The following papers were read :—

1. On the Hyoid Bone of certain Parrots. By St. George Mivart, F.R.S.

[Received March 4, 1895.]

Distinctive structural characters are so much needed for the classification of birds, that I think the following descriptions and illustrations of some skeletal structures, which, so far as I know, are now described and figured for the first time, will not be unwelcome to Ornithologists, if not to other naturalists also.

The structure of the hyoid in certain birds was described as long ago as 1835 by G. L. Duvernoy (Mém. de la Société d'Hist. nat. de Strasbourg, tome ii.), who figured those of *Ara ararauna* and *Coracopsis vasa*. In 1858 C. Giebel (Zeitsch. gesammt. Naturwiss. Band xi. pp. 42 & 43, Taf. v. & vi. figs. 35–41) gave representations and descriptions of the hyoid of the following species as named by him:—*Psittacus rufirostris* (fig. 35), *P. erithacus* (fig. 36), *P. ochrocephalus* (fig. 37), *P. leucocephalus* (fig. 38), *P. menstruus* (fig. 39), *P. sinensis* (fig. 40), and *P. cristatus* (fig. 41). Dr. Gadow (1891) has also described and figured (Bronn's Thierreich, Band vi. Abtheilung iv., Anatomischer Theil, pp. 298, 299, and 302, plate xxx. fig. 20) the hyoid of a species of *Ara*.

Having lately directed my attention to the skeleton of the Lories, I was very desirous to examine the hyoid in species of that family, in order to compare them with that of *Psittacus erithacus*, taking the latter as my type of Parrot-structure.

Through the kindness of our Prosector, Professor Beddard, F.R.S., I have received for examination the hyoid bones of *Psittacus erithacus*, *Lorius domicella*, *L. flavopalliatus*, *Eos reticulata*, *E. indica*, *Trichoglossus ornatus*, and *Stringops habroptilus*.

So far as I have been able to ascertain, the whole order Psittaci is distinguished from every other order of birds by the shape of its hyoid. The characters which, when taken together, seem distinctive are:—

(1) *Basihyal* much broadened posteriorly.

(2) *Basihyal* developing on either side a forwardly and upwardly directed process, which I propose to distinguish as a *parahyal* process.

(3) An *os entoglossum* in the form of a single broad bone with a considerable central foramen or, much more commonly, in the form of two lateral parts, entoglossals, medianly united in front by cartilage and leaving a vacant space between this and their attachment behind to the basihyal.

The real nature of these entoglossals (as I propose to call them) is not evident to me. Owen writes[1] of the ceratohyal as being

[1] Anat. of Vertebrates, vol. ii. p. 57.

"always short, usually extending forwards from its attachment as well as backward," adding that "the forward production often unites with its fellow, so as to form the basal part of the direct support of the tongue."

Each entoglossal does project both more or less backwards as well as forwards from its place of attachment to the basihyal, and this may indicate that it includes a ceratohyal element, but it must surely represent the glossohyal also. This question I will not, however, now attempt to determine.

That the Parrots should have a tongue-bone of exceptional form is, of course, only what was to be expected from the exceptional form of their tongue as a whole.

I will now first describe the hyoid of *Psittacus erithacus* as a type, then those of the three genera of Lories and that of the genus *Stringops*.

PSITTACUS ERITHACUS. (Fig. 1, p. 164.)

The *basihyal* is narrow for rather more than its anterior half, expanding slightly both laterally and vertically towards its extreme anterior end, where there is a saddle-shaped surface (for the entoglossum) convex transversely and concave vertically. Its ventral lip projects forwards much more than does its dorsal lip. On the dorsum of the basihyal at its anterior end is a slight, though marked, concavity (*c*). The posterior part of the basihyal expands into a subquadrate plate, the centre of which is traversed by a strong antero-posterior ridge continuous with the transversely convex upper surface of the narrow anterior portion of the bone. From each antero-external angle of the quadrate plate of the basihyal a marked parahyal process (*p*) extends forwards, upwards, and slightly outwards, then narrowing to a bluntish point which inclines inwards as well as upwards, the whole parahyal process on each side being more or less curved.

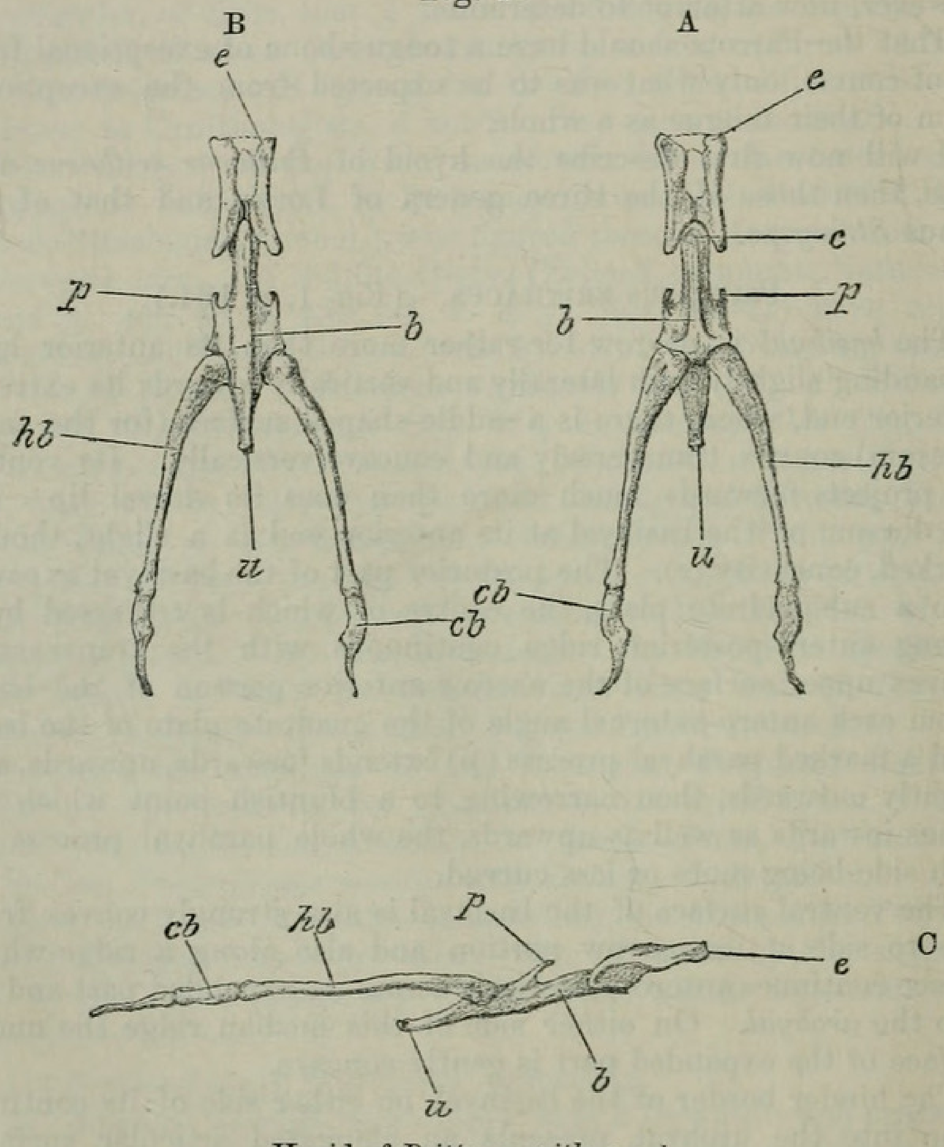
The ventral surface of the basihyal is also strongly convex from side to side at its narrow portion and also along a ridge which thence continues antero-posteriorly across its expanded part and on into the *urohyal*. On either side of this median ridge the under surface of the expanded part is gently concave.

The hinder border of the basihyal, on either side of its continuation into the urohyal, presents an elongated articular surface, concave transversely, slightly convex dorso-ventrally, for junction with the *hypobranchial*.

The *urohyal* is one with the basihyal and continues on without change of direction, tapering a little, to its somewhat blunt, slightly enlarged termination, which is tipped with cartilage. Its dorsal margin appears slightly concave antero-posteriorly, when the urohyal is viewed in profile. Its length is three-quarters the length of the basihyal.

The *entoglossum* consists of two lateral parts (entoglossals), which meet together to articulate with the saddle of the basihyal and so form a little transverse isthmus of bone, whence each entoglossal extends for a considerable distance forwards and for about half as great a distance backwards, each pair of prolongations slightly diverging as they proceed. The ends of the anterior prolongations are united by cartilage, between which, the isthmus of bone before mentioned, and the two anterior limbs of the entoglossals a vacant space is included which is longer than broad. The dorsal surface

Fig. 1.



Hyoid of *Psittacus erithacus*, $\frac{1}{1}$.

A. Dorsal aspect; B. Ventral aspect; C. Lateral aspect.

Explanation of the lettering.

b, basihyal.
e, entoglossum.
c, concavity or cup-like excavation.
p, parahyal process (see figs. 1 & 6).
parahyal arch (see figs. 2, 3, 4, & 5).
u, urohyal.
hb, hypobranchial.
cb, ceratobranchial.
h, symphysis of crura of parahyal arch.

of the bony isthmus lies, as it were, at the bottom of a bony valley formed by the much inwardly inclined dorsal surfaces of the rest of the two entoglossals.

Each entoglossal presents a dorsal surface which is slightly concave from within outwards and looks upwards and inwards and is much curved, convex dorsad, antero-posteriorly, especially at and behind the bony isthmus, the part posterior to which has a dorsal surface convex in both directions. The ventral surface of each entoglossal is correspondingly inclined downwards and outwards and is antero-posteriorly concave, while it is slightly convex dorso-ventrally at its anterior portion, the hinder portion being dorso-ventrally concave. Each entoglossal expands slightly towards its anterior end, where it shows a tendency to bifurcate; the dorsal surface of this most anterior part is concave, while ventrally it is flattened. Postaxially, its end is somewhat more pointed, but does not bend much ventrad at its point. When seen in profile the dorsal margin of each entoglossal is at first slightly concave, antero-posteriorly, and then strongly convex. Its ventral margin is nearly straight (with only a rudiment of a ventrad process), till we come to the anterior part of the descending posterior portion of the entoglossal, where it expands dorso-ventrally, bends mesiad, and joins its fellow of the opposite side. It then rapidly narrows to its hinder end, the expanded part being crossed by a slight antero-posterior ridge concave ventrad. Anteriorly each entoglossal hardly diminishes perceptibly in vertical extent and appears truncated at its termination.

The posterior side of the bony isthmus, formed by the junction of the entoglossals, presents an articular surface strongly concave from side to side and convex dorso-ventrally.

The anterior margin of the bony isthmus is strongly concave from side to side.

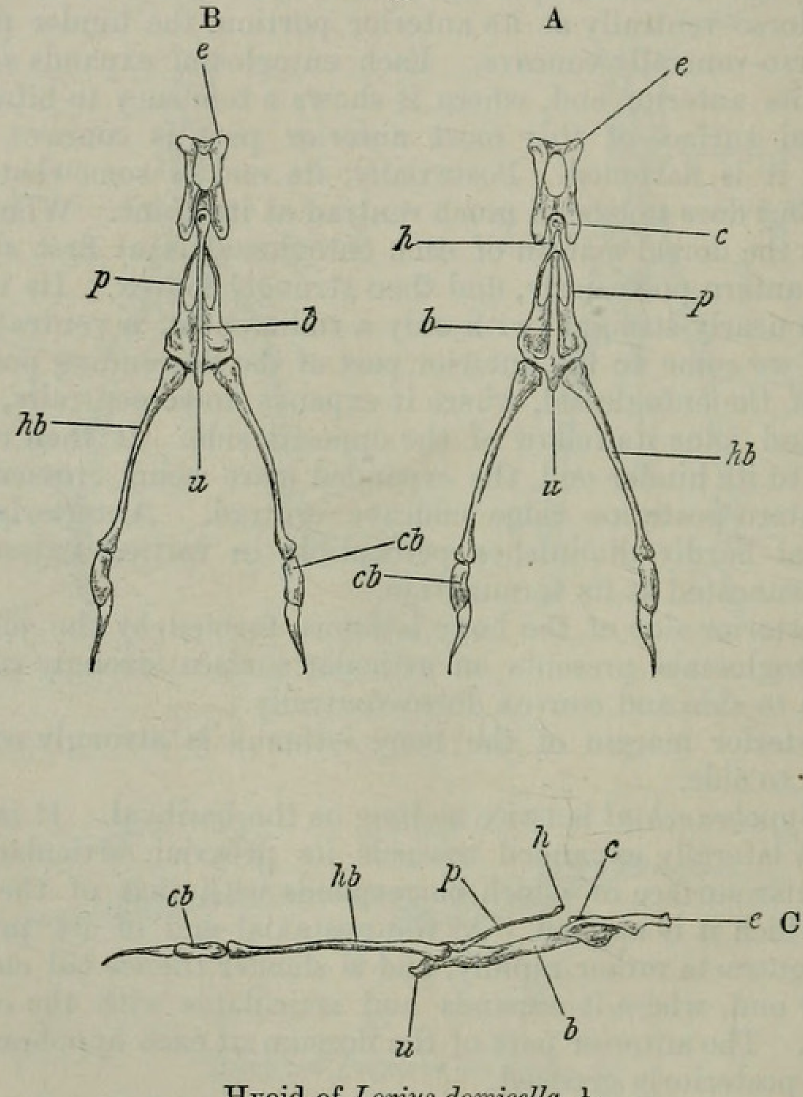
Each *hypobranchial* is twice as long as the basihyal. It is stout and much laterally expanded towards its preaxial, articular end, the articular surface of which corresponds with that of the basihyal to which it is applied. At the postaxial end of its preaxial third it contracts rather rapidly, and is slender thence till close to its hinder end, where it expands and articulates with the ceratobranchial. The anterior part of the dorsum of each hypobranchial is antero-posteriorly grooved.

Each *ceratobranchial* is in the form of a small flattened ossicle, a little more than twice as long as broad, strongly bent concave mesiad, not tapering towards its termination, which is tipped with cartilage.

LORIUS DOMICELLA. (Fig. 2, p. 166.)

Compared with *Psittacus erithacus*, as regards the structure of the hyoid, *Lorius domicella* has the *basihyal* more elongated and its posterior part less expanded laterally and less quadrate in shape. The dorsal lip of its anterior articular surface is more elevated (so that its summit is visible when the hyoid is viewed in profile) and has on its summit a cup-like excavation (*c*), which is an exaggeration of the slight depression which exists there in *P. erithacus*. The median dorsal ridge is very marked where it traverses the posterior, enlarged, part of the hyoid, and there is a marked concavity on either side of it as each outer margin of the expanded part of the basihyal is somewhat elevated. These raised margins are continued on into a very long and very delicate ossicle on either

Fig. 2.



Hyoid of *Lorius domicella*, ½.

A. Dorsal aspect; B. Ventral aspect; C. Lateral aspect.

(Lettering as before, see p. 164.)

side, which seems to represent the parahyal process of *P. erithacus*. If so, these very long and extremely delicate parahyal processes pass forwards, curving gently mesiad till they meet in a symphysis which is placed above and but little behind the dorsal cup before mentioned. Thus these processes form a *parahyal arch* (*p*), which has a singular resemblance to an "os furculum," the symphysis calling to mind the "hypocleidium" (*h*). Each crus of the arch has a slight sigmoid flexure as it advances from its base, the first flexure convex dorsad and the more distal one convex ventrad. The symphysis, as seen above, narrows somewhat towards its apex (which is blunt) and is slightly convex transversely on its dorsal side and flattened beneath or even slightly concave transversely. The symphysis is about as broad as the two crura combined, and each crus continues of nearly the same breadth till it closely approaches the symphysis.

The *urohyal* is relatively as well as absolutely much shorter than in *P. erithacus* and more laterally compressed. It also bends decidedly ventrad towards its apex, which is more truncated.

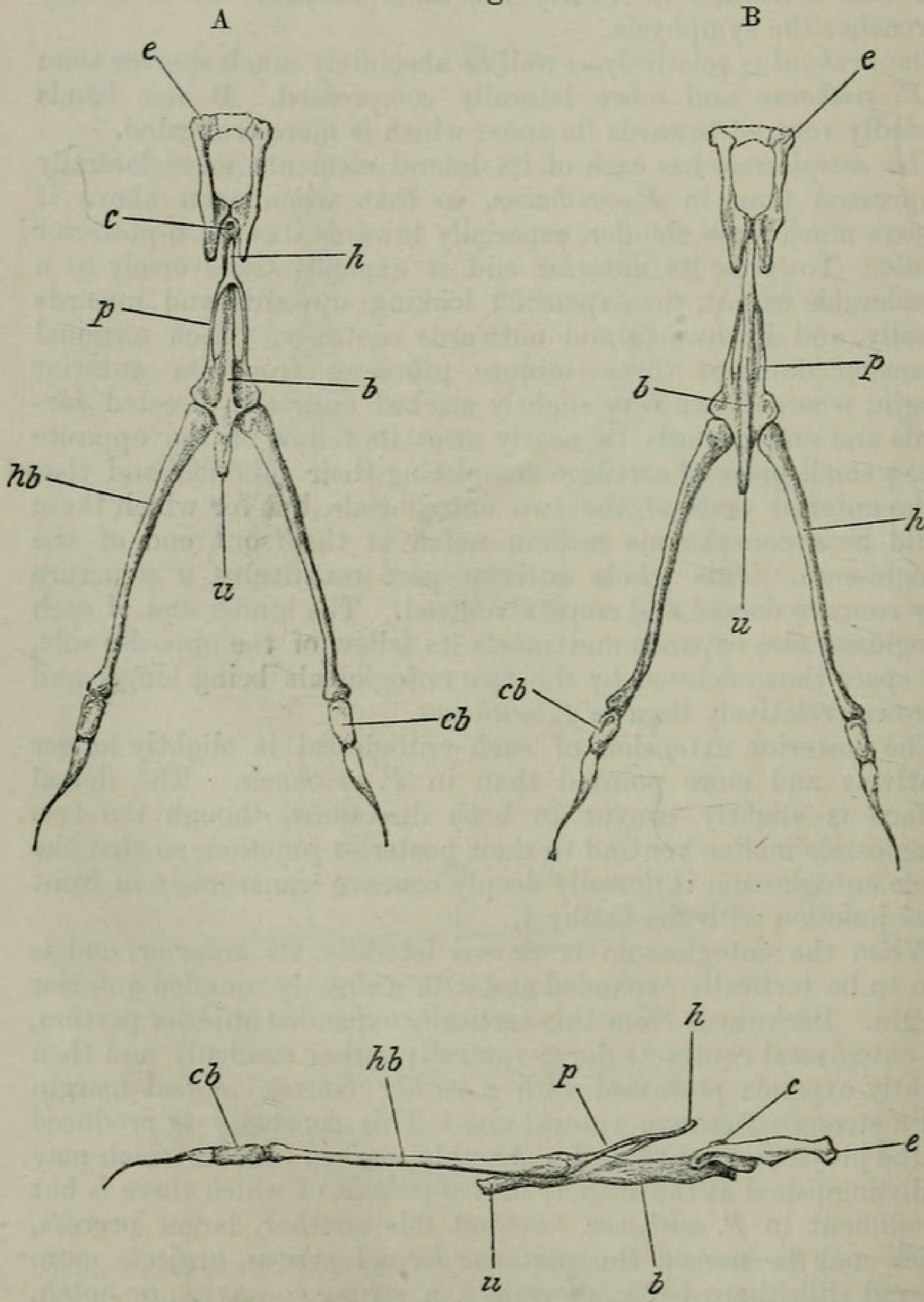
The *entoglossum* has each of its lateral elements more laterally compressed than in *P. erithacus*, so that when seen above it appears much more slender, especially towards its antero-posterior middle. Towards its anterior end it expands transversely to a considerable extent, the expansion looking upwards and inwards dorsally, and downwards and outwards ventrally. Each terminal expansion develops three minute processes from its anterior margin, whereof two very slightly marked ones are directed forwards and one inwards to nearly meet its fellow of the opposite side, a small piece of cartilage completing their junction and that of the anterior ends of the two entoglossals, but for which there would be a conspicuous median notch at the front end of the entoglossum. This whole anterior part constitutes a structure very concave dorsad and convex ventrad. The hinder end of each entoglossal also expands and meets its fellow of the opposite side, the space thus enclosed by the two entoglossals being longer and narrower relatively than in *P. erithacus*.

The posterior extension of each entoglossal is slightly longer relatively and more pointed than in *P. erithacus*. The dorsal surface is slightly convex in both directions, though the two entoglossals incline ventrad to their posterior junction, so that the whole entoglossum is dorsally deeply concave transversely in front of its junction with the basihyal.

When the entoglossum is viewed laterally, its anterior end is seen to be vertically expanded and with a slightly rounded anterior margin. Backwards from this vertically expanded anterior portion, the entoglossal contracts dorso-ventrally rather suddenly and then slightly expands postaxiad with a rather convex dorsal margin and a strongly concave ventral one. This concavity is produced by the projection ventrad of a strongly marked process which may be distinguished as the *anterior lateral process*, of which there is but a rudiment in *P. erithacus*. Behind this another, larger process, which may be named the *posterior lateral process*, projects more ventrad still, there being, of course, a strong concavity, or notch, between these two processes. This posterior lateral process consists, as in *P. erithacus*, of that ventral portion of the entoglossum which goes to join its fellow of the opposite side and form the bony isthmus in front of the articulation of the entoglossum with the saddle-shaped surface of the basihyal. Behind this the posterior process of each entoglossal projects backwards and somewhat downwards towards its apex, its dorsal margin being slightly convex and its ventral margin concave towards it hinder end. Its outer surface is very concave.

The *hypobranchial* is much shorter, relatively, and also more

Fig. 3.



Hyoid of *Lorius flavopalliatus*, $\frac{1}{1}$.

A. Dorsal aspect; B. Ventral aspect; C. Lateral aspect.

(Lettering as before, see p. 164.)

slender than in *P. erithacus.* It is also more curved, concave downwards, and presents a lateral sigmoid flexure, the anterior curve whereof is convex outwards, while the more distal one is convex mesiad. It also expands slightly more transversely at its distal end.

The *ceratobranchial* is much like that of *P. erithacus*, but slightly less expanded laterally and a little more curved, concave mesiad.

Lorius flavopalliatus. (Fig. 3, p. 168.)

The hyoid of *Lorius flavopalliatus* agrees with that of *Lorius domicella* except in the following few particulars.

The *basihyal* is more strongly and sharply bent dorsad towards its preaxial end. The two lateral halves of its posterior margin form a more decided angle with each other, open forwards. Each postero-external margin of the basihyal plate forms a much more marked and smaller angle with the proximal part of the crus of the parahyal arch. The crura of the arch are somewhat shorter, its symphysis being much longer and more pointed. The symphysis curves, antero-posteriorly, more strongly concave downwards.

The *entoglossum* has its constituent halves diverging more preaxiad. Seen laterally the anterior end of each entoglossal develops three short, vertically superimposed marginal processes.

The *urohyal* is not so much bent ventrad towards its distal end.

The *hypobranchial* is relatively slightly shorter.

The *ceratobranchial* is less curved.

Eos reticulata. (Fig. 4, p. 170.)

Basihyal—This bone in *Eos reticulata* has its expanded posterior part intermediate in form between those of *Lorius domicella* and *Lorius flavopalliatus.* The angle formed by the two sides of its posterior margin is more like that in the former, while the shape of its external margins (behind the origins of the crura of the parahyal arch) are more like those of *L. flavopalliatus.* The crura are rather shorter than in either of those species, though the symphysis of the arch is elongate, but not so much so as in the last-named species. The dorsal cup-like excavation at the preaxial end of the bone is as marked as in either of the before described forms.

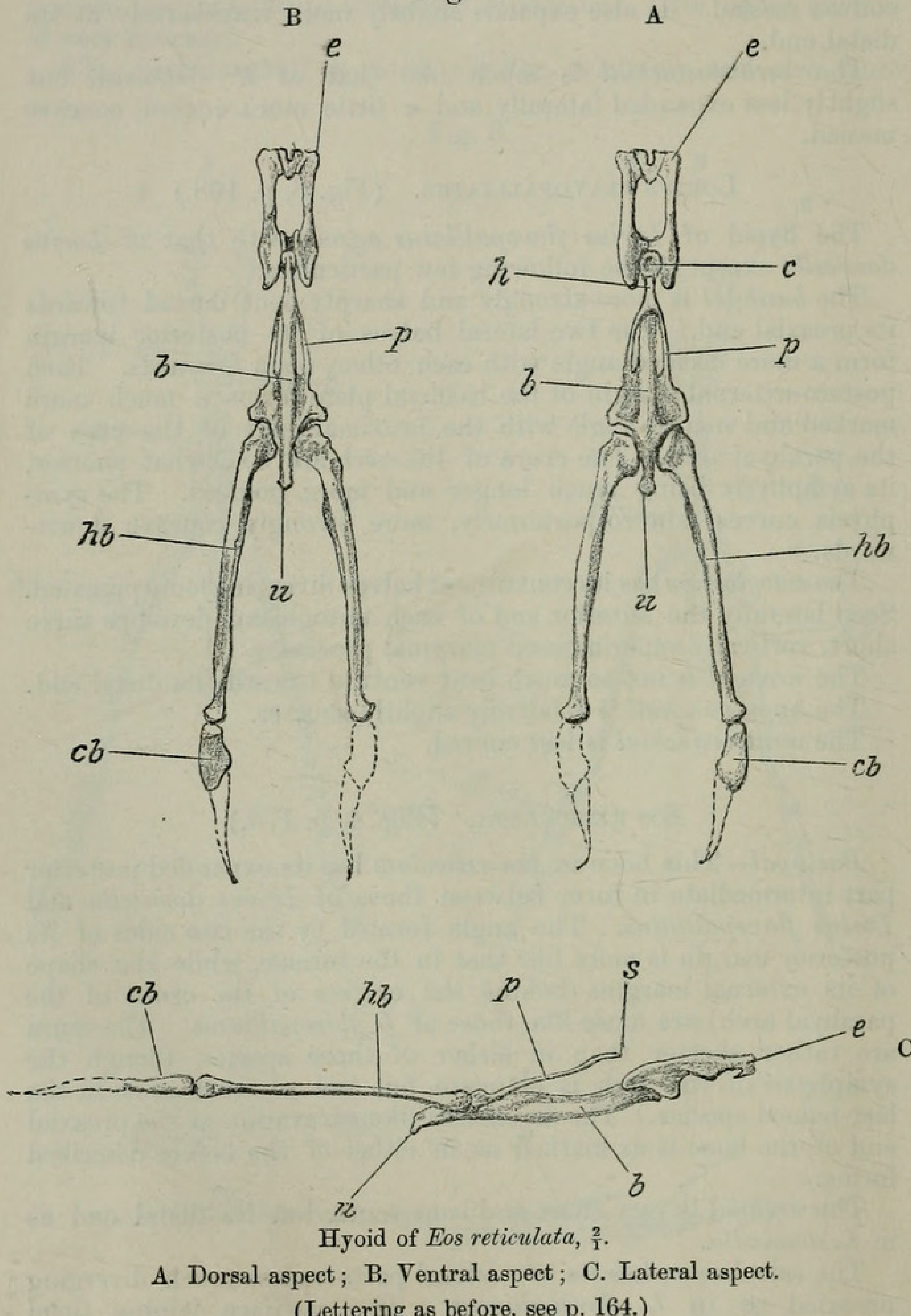
The *urohyal* is very short and bent ventrad at its distal end as in *L. domicella.*

The *entoglossum* has its two lateral parts not so much diverging preaxiad as in *L. flavopalliatus.* The cartilage joining them anteriorly is medianly notched in front and somewhat medianly prolonged behind. Both the lateral processes of each entoglossal are well developed.

The *hypobranchials* are relatively shorter and stouter than in *Lorius*, but with a similar sigmoid flexure.

The *ceratobranchial* broadens more, laterally, antero-posteriorly to its preaxial end.

Fig. 4.



Hyoid of *Eos reticulata*, $\frac{2}{1}$.

A. Dorsal aspect; B. Ventral aspect; C. Lateral aspect.

(Lettering as before, see p. 164.)

EOS INDICA [1].

In every particular which has been given with respect to the *basihyal*, *urohyal*, *entoglossum*, and *hypo-* and *cerato-branchials* of

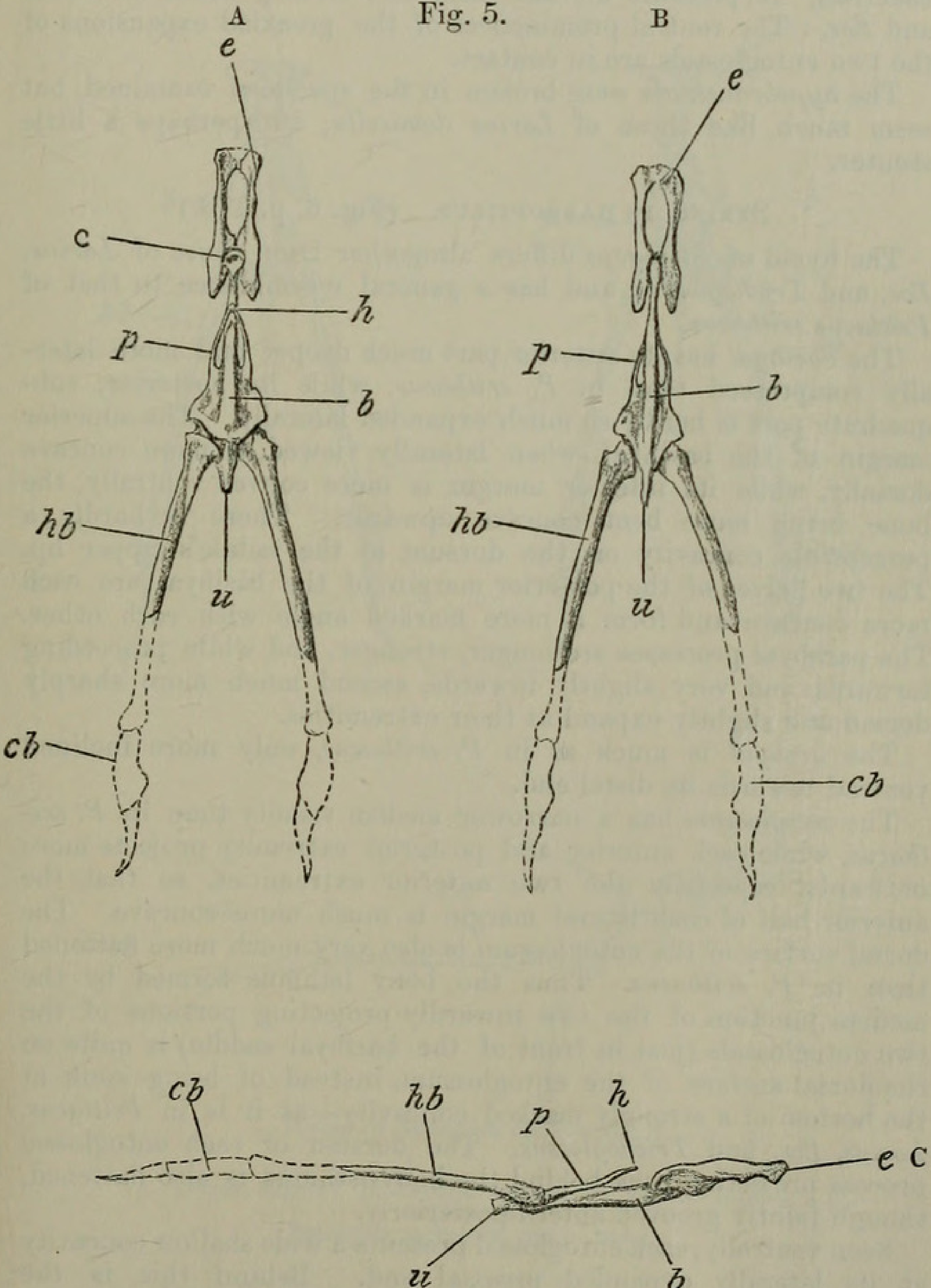
[1] I suspect that the specimen thus named may be really *Eos reticulata*.

Eos reticulata, *E. indica* entirely agrees, save that the cartilage joining the anterior ends of the entoglossals having disappeared, nothing can be said as to its shape.

TRICHOGLOSSUS ORNATUS. (Fig. 5.)

The *basihyal* of this species differs from those of *Lorius* and *Eos*

Fig. 5.



Hyoid of *Trichoglossus ornatus*, $\frac{2}{1}$.
A. Dorsal aspect; B. Ventral aspect; C. Lateral aspect.
(Lettering as before, see p. 164.)

in that the crura of its parahyal arch where they meet are not prolonged into a symphysis. It is possible that a prolonged symphysial portion may have been broken off, but I cannot detect any trace of the fracture.

The *urohyal* is very short, but slightly deflected ventrally towards its truncated distal end.

The *entoglossum* is rather more prolonged compared with the basihyal. It presents all the characters already noted in *Lorius* and *Eos*. The ventral prominences of the preaxiad expansions of the two entoglossals are in contact.

The *hypobranchials* were broken in the specimen examined, but seem much like those of *Lorius domicella*, but perhaps a little stouter.

STRINGOPS HABROPTILUS. (Fig. 6, p. 173.)

The hyoid of *Stringops* differs altogether from those of *Lorius*, *Eos*, and *Trichoglossus*, and has a general resemblance to that of *Psittacus erithacus*.

The *basihyal* has its anterior part much deeper and more laterally compressed than in *P. erithacus*, while its posterior, subquadrate part is hardly so much expanded laterally. The superior margin of the basihyal, when laterally viewed, is more concave dorsally, while its inferior margin is more convex ventrally, the bone being more bent concave upwards. There is hardly a perceptible concavity on the dorsum of the saddle's upper lip. The two halves of the posterior margin of the basihyal are each more concave and form a more marked angle with each other. The parahyal processes are longer, stronger, and while proceeding forwards and very slightly inwards, ascend much more sharply dorsad and slightly expand at their extremities.

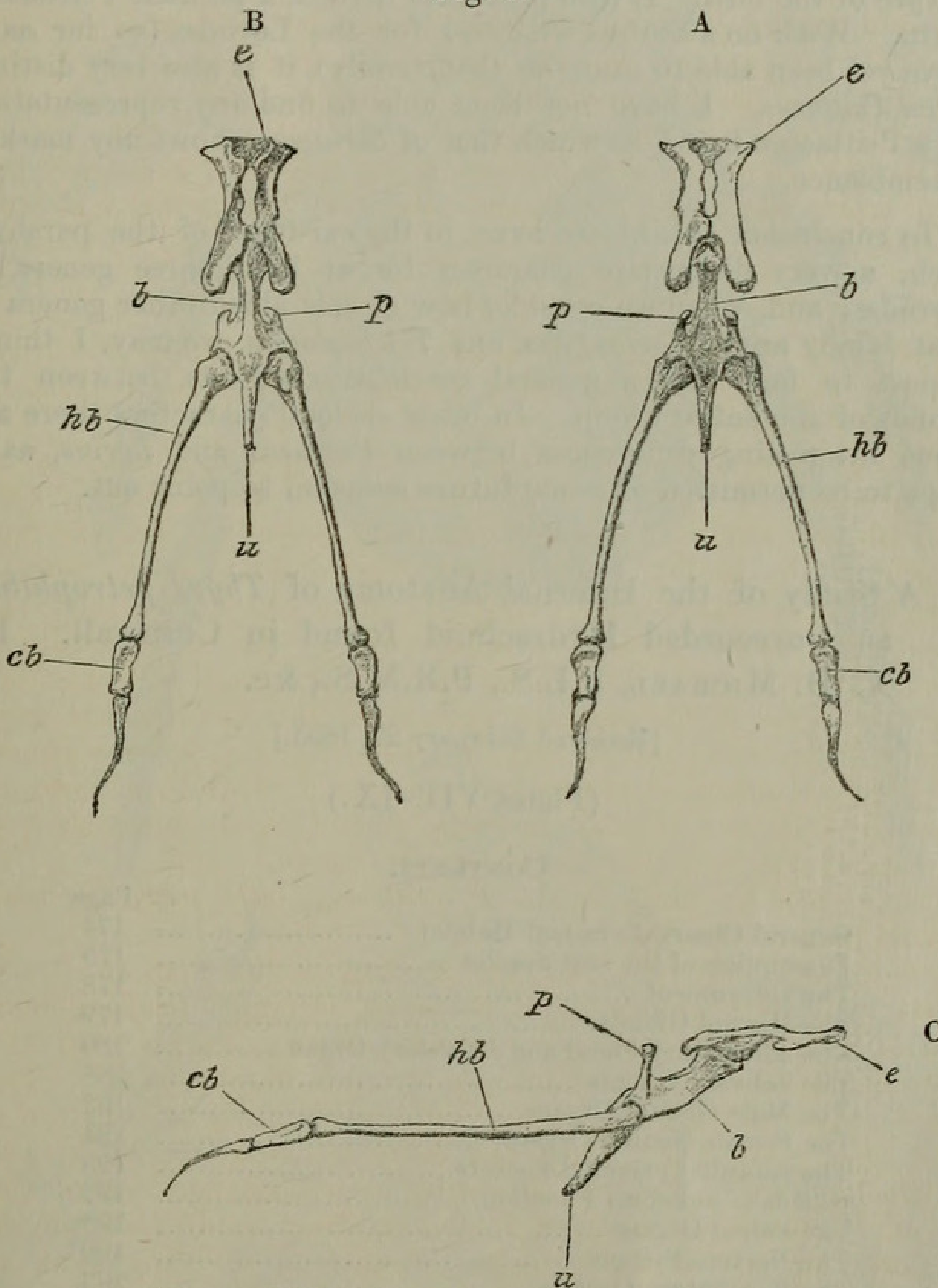
The *urohyal* is much as in *P. erithacus*, only more inclined ventrad towards its distal end.

The *entoglossum* has a narrower median vacuity than in *P. erithacus*, while each anterior and posterior extremity projects more outwards, especially the two anterior extremities, so that the anterior half of each lateral margin is much more concave. The dorsal surface of the entoglossum is also very much more flattened than in *P. erithacus*. Thus the bony isthmus formed by the median junction of the two inwardly projecting portions of the two entoglossals (just in front of the basihyal saddle) is quite on the dorsal surface of the entoglossum, instead of being sunk at the bottom of a strongly marked concavity—as it is in *Psittacus*, *Lorius*, *Eos*, and *Trichoglossus*. The dorsum of each entoglossal process projecting back behind the bony isthmus is also flattened, though faintly grooved antero-posteriorly.

Seen ventrally, each entoglossal presents a wide shallow concavity at its laterally expanded preaxial end. Behind this is the prominence of the anterior lateral process, and behind this again is the marked concavity (looking externad as well as ventrad) of the hindermost part of each entoglossal.

Seen laterally, the entoglossal shows a sigmoid curvature, its dorsal margin being concave above anteriorly and convex posteriorly. Thus seen, the preaxial end does not show any expansion, but there is a distinct anterior lateral process separated

Fig. 6.



Hyoid of *Stringops habroptilus*, ¹⁄₁.

A. Dorsal aspect; B. Ventral aspect; C. Lateral aspect.

(Lettering as before, see p. 164.)

by a notch from the posterior one; the outer surface of the posterior part of the entoglossal, which looks ventrad as well as externad, is very strongly concave dorso-ventrally.

The *hypobranchials* are elongated and, save for their anterior curvature, almost straight.

The *ceratobranchials* are slightly broader osseous palettes than in *P. erithacus*, and they are hardly as much curved.

It is interesting to find that this part of the anatomy of *Stringops* would alone suffice to declare the essentially Psittacine nature of the bird. It also proclaims it to be a peculiar Psittacine form. With no affinities whatever for the Loriidæ (so far as I have yet been able to examine that family), it is also very distinct from *Psittacus*. I have not been able to find any representation of a Psittacine hyoid to which that of *Stringops* shows any marked resemblance.

In conclusion I think we have, in the existence of the parahyal arch, a very distinctive character for at least three genera of Loriidæ; and, when we consider how closely allied other genera of that family are to *Lorius*, *Eos*, and *Trichoglossus*, we may, I think, expect to find that a general resemblance exists between the hyoids of the entire group. In other skeletal characters there are some interesting differences between *Psittacus* and *Lorius*, as I hope to be permitted on some future occasion to point out.

2. A Study of the Internal Anatomy of *Thyas petrophilus*, an unrecorded Hydrachnid found in Cornwall. By A. D. Michael, F.L.S., P.R.M.S., &c.

[Received February 27, 1895.]

(Plates VII.–IX.)

Contents.

The beautiful Acarid which forms the subject of this paper was discovered by my friend Mr. E. Bostock when we were collecting together in the neighbourhood of the Land's End, Cornwall; I have since met with numerous specimens in the same locality, but have not hitherto found it elsewhere. So far as I have been able to ascertain it has not been previously observed, and is unrecorded.