Text Figures.

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The skull is semicircular in outline, but as the ratio of length to breadth is about 4 : 5 it is not so long as wide. By careful treatment with sodium hydroxide solution the premaxillæ, maxillæ, quadrato-jugals, nasals, vomers, palatines, pterygoids, squamosals, sphenethmoid and parasphenoid may be disarticulated. Usually, however, the latter is difficult to remove, as it is more or less fused to the occipito-otic region. The posterior portions of the fronto-parietals are more firmly united with this region so disarticulation only takes place anteriorly with the sphenethmoid.

(*a*) *The Cranium.*

There is a prominent occipito-otic region (*oc.ot*) formed by the fusion of the exoccipitals and pro-otics. The chondrocranium is almost entirely replaced by the occipito-otic region and the sphenethmoid (*sph.eth.*). Both the glossopharyngeal and vagus penetrate the occipital region by distinct foramina, the inner and larger of which being that of the vagus, but posteriorly the two foramina become confluent and give rise to a shallow fossa (fig. II, IX. X.) situated on the outer side of the base of the related condyle. Dorsal to the latter is a prominence of the occipito-otic

region. The foramen magnum is slightly compressed dorso-ventrally, and it is completely surrounded by bone. On the anterior surface of each otic wing is a horizontal groove, and in the central portion is situated the auditory recess leading to the auditory foramen. An extension of the wall of the recess prevents it from being viewed anteriorly. The hinder border of the optic foramen is formed by the anterior margin of the pro-otic, which is perforated more posteriorly by two small elongated foramina. The maxillo-mandibular branch of the trigeminal issues by the larger and more dorsal (fig. II, V_1.) and the ophthalmic of the same nerve by the smaller (fig. II, V_2).

The anterior fontanelle (fig. I, *f*) is partially roofed over posteriorly by the fronto-parietals (fig. I, *f.p.*), but the anterior portion is uncovered. The sphenethmoid (*sph.eth*) is extensive, strongly compressed dorso-ventrally and roughly pentagonal in shape. Postero-ventrally the edge is entire, but postero-dorsally it is deeply notched for the anterior margin of the fontanelle (fig. I). The postero-lateral borders are concave, each with a prominence along its length, which marks the position of the anterior extremity of the overlapping fronto-parietal (fig. II, X).

The antero-lateral borders approximate forming an angle, which may be seen from the dorsal surface lying between the nasals. The sphenethmoidal septum is well developed, and on the floor of each olfactory recess is a strong ridge running to the olfactory foramen. The nasals (fig. 1, *na.*) overlap the antero-lateral borders of the sphenethmoid, and in shape each is semilunar with the concavity anterior and smooth, but the convexity is irregular. The ventral cornu is pointed and placed at an angle to the major portion of the bone; it comes into relation with the inner side of the nasal process of the maxilla (fig. I, *na.p*). The greater portion of the median ramus of the parasphenoid (fig. II, *m.r.pa*) is applied to the ventral surface of the sphenethmoid. Its edges at first slightly diverge, then converge almost to a point. On the posterior border of the transverse limb in the mid line, is an angular process (fig II, *p*). The arms of the transverse ramus (fig. II, *tr.r.pa.*) extend outwards to near the auditory recesses. The anterior extremities of the fronto-parietals

curve outwards, and their outer edges project slightly over the sphenethmoid. In the postero-lateral walls of the latter are the paired foramina for the entrance of the ophthalmic branches of the trigeminal into the olfactory capsules (fig. II, V_3). Attached to the antero-ventral surface of the sphenethmoid are the vomers (fig. II, *vo.*) which diverge anteriorly placing their distal extremities into relation with the premaxillo-maxillary junctions. Each consists of a curved bar with a thin pointed lamina arising from its outer border ; the posterior region of the bar bearing the teeth is thickened (fig. II, *vo.t.*) and along the inner aspect of the vomer is a groove which fits into the sphenethmoid.

(*b*) *The Maxillary Arch.*

As the following bones are paired and symmetrically arranged, only one side need be described.

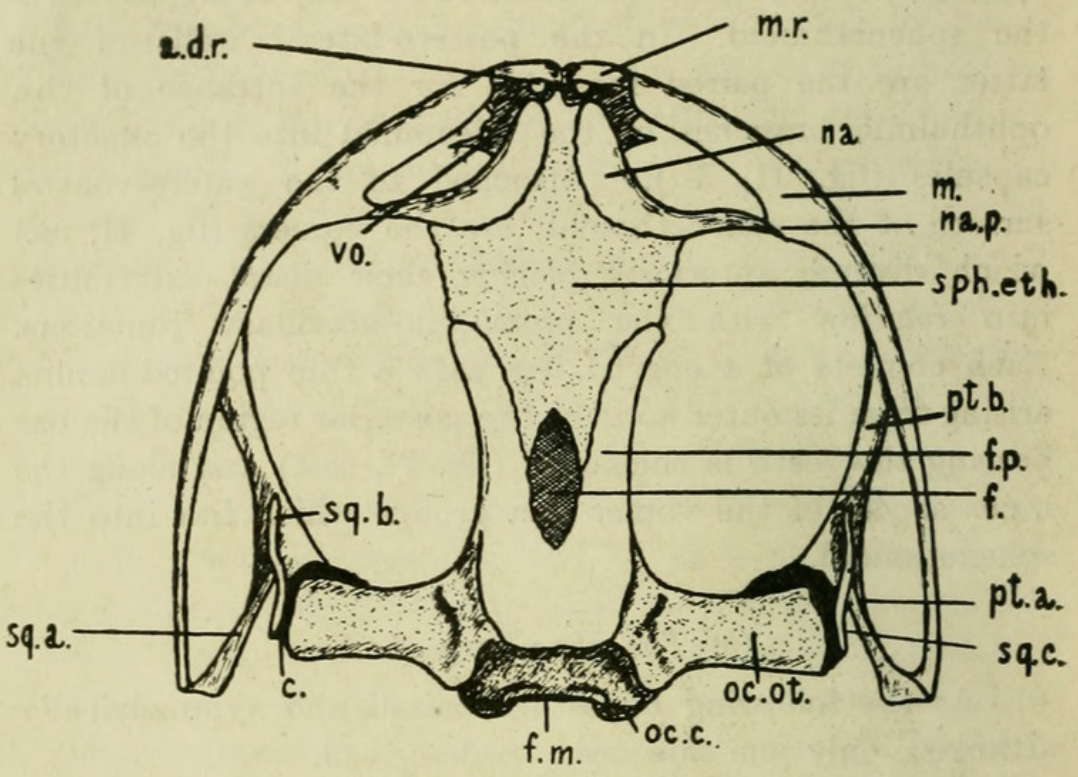
The premaxilla (fig. II, *p.m.*) is triradiate the rami being—

I. Antero-dorsal (fig. I, *a.d.r.*) dorsally directed and arising near the symphysis.

II. Maxillary (fig. I, *m.r.*) running postero-laterally to the maxilla and bearing teeth like the latter.

III. Posterior (fig. II, *p.r.*). This ramus has its origin near the antero-dorsal, and forms a prominent tooth-like process immediately within the anterior extremity of the upper jaw.

The maxilla (*m.*) has a nasal process (fig. I, *na.p.*), which is connected with the nasal. In front of the latter the maxilla is laterally compressed, while behind it gradually tapers to a point. Above the teeth of the premaxilla and maxilla is a small but definite flange of bone. The teeth of the maxilla extend a short distance behind the maxillo-pterygoidal junction (fig. II, *m.pt.j*). The sphenethmoidal attachment of the palatine (fig. II, *pal.*) is posterior to the vomer, while the maxillary connection is in the region of the nasal process. On the inner side of the posterior portion of the quadrato-jugal (fig. II, *q.j.*) is ankylosed the quadrate (fig. II, *q.*), the dual ossification having the shape of a hammer lying on its side. The long ramus of



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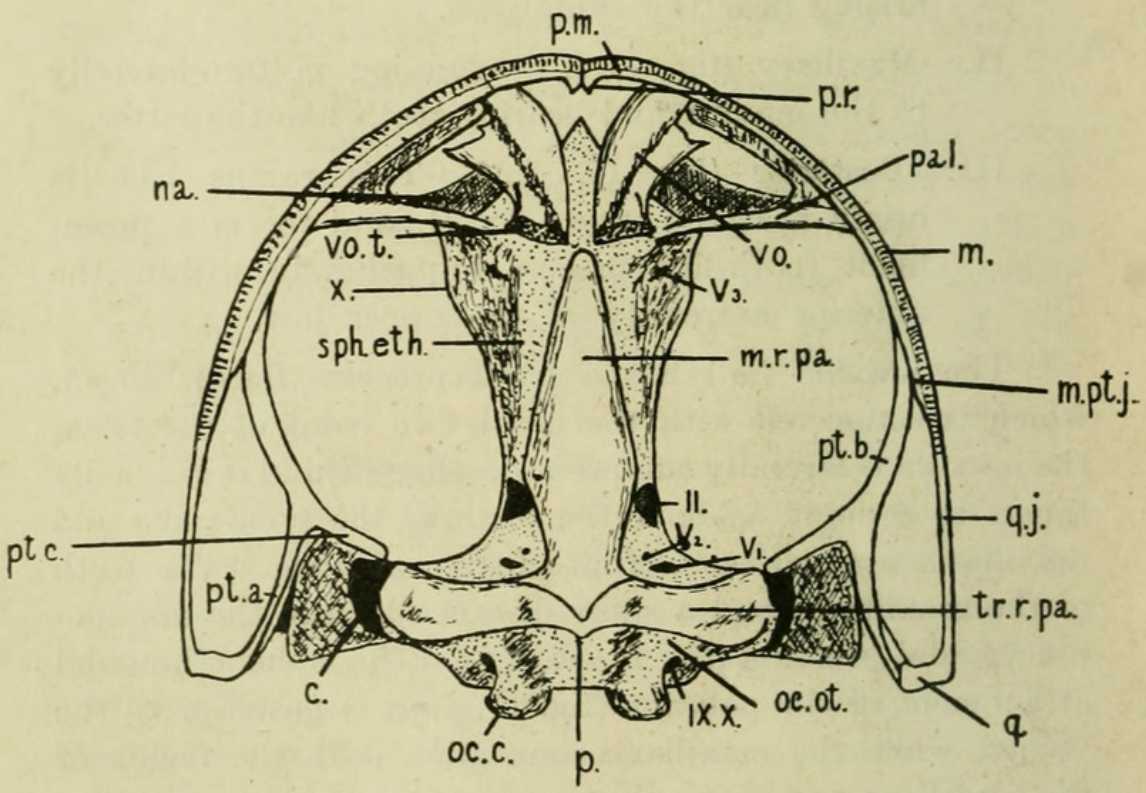

II

Fig. 1. Skull of *Hyla cærulea* White (dorsal view) × about 2½.

Fig. 2. Skull of *Hyla cærulea* White (ventral view) × „ „

EXPLANATION OF LETTERING

a.d.r. anterior dorsal ramus of premaxilla.
c. cartilage.
f. anterior fontanelle.
f.m. foramen magnum.
f.p. fronto-parietal.
m. maxilla.
m.pt.j. maxillo-pterygoid junction.
m.r. maxillary ramus of premaxilla.
m.r.pa. median ramus of parasphenoid.
na. nasal.
na.p. nasal process of maxilla.
oc.c. occipital condyle.
oc.ot. occipito-otic region.
p. posterior process of parasphenoid.
pal. palatine.
pm. premaxilla.
p.r. posterior ramus of premaxilla.
pt.a. posterior ramus of pterygoid.
pt.b. anterior ramus of pterygoid.
pt.c. internal ramus of pterygoid.
q. quadrate.
q.j. quadrato-jugal.
sph.eth. sphenethmoid.
sq.a. long ramus of squamosal.
sq.b. anterior ramus of squamosal.
sq.c. posterior ramus of squamosal.
tr.r.pa. transverse portion of parasphenoid.
vo. vomer.
vo.t. vomerine teeth.
x. position of anterior extremity of fronto-parietal.
II. optic foramen.
V_1. foramen of maxillo-mandibular of trigeminal.
V_2. foramen of ophthalmic of trigeminal.
V_3. entrance of ophthalmic of trigeminal into olfactory region.
IX.X. common foramen of glossopharyngeal and vagus.

the squamosal (fig. I, *sq.a.*) lies along the outer side of the posterior limb of the pterygoid (fig. 1, *pt.a.*) and also fits over the dorsal edge of this ramus by means of a groove on its ventral surface. The proximal portion is flattened, but the distal region is rod-like and curved, with the concavity facing outwards. The shorter arm of the transverse bar (fig. I, *sq.c.*) is directed postero-dorsally and the longer (fig. I, *sq.b.*) antero-ventrally. Both the anterior and posterior rami of the pterygoid (fig. II, *pt.b.* ; *pt.a.*) are curved, in the former the concavity being internal, but external in the latter. The inner ramus (fig. II, *pt.c.*) runs inwards and slightly posteriorly towards the otic region. On its postero-dorsal surface it is strongly grooved.

The Skull of Hyla aurea.

The skull of *Hyla aurea* is more pointed than that of *H. cærulea*, and its breadth is approximately equal to the length, hence proportionately it is less than in *H. cærulea*. The anterior fontanelle is completely roofed over by the fronto-parietals meeting medianly, this condition differing from that of *H. cærulea* in which the fronto-parietals do not meet along the major portion of their length leaving the fontanelle open. The chondrocranium between the sphenethmoid and occipito-otic region is more extensive than in *H. cærulea*.

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