Fig. 8. *Comibæna glareosa*, p. 855.
9. *Thalera obnupta*, p. 855.
10. *Ephyra fluidaria*, p. 856.
11. *Idæa grandicularia*, p. 858.
12. *Macaria boaria*, ♂, p. 861.
13. *Zanclopteryx infelix*, p. 858.
14. *Hyria volutaria*, p. 858.
15. *Idæa idæaria*, p. 857.
16. *Asthena querula*, p. 859.
17. —— *tristicula*, p. 859.

PLATE LVII.

Fig. 1. *Pyralis roborealis*, p. 865.
2. *Deba milvinalis*, p. 875.
3. *Iartheza obstitella*, ♀, p. 880.
4. *Charltona kala*, ♂, p. 879.
5. *Melissoblaptes depressellus*, p. 876.
6. *Metasia candidulalis*, p. 880.
7. *Eupithecia bilinea*, p. 863.
8. —— *conscensa*, p. 863.
9. *Scopula fotalis*, p. 875.
10. *Arrade massalis*, p. 866.
11. *Pyralis quisqualis*, p. 865.
12. —— *zizanialis*, p. 865.
13. *Botys epastalis*, p. 874.
14. *Idæa chotaria*, p. 858.
15. *Eupithecia testacea*, p. 863.
16. *Scoparia ictericalis*, p. 876.
17. *Pyralis xylinalis*, p. 865.
18. *Nephopteryx lentalis*, p. 877.
19. *Homœosoma derasella*, p. 877.
20. *Nephopteryx creperalis*, p. 877.

## 2. Contribution to the Comparative Osteology of the *Trochilidæ*, *Caprimulgidæ*, and *Cypselidæ*. By R. W. SHUFELDT, M.D., Captain Med. Dept. U.S. Army., M.A.O.U., Memb. Soc. Nat. E.U.S., Memb. Philosophical, Anthropological, and Biological Societies of Washington, &c.

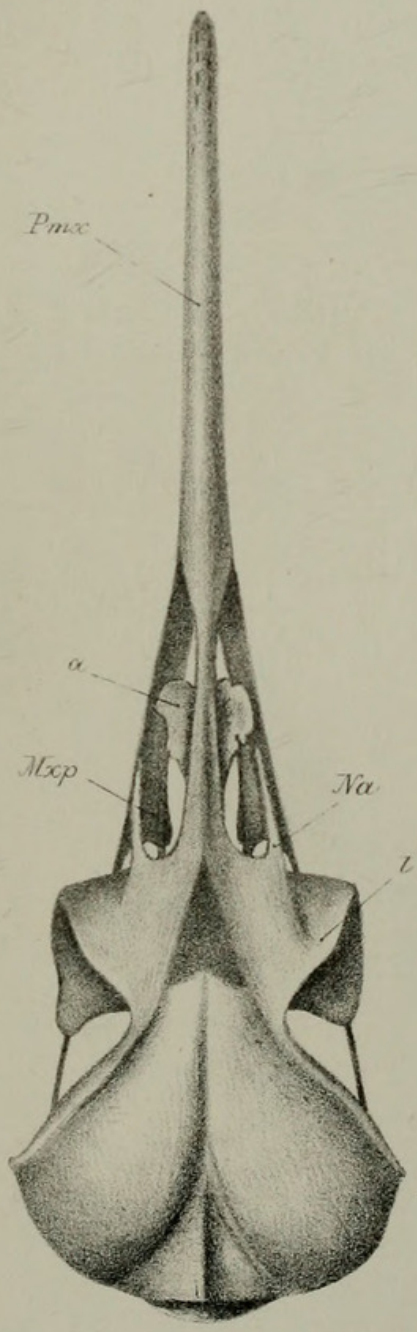
[Received September 16, 1885.]

(Plates LVIII.–LXI.)

As our knowledge of the structure of birds widens, it becomes more and more evident to taxonomists that ornithology nowhere presents a more unnatural order than the *Picariæ*. Of late years authors candidly confess that the families arranged under this head constitute merely a provisional grouping, though at the same time the classification as it now stands must be retained until such light as morphology brings to bear is sufficiently strong to disperse this artificial assemblage and relegate its members to their several and normal positions in the system.

So far as our American avifauna is concerned, it has always

Fig. 1.



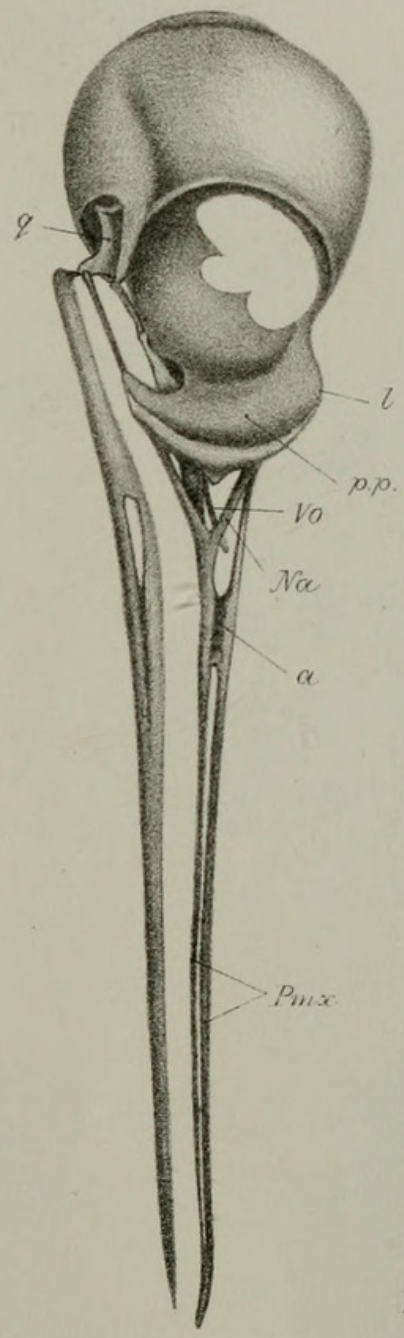
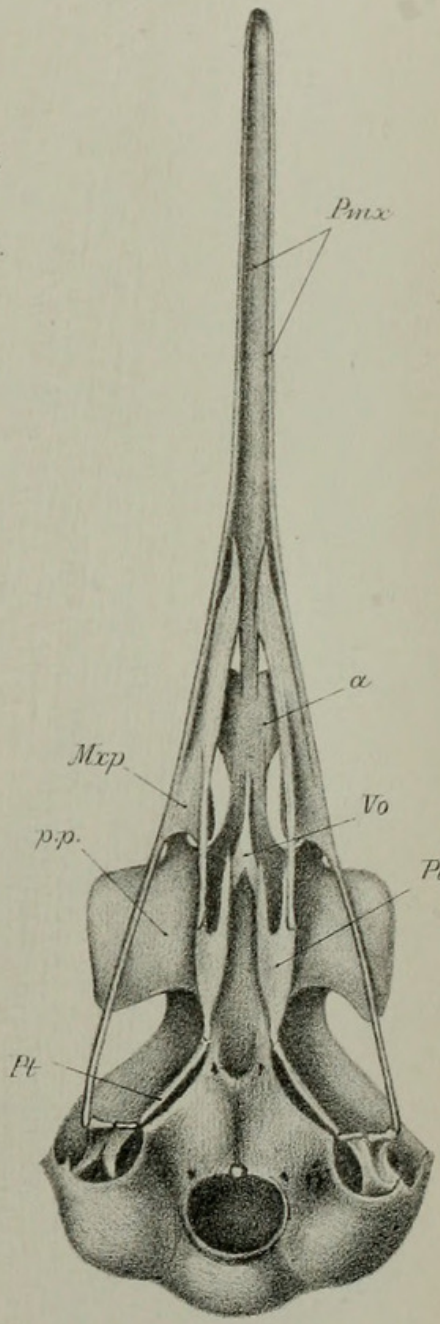




Fig. 2.

Fig. 3.

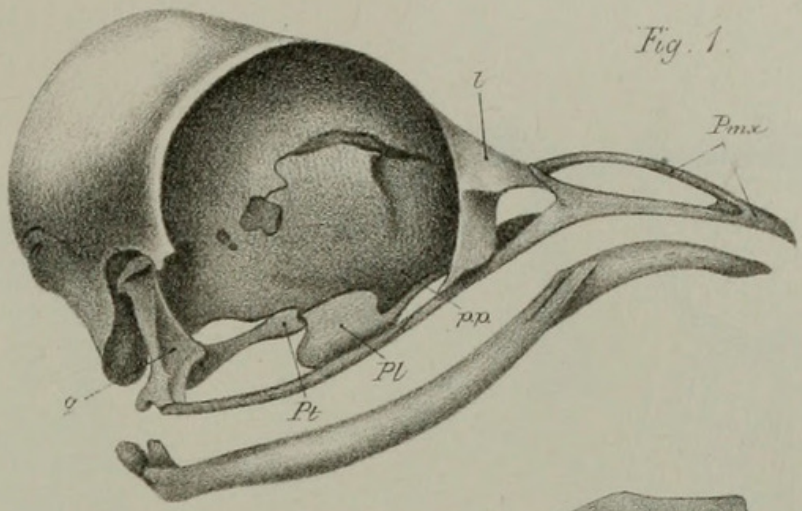



R.W.Shufeldt. del.

J. Smit lith.

OSTEOLOGY OF TROCHILIDÆ.

Fig. 1.



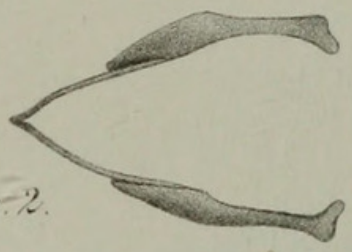



Fig. 2.

Fig. 3.

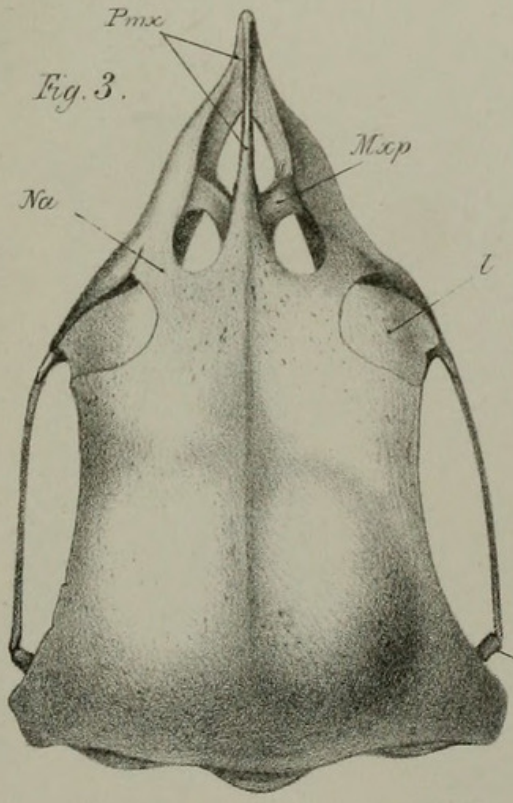
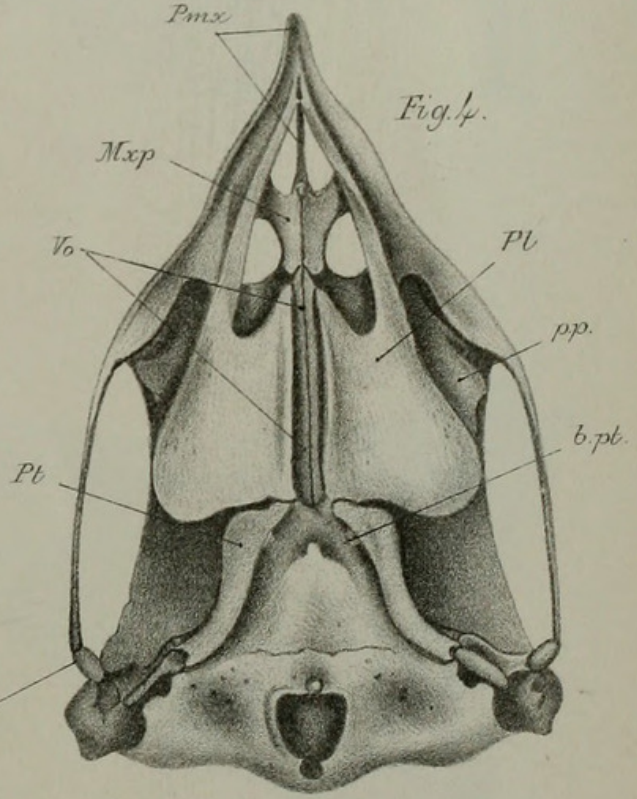



Fig. 4.




R.W. Shufeldt del.

J. Smit lith. Hanhart imp.

OSTEOLOGY OF TROCHILIDÆ.

Fig. 1.

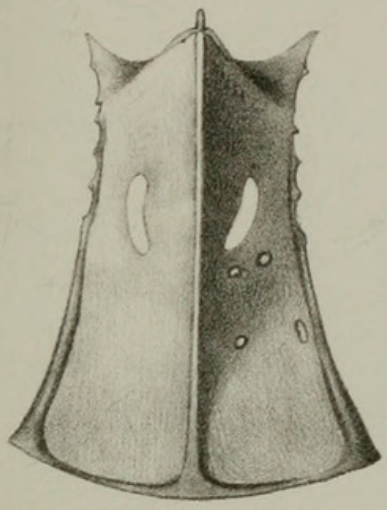


Fig. 2.

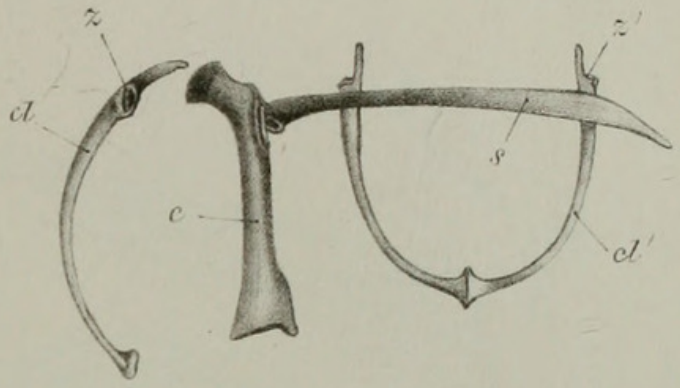



Fig. 4.

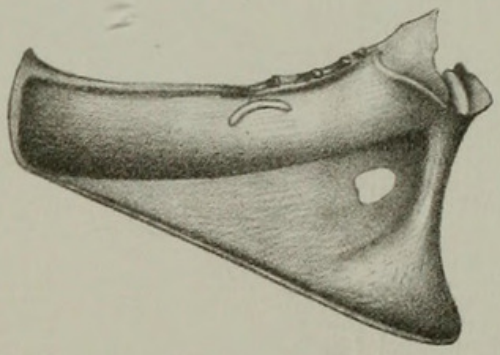


Fig. 5.

Fig. 3.

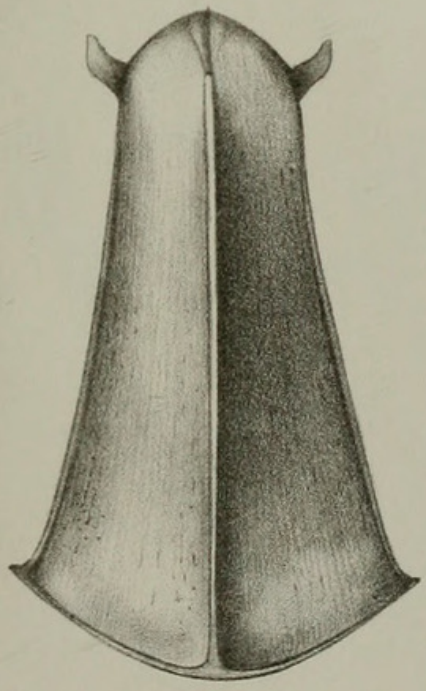
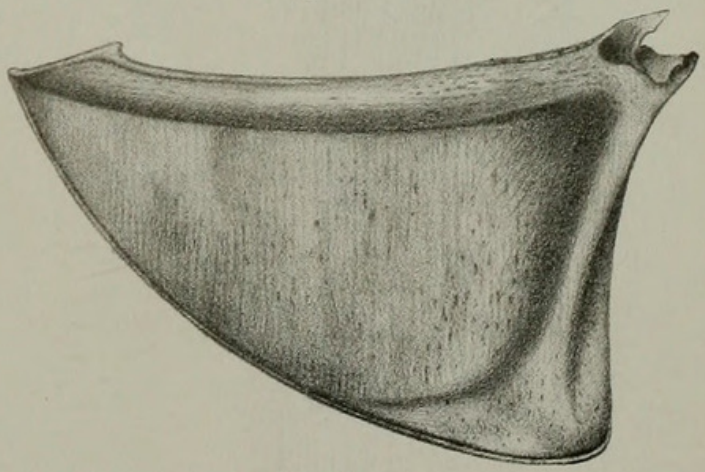


Fig. 6.



R.W.Shufeldt del.

J. Smit. lith.

OSTEOLOGY OF TROCHILIDÆ

Fig. 1.

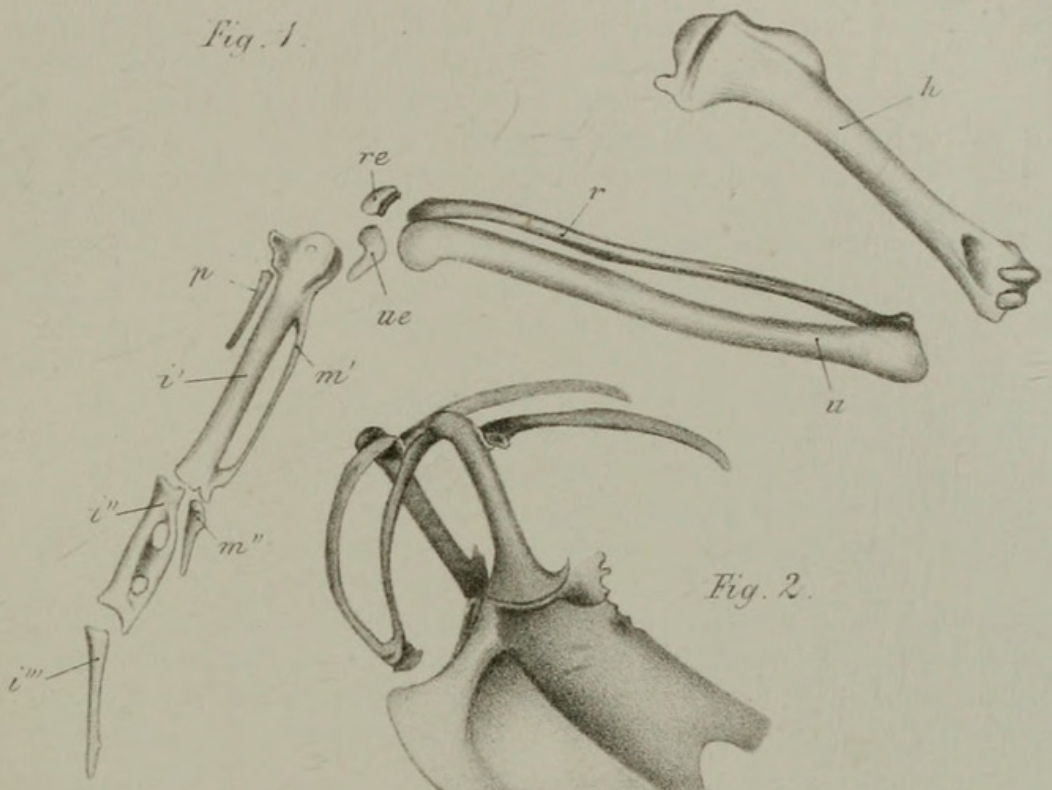



Fig. 2.



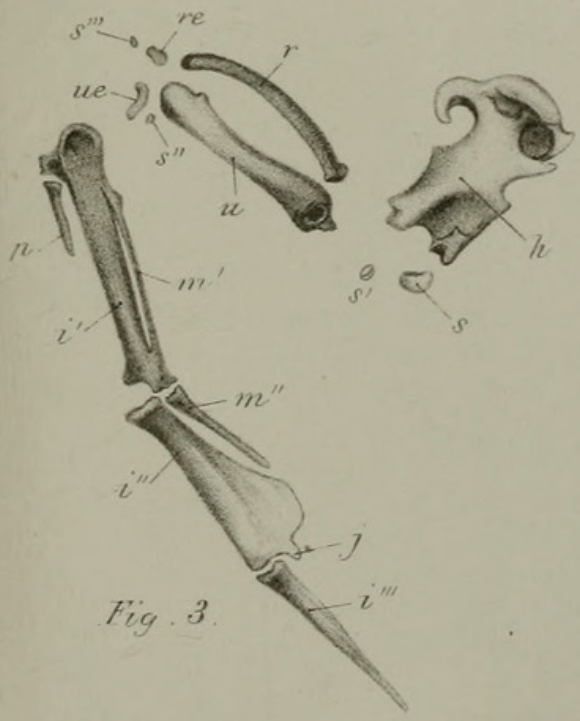



Fig. 3.

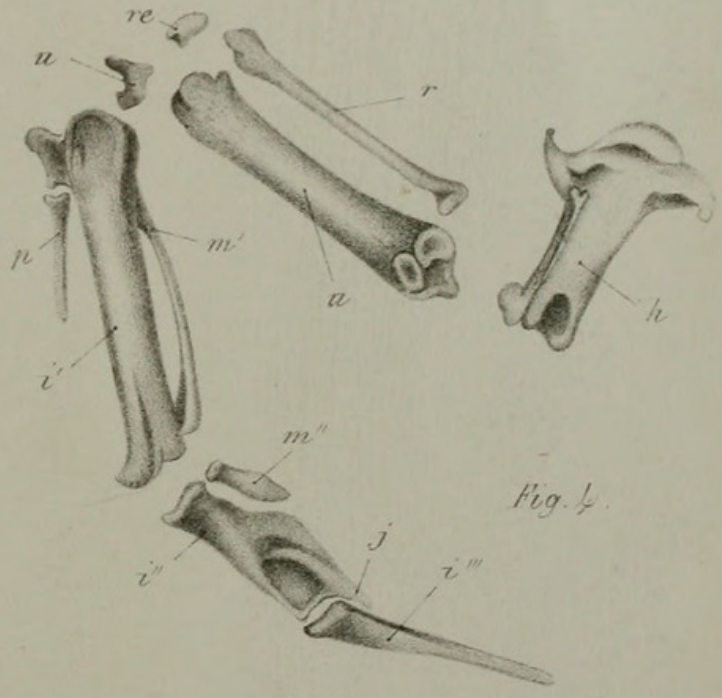



Fig. 4.

R.W.Shufeldt. del.

J. Smit lith. Hanhart imp.

OSTEOLOGY OF TROCHILIDÆ.

seemed to me, as it no doubt has to others, that the grouping together of the Humming-birds, Goatsuckers, and Swifts, is an evident confession of weakness on our part, besides being on the face of it a very decided violence done to natural taxonomy and the science of ornithology. As I look over the material before me, the discussion of which will make up the body of the present paper, the fact is strongly impressed upon my mind that the result of the study will prove to be more of a contribution to the *differences* to be found among the skeletons of the *Macrochires*, than it will afford sufficient data to place any of the forms in question in their proper places in the system; though I hope it may, in the end, prove to be a step in that direction also.

I am confident that this latter will not be satisfactorily accomplished in the case of the Picarian birds until we not only have a pretty thorough knowledge and understanding of their structure in its entirety, but an equally complete comprehension of the morphology of a number of the groups that are known to approach them in one particular or another.

To review the characters presented in the Trochilidine skeleton—for many of the important ones are already known to us—*Trochilus alexandri* affords a very good type. I have at hand a perfect skeleton of this Humming-bird, collected and prepared by myself for the purpose.

*Of the Skull of Trochilus* (Plate LVIII. figs. 1, 2, 3).—Viewing this part of the skeleton from above, we find that the superior mandible has a length of something less than two thirds of the medio-longitudinal axis (fig. 1). It is nearly flat in its anterior moiety, being much compressed from above downwards, narrow, rounded at the apex, and of nearly equal width throughout, and slightly decurved, for this part of its extent. The posterior half of the superior mandible is broad at the base, and gradually tapers forwards to merge into the portion just described; sutured traces among the bones here have all been completely absorbed; the external narial apertures are very capacious, though an attempt on the part of the nasal processes of the premaxillary to diminish their size is evidently made. This effort is to be detected in the horizontal osseous outgrowth on either side from these parts, which if it had been more extensive and produced, as it is in some birds, would have succeeded in creating narial openings, as in the majority of the class. As it is, however, in this Humming-bird a knife-blade may be carried from the foot of the nasal on the upper side of the maxillary and dentary process of the premaxillary, in contact with them to near the tip of the latter, without coming in contact with the bone above, if the knife be properly inclined at a right angle (figs. 1, 2, 3*a*). This is well seen in some Limicoline birds, as in *Numenius longirostris*, though in them the osseous outgrowth *a* referred to, is not developed [1].

[1] See author's osteology of *N. longirostris*, &c., in the Journal of Anatomy and Physiology for Oct. 1884, plate iv. fig. 3, and his meaning will be clear. Here, however, the bones simply rest against each other, though they would allow the passage of a knife-blade from *i* to *k*.

The lacrymo-frontal region is very broad transversely in *Trochilus*, and presents a deep and well-defined triangular depression in the median line, with its apex directed to the front. Posterior to this the vault of the cranium mounds up, smooth and semiglobular. A median furrow marks this part of the skull, which divides behind, to have its branches pass on either side of the supraoccipital prominence forming its lateral boundaries. In life these creases lodge the recurved and delicate extremities of the hyoidean apparatus.

The superior orbital peripheries are somewhat tilted upwards in this skull, for their posterior moieties (fig. 1).

In the side view, as shown in fig. 2, the peculiar conformation of the superior mandible is still better seen. This aspect also affords us a good opportunity to see the position of the vomer *Vo*, and its relation to the surrounding bones.

A *nasal* is a delicate and quite straight bar of bone, which descends at an angle of about 45° to meet the usual elements below and merge into them. Above, it forms the rounded posterior margin of the narial opening, thus constituting the holorhinal type of structure as described by Mr. Garrod [1].

The antorbital plate, or the "pars plana," is an enormously enlarged mass of bone, which has indistinguishably incorporated with it the *lacrymal*.

This extraordinary development may be seen in all of the views of the skull of *Trochilus* which illustrate this paper, and its form easily studied. Anteriorly, it is convex from above downwards, being correspondingly concave in a similar direction posteriorly. Above, it rises to a greater height than the margin of the orbit, while below it rests upon the maxillary and jugal bar. Its lateral extension is nearly equal to that of the brain-case behind. Now although this gives to the anterior wall of the deeply excavated orbit a nearly unbroken surface, being pierced alone by a minute foramen for the passage of the olfactory nerve, it is more than can be said for its posterior surface, which latter is almost completely deficient in an osseous partition separating the orbital cavity from the brain-case. This deficiency is so far extended forwards as to include the hinder portion of the interorbital septum. It will be seen by referring to fig. 2 that this latter is of very limited extent, as the lower notch there shown denotes the point where the optic nerve issues from the cranium. With the exception of a minute span of bone behind, the groove that lodges the olfactory nerve on its passage through the orbit is an open one, and leads directly to the foramen in the pars plana, already described.

The *quadrate* of this Hummer is an exceedingly curiously formed bone, while its method of articulation is equally unique among birds, so far as I am aware, being extended, when *in situ*, nearly in the horizontal position between its mastoidal and quadrato-jugal articulations.

Its mandibular foot presents for examination two transverse and very narrow facets, a similar number being awarded to its mastoidal

[1] P. Z. S. 1873, pp. 33-38.

end. Quite a prominent peg-like process is developed to receive the excavated end of the corresponding pterygoid. The "orbital process" is much reduced and inconspicuous, and the entire bone is thoroughly pneumatic.

Many points of uncommon interest present themselves for our examination upon the under view of the skull of *Trochilus*. They are all clearly shown in my drawing of these parts (Plate LVIII. fig. 3). Anteriorly, we observe, underlying the lateral margins of the premaxillary, its slender and free dentary processes, each fusing behind with a similarly delicate rod of bone sent forward on the part of either maxillary (*Pmx*).

We find that this last-named element developes a broad maxillo-palatine process, which latter portion is carried far forward as a free lamella of bone with pointed apex, while the maxillary proper becomes continuous with the dentary rod of the premaxillary in the method already described.

A wide interval separates, in the median space, the *maxillo-palatines* (*Mxp*), within which the *vomer* (*Vo*) is plainly to be seen. This last bone is deeply cleft behind, where it rides the very large rostrum, while anteriorly it is produced as the finest imaginable spiculi-form prolongation [1]. The posterior vomerine limbs are above the palatines, each one extending backwards nearly to the pterygoidal articulation on either side. Adopting the admirable nomenclature for the different parts of the *palatine* bone proposed by Prof. Huxley, we find that the body of the bone, being flat and horizontal, lacks the prominent internal and external *laminæ* found in many birds, its outer margin being produced forwards as a very narrow strip of bone to underlap the maxillo-palatine of the same side, and indistinguishably fused with it, at a point about opposite the anterior apex of the vomer. The inner palatine margin, for its anterior moiety, is produced forwards as a free apophysis shutting out from our sight, upon this aspect of the skull, the corresponding vomerine limb. This latter is applied to the "*ascending process*," the inner margin of which is that part of the palatine bone which rests against the sphenoidal rostrum. The "*postero-external angle*" is, in *Trochilus*, reduced to *nil*, as already hinted; the outer margin of the palatine is, from head to anterior ending, nearly a straight line.

A considerable interval exists between the palatines in the middle space, and, indeed, these bones do not come in contact with each other anywhere throughout their extent.

Posteriorly, the palatine head articulates with the pterygoid in a little pit that occupies the summit of a well-marked elevation developed on the part of the rostrum beneath the point of meeting of these elements.

[1] Professor Huxley states, in his "Classification of Birds" (P. Z. S. April 11th, 1867), that "*Trochilus* has the true Passerine vomer, with its broad and truncated anterior, and deeply cleft posterior end. I have not yet been able to obtain a perfectly satisfactory view of the structure and arrangement of the palatine bones in the Humming-birds." I must believe from the statement made in the latter half of the quoted paragraph that the skull in Prof. Huxley's hands was an imperfect one, and that the delicate vomer I have described above was broken off, leaving only the broad base referred to by him.

A *pterygoid* is a delicate and nearly straight rod of bone, articulating with the palatine in the manner just described, and with the corresponding quadrate by means of a cup-and-ball joint, the latter element developing the convexity for the purpose.

The *rostrum* is transversely very broad behind, where it is likewise longitudinally excavated. As it is produced forwards, however, it ascends, becoming gradually narrower, convex from side to side, to finally abut against the under aspect of the cranio-facial region, where we find that its anterior margin has at last attained a sharp edge. It is unnecessary to add, that this latter portion of the rostrum is made up of the ethmoidal bone, the two imperceptibly merging into each other in the Humming-birds.

Some of the characters thus far described, as they are found to exist at the under side of the skull of *Trochilus*, are curiously suggestive of the struthious type of structure, more especially the exposed and broad rostrum behind, and the method of finishing off of the maxillaries and maxillo-palatines in front. *T. alexandri* has the basi-temporal region of its skull very deep, and wide from side to side. It is pierced at about the usual sites by foramina for nerves and vessels to find their exit from, and others to enter the cranial casket. The plane of the foramen magnum is nearly coincident with that of the basis cranii; and this aperture is very large comparatively, and of a broad elliptical outline. On the other hand, the condyle is notably minute in its dimensions, and of a hemispheroidal form.

The *mandible* of the Alexander Humming-bird is seen upon lateral view in Plate LVIII. fig. 2. It will be observed that it is quite as delicately fashioned as the remaining half of the beak above. Its hinder fourth is bent downwards, and a well-marked ramal vacuity exists. Viewed upon its superior aspect, this bone has a very acute V-shaped outline, with rather a long symphysis, which latter is excavated in the longitudinal direction above. Either articular end presents a very shallow facet on its upper side; behind, its angle is truncated, while the in-turned processes of the ramal limbs at this extremity are well developed and point directly towards each other, being perpendicular to the median plane. This bone is largely pneumatic.

The elements of the *hyobranchial apparatus* are absolutely filamentous in character, the greatly lengthened thyro-hyals curving well up behind the occiput, after the style of some Woodpeckers. The first basi-branchial is very long and straight, while the second one is reduced to a mere rudiment; both are independent bones and the heads of the ceratobranchials articulated at the sides, where they meet each other.

The ceratohyals and glossohyal do not ossify in this Humming-bird.

Having examined the skeleton of *Trochilus* thus far, I will now briefly present the characters of the same part as they are found in the two remaining groups, taking up the Goatsuckers first. After that, it is my intention to discuss the balance of the axial skeleton

for each type, and conclude the descriptive part of the paper with a comparison of the bones of the limbs. Finally, analytical tables will be presented contrasting the essential osteological characters of the several forms that have been examined.

*Of the Skull in certain Caprimulgine Birds* (Plate LIX. figs. 1–4).—It is hardly necessary for me to say that the skull of any Nightjar is as different from that part of the skeleton in *Trochilus* as this structure can well be in any two existing types of birds. Indeed, so great are the differences, and extended to so many of the parts, that I do not feel called upon to institute a comparison between the two—as this can better be done by the reader for himself from the figures in the Plates—but simply present here a description of the more important of these characters, comparing them, so far as my material will permit, with forms more or less nearly related, as well as with the corresponding characters as they occur in several species of the group.

To this end my material affords a full series of skeletons of the several representatives of the genus *Chordediles* and some excellent skeletons of *Phalænoptilus nuttalli*.

Regarding the skull of *C. texensis* from a lateral view (fig. 1), we are struck with the peculiarly arched culmen formed by the median portion of the premaxillary, which is simply a delicate, laterally compressed rod connecting the mid point of the basal region with the apex of the beak. Such a condition is approached also by many Swifts; and in Nuttall's Whippoorwill the valley which is found on either side of this arch harbours the peculiar tubular nostril of that bird.

The superior mandible, as a whole, is somewhat decurved, with cultrate margins.

A *lacrymal* is a large and freely articulated bone; above, its upper surface contributes no little amount to the general frontal area.

In this latter region its inner margin is convex and closely applied throughout its extent to the opposed concave edge of the combined frontal and nasal elements. Mesially and on the anterior wall of the orbit, the lacrymal rests upon the *upper* border of the pars plana, while on its outer aspect it presents a longitudinal and shallow groove. Its lower part is foot-like in form, directed backwards, and is in contact with the maxillary bar.

The form and method of articulation of the lacrymal in *P. nuttalli* is essentially the same as in the last species; but its descending limb has its foot portion T-shaped, and the anterior or heel-process is lodged in the broader part of the maxillary bone.

The orbital cavity in the *Caprimulgidæ* is particularly notable for the completeness of its bony walls. It is large among the Whippoorwills, but very strikingly so in the Night-hawks.

So far as I have examined the interorbital septum, it is very thick from side to side, though composed of a delicate diploic tissue, which is continuous in structure with that found about the brain-case and in the ethmoidal region, it all being overlain by a firm compact film.

A perfectly circular and small foramen rotundum opens separately into each orbit, and the other nerves have independent orifices.

In *C. texensis* the hinder part of the palatine with the broad pterygoid form quite a complete orbital floor (figs. 1 and 4), the Whippoorwills not being quite so fortunate in this particular.

The *pars plana* is always large and generally of a quadrilateral form, its outer margin being concave outwards. It constitutes a very efficient wall between the orbital and nasal cavities.

The track of the olfactory nerve is an open groove for its entire length, this branch passing directly over the free margin of the pars plana, close to the ethmoid, in the recess between the nasal and frontal bones.

I find the postero-superior periphery of the margin of the orbit to be sharp and raised in the Texas Nightjar, which is not the case in the Whippoorwills, where it is somewhat rounded and never tilted above the general frontal superficies.

Throughout the group we always see a slender and fragile quadrato-jugal bar. In *Chordediles* it curves gently upwards to meet the maxillary portion, the articulation between the jugal and maxillary in these birds being a very feeble one, and always coming away early during maceration. This latter does not apply to the Whippoorwills, in which forms we find the quadrato-jugal portion of the bar nearly horizontal, while the maxillary descends to meet the anterior end, the two uniting firmly at a rounded angle at this point, with the convexity directed outwards (fig. A, p. 893).

*C. texensis* possesses a peculiarly formed *os quadratum*, it being very much compressed in the antero-posterior direction, slightly twisted upon itself, and a completely aborted orbital process. The mastoidal head develops two facets, which are barely separated from each other; the outer is long, is placed transversely, and is reduced almost to knife-edge proportions; the inner is triangular, being directed upwards, backwards, and inwards.

The mandibular facets are also two in number. They have an oblique position on the foot of the bone, with the hinder end of the inner one outermost, a deep, oblique valley separating the two.

Viewing the skull of *Chordediles* from above (Plate LIX. fig. 3), we have another good opportunity to see the peculiar form of the premaxilla (*Pmx*). We also note that this Goatsucker has the holorhinal type of structure, the nasal being quite broad. In *Phalænoptilus*, however, these latter bones are different, being slender rods of bone, and considerably longer than they are in the Texas Nightjar.

Throughout the group, we are enabled to see, upon this aspect of the skull, the upper and anterior surface of the maxillo-palatines (*Pmx*) through the open space between the maxillary and premaxillary.

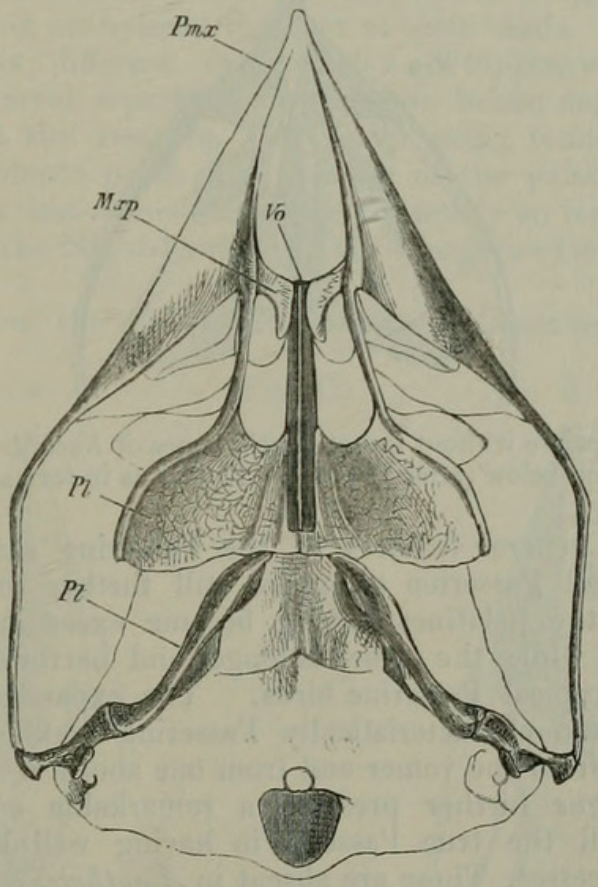
In *Chordediles* the frontal region of the skull is somewhat depressed, while the cranial vault is quite dome-like in contour. Here, again, a marked difference is presented by the Whippoorwills, where the convexity is general, not nearly so decided, and in them

too a strong, median, longitudinal groove traverses this part of the skull.

Whippoorwills have a far more compressed skull, in the vertical direction, than the Night-hawks ; and there is a great deal about this part of the skeleton in them that reminds one of the skull of some of the Owls.

Turning to the under side of the skull of *Chordediles* (as shown in Plate LIX. fig. 4) we find the well-developed *maxillo-palatines* (*Mxp*) in contact with each other for their entire lengths in the median line. In very old Night-hawks this close union finally results in anchylosis, thus producing a perfect direct desmognathous condition of type of palatal structure in these birds. The broad

Fig. A.




Under view of the Skull of *Caprimulgus europæus* (×2) (after Huxley).

*Pmx*, premaxillary ; *Mxp*, maxillo-palatine ; *Vo*, vomer ; *Pl*, palatine ; *Pt*, pterygoid.

and long *vomer* (*Vo*), with its median carination beneath, merges with the palatines posteriorly, while in front its free tip just rests in a notch found at the middle point of the apposed maxillo-palatines behind.

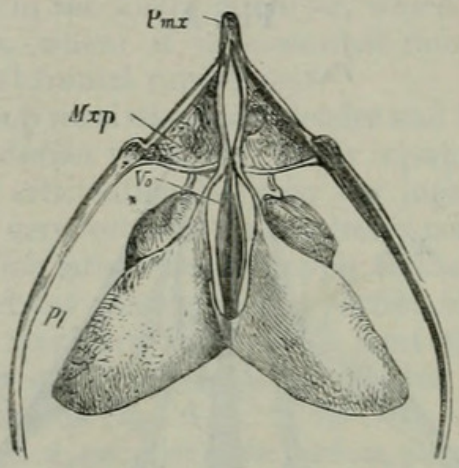
Nuttall's Whippoorwill exhibits a very different condition of these parts from this ; in it we find the maxillo-palatines are well separated from each other in the median line, and fail to come in contact with the vomer above them. This latter bone is even

broader than in the Texan Nightjar, being *rounded* in front, but otherwise agreeing very well with that bird.

In fact in all essential details, so far as the osseous structures at the base of the skull are concerned *Phalænoptilus* agrees with the same parts as shown by Professor Huxley in his figure of *Caprimulgus europæus*, in his memoir upon the Classification of Birds (P. Z. S. 1867), and I have reproduced that figure here in order to show their arrangement (fig. A, p. 893).

To recall also this eminent biologist's observations upon the skull of the European Goatsucker, the following passages are quoted from the memoir in question; he says, "The skull of *Caprimulgus*, though

Fig. B.




View of the palate without the pterygoid bones of *Nyctibius jamaicensis*. Seen from below (after Huxley). Letters as in former figures.

it retains the general features of the Passerine cranium, departs from the typical Passerine structure still further than the Swifts, the body of the palatines having become exceedingly broad and flattened out, while the vomer is longer and narrower than in the Swifts or the typical Passerine birds. The expanded inner end of the slender and characteristically Passerine maxillo-palatines are quite distinct from the vomer and from one another.

"*Caprimulgus* further presents a remarkable contrast to the Swifts and all the true Passeres in having well-developed basi-pterygoid processes. These are absent in *Ægotheles novæ-hollandiæ*, the palate of which is intermediate between that of the Goat-suckers and that of the Swifts.

*Nyctibius* closely resembles *Caprimulgus*, even to possessing the very peculiar division of each ramus of the mandible into two portions—the one of which is movable upon the other—pointed out in the latter genus by Nitzsch. But the slender anterior processes of the palatines are closely approximated in the middle line, instead of remaining widely separated, as in *Caprimulgus* and *Trochilus*; and the maxillo-palatines are closely adherent to them and to the vomer, though a true anchylosis does not appear to have taken place" (fig. B).

Thus we see that the American genus *Chordediles* approaches *Nyctibius* in this particular.

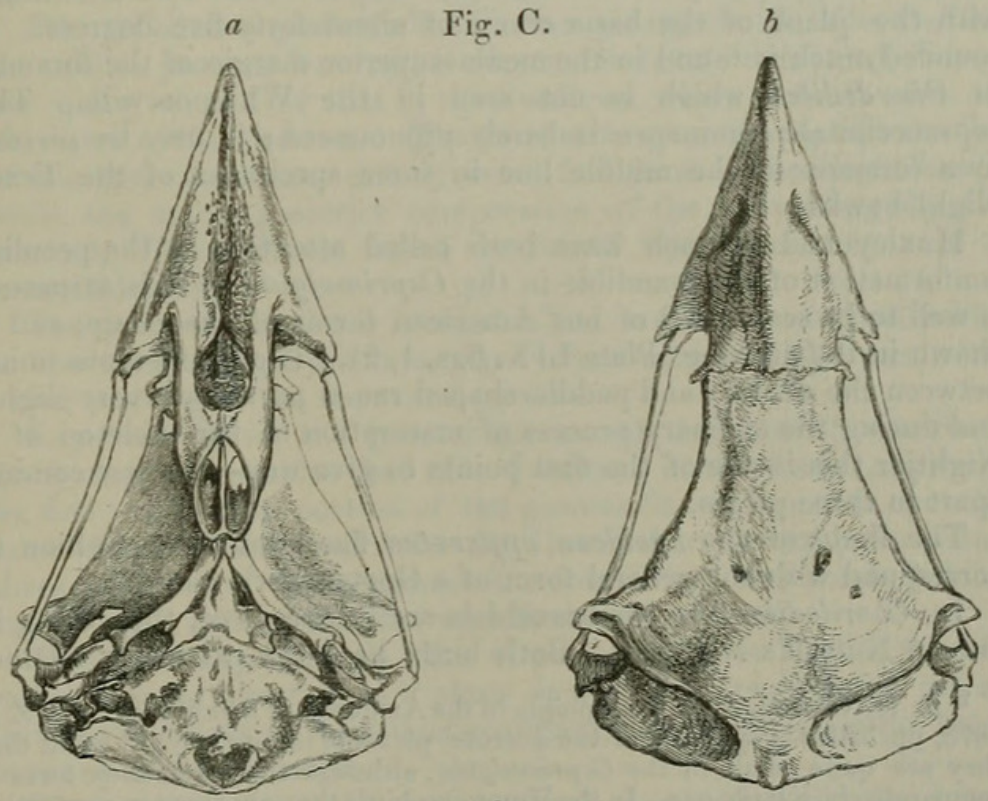
Returning to the basal view, again, of the former bird (fig. 4, Plate LIX.), we find that the palatines are very broad, flat, and smooth, lying mostly in the horizontal plane. Their postero-external angles are rounded, while their ascending processes are just sufficiently pronounced to afford a low crest behind to unite with the vomer. Anteriorly, their narrow and ribbon-like extremities can be traced to the apex of the superior mandible (fig. 4).

The *pterygoids* are much flattened from above downwards, while their anterior ends are somewhat dilated. Beneath this latter portion we find each articulating with the basisphenoidal facet. Quite an interval separates the points where they articulate with the palatines, and the joints are very close ones, the palatines themselves being anchylosed together at their heads.

The case is different in Nuttall's Whippoorwill, where an appreciable interval separates the palatine heads, and these really articulate with the rostrum, the vomer being found immediately beyond this minute point of separation of the palatines. In this bird, too, these last-named bones are not nearly so much spread out as they are in the Night-hawks, and their postero-external angles are quite pointed.

In speaking of the skull of *Steatornis*, the lamented Garrod says,

Fig. C.




Skull of *Steatornis*.

*a*, base; *b*, superior surface.

"In the skulls the lacrymal bones are not developed as they are in the Strigidæ and Caprimulgidæ. The palate is strongly

desmognathous, as in the Falconidæ, and much more so than in the Strigidæ, which are almost schizognathous. The palatine bones also meet across the middle line for $\frac{1}{8}$ of an inch, in a manner which is quite peculiar, and can be best understood by a reference to the drawing, each bone being apparently folded on itself behind the point of junction with its fellow, and articulating with the basi-sphenoidal rostrum, as well as anchylosing with the vomer by its inflected and upward-turned margin; each developes a very short slender anteriorly directed process close to the vomer, which projects forwards on each side of it near its middle.

"The vomer itself is a quarter of an inch long, slender and quite blended with the palatines; its anterior pointed extremity advances as far forwards as the posterior border of the median palatine symphysis mentioned above.

"The posterior external angles of the palatines, so large in *Caprimulgus* and *Podargus*, are not developed. The basipterygoid facets are large. In the eye the sclerotic ossifications are not considerable, as in the Owls, being not at all unusually developed[1].

Among the American Nightjars the basitemporal area of the skull is both broad and deep. A lip of bone usually shields the double entrance to the Eustachian tubes, while the lower margins of the auricular rims are produced well downwards.

The condyle is small and of a hemispherical form; the plane in which the periphery of the foramen magnum lies makes an angle with the plane of the basis cranii of about forty-five degrees. A rounded notch is found in the medio-superior margin of the foramen in *Chordediles*, which is not seen in the Whippoorwill. The supraoccipital prominence is barely pronounced; it may be pierced by a foramen in the middle line in some specimens of the Texas Night-hawks.

Huxley and Nitzsch have both called attention to the peculiar conformation of the mandible in the *Caprimulgidæ*. This structure is well to be seen in all of our American forms of the group, and is shown in the drawing (Plate LIX. figs. 1, 2). The ligamentous union between the dentary and paddle-shaped ramal portions is very slight, and during the ordinary process of maceration of the skeleton of a Nightjar this is one of the first points to give way—the jaw coming apart in three pieces.

The limbs of the *hyoidean apparatus* flare out in a fashion to correspond with the general form of a Goatsucker's mouth.

In *Chordediles* the basibranchials are in one piece, they being in two in Nuttall's Nightjar. Both birds have the extremely slender

[1] A. H. Garrod, "On some points in the Anatomy of *Steatornis*" (P. Z. S. 1873, pp. 526–33), speaking of the sclerotal plates of the eye, says, "I find that they are quite small in the *Caprimulgidæ*, although the circle they form is comparatively a large one. In the Humming-birds they are about in proportion with the size of the birds. Some of the Swifts, however, present rather an unusual condition of these plates, the posterior ones being much the deepest, which depth gradually diminishes, as we pass either way round to the opposite side of the circlet, the middle anterior one being the narrowest plate of any; this feature is quite noticeable in some of the Swallows."

hypohyals quite long, their cartilaginous ends curling well up behind the skull. Minute cerato-hyals may ossify in *Chordediles*; but I have not observed them to do so in *P. nuttalli*.

This anterior portion of the apparatus has the arrow-head form seen among the class generally where that part is short, and the glossohyal is not produced far forwards.

*Of the Cypseline Skull.*—Upon a lateral view of the skull of *Panyptila saxatilis* the external narial aperture is seen to be very large and elliptical in outline. The maxillary process of the nasal descends in a straight line to join the maxillary below, which latter bone, like the premaxillary, is very delicately constructed. I have failed to find a free lachrymal in the Swifts, and if it does occur it is very rudimentary. It is just possible that it may be incorporated with the pars plana, as it is in the Swallows and some other passerine birds.

Owing to the narrowness of the mid-frontal region, the orbital cavity, though very capacious, is not relatively so deep as in *Chordediles*, but has the same general aspect it presents in the Swallows. The interorbital septum usually contains one or two extensive vacuities in it, and the greater part of the tract for the olfactory nerve and its cranial exit is deficient in bony support.

The pars plana is of a quadrate outline, very large and, I believe, in all true Cypseline birds, of a tuberous conformation, as it here is in the Rock-Swift.

*Panyptila* has a quadrate-bone in many respects like *Chordediles*; the orbital process, however, is very much better developed, though not quite so well as it is in the Swallows, where it wears more the character of the Passeres. The two facets upon the mandibular foot of the bone are almost exactly as we find them in the Night-hawks, while the antero-posterior compression of the body is equally well marked. Two narrow facets are found upon the summit of its mastoidal head.

The quadrato-jugal rod is slender and retains a uniform calibre to the maxillo-jugal junction, when it becomes laterally compressed before arriving at the expanded portion.

Seen from above, the general contour of the skull of the Rock-Swift closely resembles that of a Swallow; in the former, however, we find the median portion of the premaxilla constructed upon the same plan as I described it for the Goatsuckers, being reduced to a thread-like rod of bone between the insertion of the nasals behind, and where it merges into the mandibular tip in front.

This gradually expands after it passes the former point to make rather a broad insertion as it abuts against the cranio-facial region, leaving, as it does so, a conspicuous triangular vacuity on either hand, between it and the nasals.

The cranio-facial region is somewhat concaved, while the inter-orbital space, upon this aspect of the skull, is narrow, in both of which particulars the Swifts agree with the *Hirundinidæ*.

The vault of the cranium is smooth and uniformly convex, being barely marked in the median line by a longitudinal crease. All of

the essential characters of the basal aspect of the skull as found in the typical Swifts are present in *Panyptila*, and they perfectly agree in most important points with the same characters as described by Professor Huxley for *Cypselus apus* (figs. D and E).

The *vomer* (*Vo*) is long and narrow, being deeply cleft behind where it straddles the rostrum of the sphenoid. Either limit is carried back as far as the palatine head of the corresponding side, with which it firmly articulates, as well as with the initial portion of its ascending process. Anteriorly, the vomer dilates into a horizontal, triangular extremity, the line of the base being in front, its angles just resting, one on either side, on the upper edges of the broad maxillo-palatines, while the apex merges into the cleft portion which extends backwards.

A *maxillo-palatine* (*Mxp*) has the form of a spherical triangle, is notably well developed, but does not meet its fellow in the median line, the interval being spanned by the vomer, as just described.

The *palatines* (*Pl*) are principally in two horizontal planes, and either one has a very characteristic form in the Swifts, which is nearly approached by the Swallows. Its inner margin is deeply cleft, giving rise to an anteriorly directed process that is quite striking in the *Cypselidæ*, though it amounts to nothing more than an exaggeration of a similar condition found in the Passeres.

The narrow palatine body merges anteriorly into the premaxillary, and as it passes forwards to do so, underlaps the great tuberous antorbital; while further on, it shuts out of sight from this view the connection between the vomer and the maxillo-palatine.

Another exaggeration of a Passerine character of the palatine, seen in the Swifts, is the form assumed by the postero-external angle of the bone. It is in them produced into a well-marked oblong process directed backwards and outwards (see figs. D, E, and F).

In the Passerine birds generally the palatines have but one point where they come in contact, and this is at their heads under the rostrum, where they articulate with the pterygoids. This applies also to the Swallows, while in *Panyptila*, and presumably in other Swifts, these bones fail to meet even here, being separated by quite an appreciable interval (fig. D). We have already seen that they are very widely separated in *Trochilus* at this point.

A *pterygoid* (fig. D, *pt*) is a very long, slender, and straight rod of bone, having the same essential characters and making the same style of articulations with quadrate and palatine, as in the typical Passerine birds.

In most particulars of any importance, so far as the basis cranii, the rostrum, ethmoid, and all other parts of the skull of *Panyptila* are concerned, they make no great departures from the generalized Passerine skull, and they are by no means very different from such characters as they are found in *Hirundo*. Indeed, so far as this part of the skeleton goes, my studies of the osteology of American *Cypselidæ* and *Hirundinidæ* fully confirm Professor Huxley's investigations in that direction, who long ago pointed out the close relationship of these two groups of birds (P.Z.S. 1867, p. 452).

Fig. D.

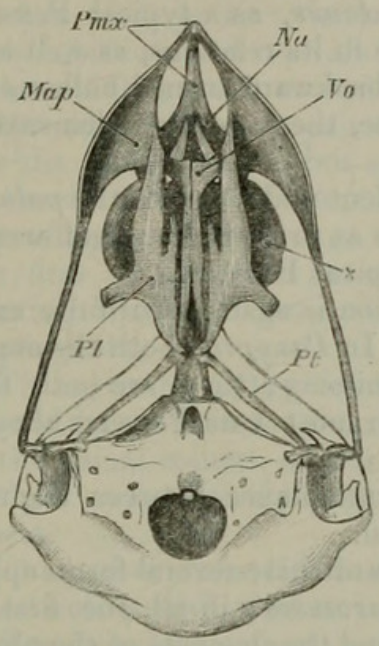



Fig. E.

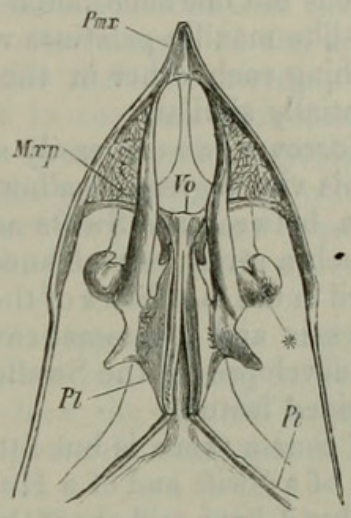



Fig. F.

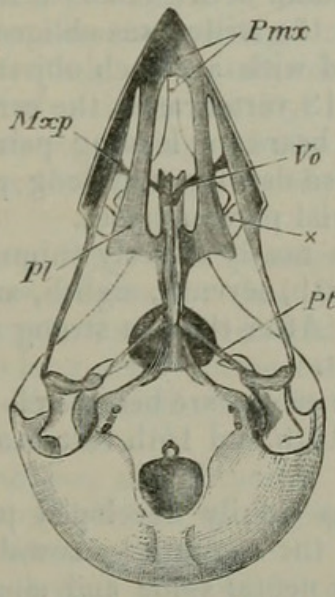



Fig. D. Under view of the skull of *Panyptila saxatilis* (×2). (Drawn by the author from a specimen in his own cabinet.)

Fig. E. Under view of the anterior portion of the skull of *Cypselus apus* (×2). (after Huxley).

Fig. F. Under view of the skull of *Tachycincta thalassina* (×2). (Drawn by the author.)

*Pmx*, premaxillary; *Mxp*, maxillo-palatine; *Vo*, vomer; *Na*, nasal; *Pl*, palatine; *Pt*, pterygoid. In figure E the anterior excavated end of the vomer has a crescentic shape, its angles terminating in free horns above the palatine bones by which they are concealed in the figure. The * directs attention to the inferior portions of the antorbitals. They have a very peculiar form in *C. apus*, as shown in fig. E.

In *Tachycincta thalassina*, as a representative of the Swallows (fig. F), we find the broad *vomer* (*Vo*) doubly notched in front, whereas in a skull of *Oroscoptes montanus*, as a typical Passerine, there is but one such notch; otherwise in its relations, as well as the hair-like maxillo-palatines with their backward-turned bulbous ends touching each other in the median line, these several elements are essentially similar.

Moreover, we can easily see the evident middle place the *palatines* of this violet-green Swallow hold, both as to their form and arrangement, between the Swifts and more typical Passeres.

Such a serial resemblance in gradation is again beautifully exemplified in the *mandibles* of these birds. In *Panyptila* both the angular processes and the ramal cavities are missing; they are both fairly well developed in the Swallow, while in most true Passeres they are a decided feature.

Of course there is but little or no resemblance between the mandible of a Swift and of a Humming-bird.

What I have said about the *mandibles* of these several forms applies with equal truth to the *hyoidean apparatuses*; in all, the first and second basibranchials are in one piece, and the elements of the glossohyal portion remain in cartilage throughout life.

*Of the remainder of the Axial Skeleton in* Trochilus.—One cannot well study the spinal column of Alexander's Humming-bird without the aid of a strong lens; the writer was obliged to bring to his assistance a microscope armed with a 2-inch objective. By the help of this instrument I count 13 vertebræ in the cervical region before we come to that one which bears the leading pair of free ribs. In the middle of the series these develop very long postzygapophyses, and the finest imaginable parial parapophyses.

The neural spines are nearly entirely suppressed throughout the series, while the fifth, sixth, seventh, eighth, and ninth contribute to form the carotid canal. After these a strong median hypapophysis is found on each segment.

The articulation of the centra are heterocœlous. Freely suspended ribs are found upon the 14th and 15th vertebræ, the last pair having epipleural appendages.

The 16th vertebra has a fully developed pair of ribs, which are the first to connect with the sternum by costal ribs. This vertebra is characterized by a low neural spine and single long median hypapophysis.

The 17th vertebra also possesses perfect ribs, and in it the hypapophysis is not so prominent, and the neural crest is still inconspicuous.

Strange to say, the 18th and 19th vertebræ, with complete ribs reaching the sternum by hæmapophyses, are thoroughly anchylosed with the pelvic sacrum, having their neural spines and hypapophyses merged into each other as common superior and inferior crista respectively. The former soon subsides upon the dorsal aspect of the sacrum, while the latter is met by a transverse crest developed by the 21st vertebra, beyond which it subsides over the body of the 23rd vertebra. This arrangement forms a crucial raised crest on

this aspect of the pelvis, which strikes one upon the first glance at the bone. Two more ribs follow the pair borne by the 19th vertebra; the first of these meet the last pair of costal ribs below, while above, their tubercula and capitula have been so far absorbed that these ribs look as if they were anchylosed to the outer margin of the ilium on either side. The last pair of ribs neither meet the sternum below nor the pelvis above, but are attached to the pair just described. These ribs differ from the preceding ones in not developing epipleural appendages. This arrangement, it will be seen, gives 8 pairs of ribs; the first two pairs do not reach the sternum; the next 5 pairs do, meeting 5 pairs of costal ribs; finally the last pair are in every sense floating ribs.

Through the 27th vertebra, the following segments are appropriated by the sacrum; then come 5 free caudals, making 32 vertebræ in the spinal column of this Humming-bird, the whole being finished off by a comparatively large pygostyle, probably composed of several others.

The *pygostyle* is terminated in a peg-like point, and is not flattened and quadrilateral as in the Swifts and many Passeres.

*Trochilus* has a short and broad pelvis, being much compressed from above downwards. Viewed from above, we find that the open "ileo-neural grooves" are over the 18th and 19th vertebræ, the two described above as anchylosing with the fore part of the sacrum. This arrangement is rare among existing birds—unique so far as I can recall at the present writing. The anterior and in-turned extremities of the ilia are rounded points, meeting the outer sacral margins just opposite the posterior endings of the ilio-neural grooves. The parial foramina among the diapophyses of the urosacral vertebræ are quite large.

Professor Owen found them small in a specimen of *Trochilus pella*[1].

Upon a lateral view we observe that the narrow ilium is much concaved immediately anterior to the cotyloid cavity; its outer margin forming a part of the long gentle curve completed by the postpubis, which latter projects far behind where it is turned upwards. No propubis is developed.

The acetabulum, ischiac, and obturator foramina present nothing of marked interest; they have all an average size and are in due proportion with the surrounding parts.

The obturator foramen is thoroughly closed in by the ischium, after which this bone arches over an obturator space, to meet the postpubis again in a little foot-like process.

In many birds a notch on the hinder border of the pelvis denotes the landmark between ilium and ischium in this situation. No such feature exists in *Trochilus*, this Humming-bird having in the posterior portion of its pelvis much to remind us of similar parts of the skeleton in the Passeres.

The *sternum* (figs. 3 and 6, Plate LX.).—So far as its general form and characteristics go, the sternum in the Hummers has long been known to us, and this information has been principally derived from

[1] 'Anat. and Phys. of Vert.' vol. ii. p. 32. Lond. 1866.

studies of the structure of the present genus. In *T. alexandri* we find that the bone has a round anterior margin with complete abortion of the manubrial process. Just within this line, the sternum is much thickened, mounting up above in the median line into quite a prominent pyramidal elevation. On either side of this a circumscribed pit is found, while mesially, and directly behind it, is a single pneumatic foramen. For the rest, the dorsal aspect of the bone is smooth and generally concaved.

The costal processes are conspicuous, being directed forwards and outwards, and either costal border behind them supports five articulations for the costal ribs.

Plate LX. fig. 6 shows the wonderful depth of the sternal keel in this unrivalled little prince of volants. In front it is fortified by a thickened rib of bone, as in most carinate birds, while its convex inferior margin is finished off with a rim, which appreciably projects beyond it all along its sides.

The posterior sternal margin is entire, being convex outwards and approximately a portion of an arc of a circle with a radius of 6 millimetres (2·4 mms. in the fig., it being $\times 4$).

Much stress has been laid upon this fact in comparing the *Trochilidæ* with the Swifts; but a comparison of the figures will at once show how essentially different these bones are.

Turning now to the *shoulder-girdle* of *Trochilus alexandri*, we are confronted with an exceedingly interesting structure and one which markedly departs from these elements in ordinary birds. Of the three bones the most striking difference is seen in the *coracoid* (Plate LX. fig. 5). This element has a straight shaft with a very slightly dilated sternal end, the whole being much compressed in the antero-posterior direction. Just above its middle it is pierced by an elliptical foramen with its long axis corresponding with the long axis of the shaft; immediately above this, again, we find a similar foramen that represents the *tendinal canal* in other birds, but here completely surrounded by bone. The glenoid cavity is comparatively large and projecting, while the summit of the bone, when the arch is *in situ*, points towards the median plane.

Professor Owen's figure of *T. pella* referred to above shows very well indeed the position of the *furcula*, when articulated as in life, in the Hummers. Its seemingly high position is largely due, however, to the great depth of the carina in these birds.

As for the bone itself, we find it assuming a form at the very limit of the U-shaped variety.

Its limbs are almost filamentous in character, and the hypocleidium of rudimentary development only.

Its heads are compressed from side to side, but very slightly enlarged, and are quite sharply crooked downwards and backwards to have their apices meet the scapulæ. They rest against the coracoids on the mesial side of the bridge that closes in the tendinal canal alluded to above.

A *scapula* contributes but a very small share of the articular surface to the glenoid cavity—less than a fourth, I should judge.

The bone is notably compressed in the vertical direction from head to apex, the former being unusually flattened for a representative of this class.

Rather more than the hinder third of the blade is bent abruptly in such a manner as to have the angle occur on the inner margin, with its aperture, quite an open one, to the outer side. From this point to the sharp apex, the blade gradually tapers away.

When this pectoral arch is articulated the axis of the shaft of the coracoid is approximately in a plane which is parallel to the plane of the dorsal surface of the sternal body.

*Of the remainder of the Axial Skeleton in certain Caprimulgine Birds.*—Nuttall's Whippoorwill and *Chordediles* each have eleven vertebræ in their cervical region before we come to a segment supporting a free pair of ribs. Each agrees, again, in having this first pair of ribs rather long and without epipleural appendages. In the Whippoorwill the next pair of ribs also have free extremities and well-developed processes anchylosed to them, while in the Night-jar, these latter also being present, we find that the ends of the ribs articulate with sternal ribs. These are of unusual type in a specimen before me, being high up on the costal processes, exceedingly small, indeed far smaller than I ever saw them in a bird of the same size, and the one on the left side being anchylosed to the sternum. Posterior to this pair of ribs both of these forms agree again, and that in having four more pairs each.

Of these, the first three fulfil all the requirements of true dorsal ribs as we find them among birds generally. The last pair spring from the sacrum, although their hæmapophyses also reach the costal borders of the sternum. They do not have epipleural appendages upon them.

It will be seen that this arrangement gives the Goatsuckers 16 movable vertebræ in the column before arriving at the first one appropriated by the pelvis.

Then, as well as I can manage to count in the adult specimens, either of these birds has ten more segments in the pelvic sacrum. *Chordediles* differs from the Whippoorwills, however, in having six caudal vertebræ and a pygostyle, whereas the latter have but five and the terminal piece. In either genus the *pygostyle* has a long, sharp, and straight superior border, and a thickened posterior one, especially below where a triangular flattened area makes its appearance, and the bone is not nearly so deep in the antero-posterior direction.

With the exception of the tuberous apophysis of the axis, the vertebræ in these birds are notable for the entire absence of the neural spines until we find them developed in the dorsal series. On the other hand, after passing the four or five vertebræ in the mid-cervical region that are marked by the open carotid canal, the hypapophyses are quite a prominent feature, and it is only in the last two segments before the pelvis that these latter are absent.

The lateral canals commence in the third vertebræ and extend through the cervical series as usual.

The transverse processes of the tail-vertebræ in *Chordediles* are very long, and though the neural spines are not lofty, the last four segments have prominent bifid hypapophyses, which are not nearly so conspicuous in the Whippoorwill.

Notwithstanding the fact that the *pelvis* has the same general characters alike in these two genera, there are at the same time a number of striking minor differences which render it impossible to mistake their identity.

In both forms the bone is notably spread out and flattened in the vertical direction; this is perhaps best marked in the Nightjars, where, too, we find the ilio-neural grooves shallow and wide, and the anterior or preacetabular portion of the ilium long and narrow, being concaved for its entire length. The parial foramina on the hinder moiety of the dorsal aspect are large, regularly decreasing in size as we pass forwards. Upon this view the tops of the anti-trochanters form a prominent lateral feature of the pelvis.

Regarding the bone upon side view in *C. texensis*, we observe that the outer marginal line of the ilium is directly continuous with the postpubis behind, the propubis being entirely absent.

The postpubic element is extremely slender, and in direct contact with the inferior margin of the ischium for its entire length, projecting but a short distance beyond it behind.

The obturator foramen is relatively very small, and, indeed, neither the acetabulum nor the ischiac foramen is of great size comparatively.

*P. nuttalli* has a proportionately deeper and narrower pelvis than the one just described for a Night-hawk, with its ridges and lines more pronounced, giving the bone a more angular aspect.

The ilia in front have their anterior ends drawn out into points, and turned in nearly to touch the quite prominent crista formed by the common neural spines of the sacral vertebræ. This feature is characteristic of the pelvis in the Whippoorwill, and at once distinguishes it from the pelvis in the other genus.

Plate LXI. fig. 2 shows very well the general form of the *sternum* and the *shoulder-girdle* in the *Caprimulgidæ*, and their mutual relation when articulated *in situ*, the specimen being from *C. texensis*.

It will be seen that the sternum is broadly 1-notched at its posterior border; that it is without a manubrium, and has a concave anterior, and convex inferior border to its handsome keel, the angle at the meeting of the two being rounded off.

The costal processes are well pronounced (still more so in *P. nuttalli*), and the sternal body is decidedly concave on its dorsal aspect, usually showing a median pneumatic foramen in front.

A *coracoid* has a subcylindrical shaft of considerable length, terminated above in a tuberous summit, and a well-dilated sternal extremity with upturned external process. These bones, when articulated, do not meet in the median line. The *furcula* assumes the U-shaped pattern of the bone, with but a fairly-well developed hypocleidium. Its limbs are transversely compressed, and the terminal head not much dilated. These latter rest, when *in situ*,

against the coracoids, their apices extending backwards to touch either scapula. In Nuttall's Whippoorwill an outer ledge is developed on either clavicular head to abut against the corresponding coracoid in front, a feature which is still better displayed on the part of the *Cypselidæ* (Plate LX. fig. 2, *z*).

A *scapula* in the Night-hawk has the typical blade-like portion, which is more inclined to be truncated in *Phalæonoptilus*. Both birds have its head broad transversely, and somewhat flattened from above downwards. When articulated it rests upon rather a meagre scapular process of the coracoid, with its inner angle extended forwards to meet the clavicle, as already defined above.

The elements of the pectoral arch seem to be non-pneumatic bones throughout the *Caprimulgidæ*.

*Of the remainder of the Cypseline Axial Skeleton.*—We find in the cervical region of the column of *Panyptila saxatilis* twelve vertebræ before meeting that one in which the pleurapophyses have become liberated as ribs. These latter are here of the most rudimentary character; for in a specimen before me, on one side the rib is merely represented by a minute rod of bone suspended from beneath the transverse process, while on the opposite side the head of the bone is found, and the whole is rather more advanced. The atlas is more than usually delicately constructed, while the axis is very narrow in the antero-posterior direction.

A shallow carotid canal seems to be confined to the fourth and fifth vertebræ, the usual process taking its place after that. All these vertebræ, as a rule, are notably short, with well-developed pre- and post-zygapophyses.

Beneath, the parapophyses are as long as the centra, and are placed rather close together on each vertebra.

The articulations are of the heterocœlous type, and the lateral canals are very short. One very interesting feature is seen in this part of the spinal column of the White-throated Rock-Swift, and that is the ossification of the interspinous ligaments among the ultimate segments. The neural spines of the tenth, eleventh, twelfth, and thirteenth vertebræ are low and inconspicuous, and the fine thread-like ligament that joins these processes has become thoroughly ossified, the minute osseous rods thus formed articulating, at either end, with the neural spines of the vertebræ in question. These vertebræ, in *Panyptila*, are essentially very different from the corresponding bones in *Trochilus*.

The fourteenth vertebra possesses a pair of free ribs, which may or may not have uniform appendages near their lower extremities; and this segment has likewise many of the characteristics of the dorsal series that follow.

Below it develops a tricornuate hypapophysis, this process being markedly prominent on all the succeeding vertebræ, occurring also upon the first two in the sacrum, an unusual thing. The presence of this formidable series of hypapophyses is accounted for by the same law that demands their presence in *Colymbus*, the sole difference being that, while the latter, by the aid of his strong wings, passes

with the greatest velocity beneath the water, the Swift in its flight paddles the air with an equal rapidity of wing, both birds requiring powerful *longi colli* (and consequent firm and extensive supports for them), these muscles being the ones brought into action in seizing their prey during the height of this volant motion.

The fifteenth, sixteenth, seventeenth, eighteenth, and nineteenth vertebræ are true dorsals, having perfect ribs connecting them with the sternum; and they have low neural spines which interlock with each other at their ends, these vertebræ all being freely movable upon one another.

Nothing of special importance characterizes these ribs; all have strong epipleural appendages anchylosed to them, save the last pair, in which they are absent. Two pairs of feeble ribs also spring from beneath the sacrum, the hinder pair being very rudimentary in some specimens.

From the twentieth to the twenty-ninth vertebræ, all inclusive, are firmly anchylosed together to form the pelvic sacrum. To their outer common diapophysial margins, the ilia make thorough connection, the sutural traces being nearly absorbed. A few small foramina are found upon the dorsal aspect among the fairly defined transverse processes.

*Six* vertebræ and a large pygostyle make up the skeleton of the tail. The last but one of these has wide-spreading diapophyses, the others being less prominent in this particular.

Adding all these together, we find that the spinal column of *Panyptila* contains, besides its pygostyle, thirty-five vertebræ, three more than we found in the spinal column of *Trochilus*, which contains but thirty-two.

The violet-green Swallow has thirty-five vertebræ in its column, and presumably others of the family have the same. Moreover, the essential characteristics as seen in the ribs, pelvis, and other parts of the axial skeleton also agree.

In the short and wide *pelvis* of *Panyptila* we find upon superior view open ilio-neural grooves, a small preacetabular area, with the concave surface of the bone, on either side, facing upwards, forwards, and outwards. The postacetabular portions of the ilia are each of a quadrilateral outline, and their superficies uniformly convex.

A side view of the pelvis presents a large, elliptical, ischiac foramen, a small cotyloid ring, and considerable traces of an obturator space, the foot-like process of the ischium meeting the postpubis behind the last.

This pattern of the bone is pretty much the same as we find it in the Swallows (*Hirundo, Tachycineta, Petrochelidon, Cotile*), the principal differences being, that in the latter group the parial foramina among the sacral transverse processes are always notably large, and the posterior ilio-ischiac margins are notched (barely perceptible in *P. saxatilis*); both of these characters, especially the last, are well-known Passerine ones.

The form assumed by the *sternum* in *Panyptila* is shown in figures 1 and 4 of Plate LX. Here, upon the ventral aspect we see

the prominent, triangular, costal processes, with their borders behind them, each of the latter supporting five articular facets. From the last of these the sternal body becomes progressively wider to terminate in acute postero-external angles formed by the intersection of the unnotched, slightly convex, xiphoidal border.

So thin are the walls of the body of this sternum that we frequently find large vacuities existing in it that tend to be symmetrical in character for either side of the carina.

This attenuity of the sternal body does not apply, however, to its margins, the two lateral, as well as the hinder one, being characterized by a thickened deposit of bone.

Upon a lateral view we are enabled to see that the sternum of this Swift develops quite a prominent manubrium, which stands between the coracoidal facets. These latter are of an oblong form, with their long axes parallel to the plane of the keel. The keel is thickened in front, and concave forwards.

Its angle is rounded off, and the line of its lower margin nearly straight; it may, too, show deficiencies in its substance similar to those in the body.

This keel to the sternum of the Swift is not so deep in comparison with the remainder of the bone as we often find it among the Passeres, and in this particular it is not to be mentioned with the extraordinary carinal development in *Trochilus* (Plate LX. fig. 6).

A glance at Plate LX. fig. 2, is sufficient to convince us that *Panyptila* has a *shoulder-girdle* differing in many important respects from the Humming-birds, as well as the typified arch of the Passeres. Its *furcula* is broadly U-shaped, with scarcely any hypocleidium developed below. The apices of the heads reach back to the scapulæ, and they also possess the outer lateral abutments (fig. 2 *z*) for the heads of the coracoids, much as we found them in Nuttall's Whippoorwill.

As for *coracoid* and *scapula*, the former has a prominent head directed forwards and upwards, a shaft shorter than in the Swallows; but otherwise both this bone and the latter differ in no leading details from the same elements as found in these birds. And at the same time it is hardly necessary to add, after what has gone before, that it, as a whole, differs fundamentally and in essential details from the girdle in *Trochilus*.

Swallows, as we know, have both sternum and pectoral arch agreeing with the Passerine type. This family also has the *os humero-scapulare* developed, a fact which intimates that the affinity between these two groups is still the closer.

*Of the Pectoral and Pelvic Limbs in the Humming-birds, Night-jars, and Swifts* (Plate LXI. figs. 1, 3, and 4).—So far as I have examined them, the Caprimulgine birds have their pectoral limbs constituted as in the ordinary representatives of the class. The *humerus*, in proportionate length with the bones of the antibrachium (fig. 1), has quite a straight subcylindrical shaft, a rounded and rather short radial crest, a pneumatic fossa and foramen, arched over in the usual manner by the ulnar crest, and finally a distal extremity