

three of these sub-genera there are species which have the large muscular impressions of the ventral valve obliquely striated or grooved. This seems to show that the muscles were not single, but composed of several bands. The three genera pass gradually into each other, and yet I think some sort of a subdivision is required. It seems almost absurd to place such shells as *T. grandis* and *O. Canadensis* in the same generic group.

Proposed new genus of Pteropoda.

Genus HYOLITHELLUS, gen. nov.

Since the sheet containing the description of *Hyolithes micans* was printed off, I have arrived at the conclusion that a new genus for its reception should be instituted. I propose to call it *Hyolithellus*. It differs from *Hyolithes*, in its long slender form and in the peculiar structure of its operculum.

Montreal, 23d March, 1872.

ART. XLVIII.—*Preliminary Description of HESPERORNIS REGALIS, with Notices of four other new Species of Cretaceous Birds;*
by O. C. MARSH.

THE few remains of birds hitherto described from the Cretaceous deposits of this country, although of much interest, all pertained to comparatively small species, and belonged, apparently, to families still existing.* It is fortunate, therefore, that the existence of a fossil bird, so large and remarkable as the one that forms the subject of the present description, should first be made known by the discovery of such important parts of a skeleton, as to afford ample material for the determination of its affinities. This interesting discovery has already been announced in this Journal, and the name, *Hesperornis regalis*, proposed by the writer for the species thus represented.† The present paper is preliminary to a full description, with illustrations, now in course of preparation. The other species briefly described in this article are likewise of interest, as they add some new forms to the limited avian fauna heretofore found in the Cretaceous beds of the Atlantic coast.

Hesperornis regalis, gen. et sp. nov.

The remains of this species at present known consist of portions of one skeleton, including the nearly entire posterior limbs, from the femur to the terminal phalanges, parts of the pelvis, several cervical and caudal vertebræ, and numerous ribs,

* This Journal, vol. xlix, p. 205, March, 1870. † Vol. iii, p. 56, Jan., 1872.

all in excellent preservation. Fragments of four other individuals were also found by the writer, which agree essentially with the corresponding parts of the more perfect skeleton. An examination of these various remains soon makes it evident that they represent a gigantic swimming bird, having its nearest living allies probably in the *Colymbidæ*, but differing widely in many respects from that group, and from all other known birds, recent and extinct.

The femur is unusually short and stout, much flattened antero-posteriorly, and the shaft curved forward. It somewhat resembles in form the femur of *Colymbus torquatus* Brün., but the great trochanter is proportionally much less developed in a fore-and-aft direction, and the shaft is much more flattened. The tibia, or *tibia-tarsus*, is straight and elongated. Its proximal end has a moderately developed cnemial process, with an obtuse apex. The epi-cnemial ridge is prominent, and continued distally about one-half the length of the shaft. The distal end of the tibia has on its anterior face no ossified supra-tendinal bridge, differing in this respect from all known aquatic birds. The fibula is well developed, and resembles that of the Divers.

The tarso-metatarsal bone is much compressed transversely, and resembles in its main features that of *Colymbus*. On its anterior face there is a deep groove between the third and fourth metatarsal elements, bounded on its outer margin by a prominent rounded ridge, which expands distally into the free articular end of the fourth metatarsal. This extremity projects far beyond the other two, and is double the size of either, thus showing a marked difference from any known recent or fossil birds. There is a shallow groove, also, between the second and third metatarsals, which taken in connection with the deeper one, made the specimen appear, while still in the rock, as if its main elements were separate. The second metatarsal is much shorter than the third or fourth, and its trochlear end resembles in shape and size that of the former. The existence of a hallux is indicated by an elongated oval indentation on the inner margin above the articular face of the second metatarsal. The free extremities of the metatarsals have the same oblique arrangement as in the *Colymbidæ*, to facilitate the forward stroke of the foot through the water. There are no canals or even grooves for tendons on the posterior face of the proximal end, as in the Divers and most other birds; but below this there is broad, shallow depression, extending rather more than half way to the distal extremity.

The phalanges of the large, external toe are very peculiar, although an approach to the same structure is seen in the genus *Podiceps*. On the outer, inferior margin they are all deeply exca-

vated. The first, second and third have, at their distal ends, a single, oblique, articular face on the inner half of the extremity, and the outer portion is produced into an elongated, obtuse process, which fits into a corresponding cavity in the adjoining phalanx. This peculiar articulation prevents flexion except in one direction, and greatly increases the strength of the joints. The terminal phalanx of this toe was much compressed. The third, or middle, toe was greatly inferior to the fourth in size, and had slender, compressed phalanges, which correspond essentially in their main features with those of modern Divers. The phalanges of the first and second toes of the present specimen are wanting.

Portions of the pelvis, found with the posterior limbs in three of the specimens, indicate that the illia were separated from each other, and not very firmly ossified to the sacral vertebræ. The acetabulum was covered with a thick cushion of cartilage, as in *Apteryx*, and, at its upper margin, the anterior and posterior extensions of the illia, if both existed, were disconnected, or unossified at their union.

The cervical and caudal vertebræ preserved present no features deserving of special mention in this preliminary notice. The latter are numerous, but apparently not much in excess of those in some modern birds. Unfortunately, no portions of the skull were recovered. The femur and tibia have very thick, compact walls, and do not appear to have been pneumatic. The tarso-metatarsals and the phalanges were nearly or quite solid.

Measurements.

Length of right femur,-----	98· mm.
Transverse diameter of proximal end,-----	53·
Diameter of articular head,-----	18·5
Transverse diameter of shaft, at middle,-----	22·
Antero-posterior diameter,-----	19·2
Transverse diameter of distal end,-----	53·5
Length of right tibia,-----	316·
Transverse diameter of proximal articulation,-----	38·
Length of cnemial process,-----	22·
Transverse diameter of shaft, at middle,-----	29·
Transverse diameter of distal end,-----	32·
Antero-posterior extent of outer condyle,-----	32·
Antero-posterior extent of inner condyle,-----	22·
Length of right tarso-metatarsal,-----	137·
Length to distal end of third metatarsal,-----	130·
Length to distal end of second metatarsal,-----	116·
Transverse diameter of proximal articulation,-----	36·
Least transverse diameter of shaft,-----	15·
Transverse diameter of distal end of fourth metatarsal,--	16·
Transverse diameter of third metatarsal,-----	8·5

Transverse diameter of second metatarsal,-----	8· mm.
Length of proximal phalanx of fourth toe,-----	45·
Length of second phalanx,-----	39·5
Length of third phalanx,-----	40·
Length of proximal phalanx of third toe,-----	41·

The various remains of the present species already discovered belonged to five individuals, which differed but little in size, or in any important particulars. Taking the great Northern Diver (*Colymbus torquatus* Brün.) as a standard of comparison for the portions that are wanting, the skeleton of *Hesperornis regalis* would measure about five feet and nine inches from the apex of the bill to the extremities of the toes.

The affinities of *Hesperornis* have already been mentioned. The characters given in the above description show plainly that, although a comprehensive type, it belongs in the Palmipedes; and while most nearly allied to the *Colymbidæ*, it still differs so widely from that group in the structure of the pelvis and posterior limbs as to demand a place in at least a separate family, which may be called *Hesperornidæ*.

All the remains of the species now known were found by the writer, last summer, in the gray shale of the upper Cretaceous, near the Smoky Hill River, in Western Kansas.

Graculavus velox, gen. et sp. nov.

Among the vertebrate remains in the Yale Museum, from the Cretaceous green-sand of New Jersey, are fragments of the skeletons of two aquatic birds, which apparently belong to the same genus, although to quite distinct species. Both of these differ essentially from any recent birds, but are evidently most nearly allied to the Cormorants. The largest of these birds, to which the above specific name may be given, is mainly represented, at present, by the proximal half of a left humerus, in perfect preservation, and hence a very characteristic specimen. In its general features this humerus resembles that of the common Cormorant (*Graculus carbo* Linn.), although indicating a somewhat smaller species. The articular head is much more compressed transversely, its apex is more prominent, and its anconal margin is strongly deflected. The median ridge, on the anconal side below the head, is rounded instead of angular, and the ulnar crest is much less produced distally.

Measurements.

Greatest diameter of proximal end of humerus,-----	23·75 mm.
Vertical diameter of articular head,-----	13·
Transverse diameter,-----	6·
Proximal extension of head beyond ulnar crest,-----	4·6
Least diameter of shaft below proximal extremity,-----	6·

The specimens on which this species is based were found by John G. Meirs, Esq., at Hornerstown, New Jersey, in the green-sand of the upper Cretaceous, and by him presented to the Museum of Yale College.

Graculavus pumilus, sp. nov.

The present species, which is hardly more than one-third the size of the preceding, is likewise represented by the proximal end of a humerus, as well as by some other characteristic remains. The articular head in this specimen is equally compressed, and shows the same prominent apex, but is without the anconal deflection, which distinguishes the larger species. The lower half of the head is narrower transversely, and separated from the internal trochanter by a wider notch. The median ridge, moreover, on the anconal face is much more acute.

Measurements.

Greatest diameter of proximal end of humerus,-----	13.25 mm.
Vertical diameter of articular head,-----	8.
Transverse diameter,-----	4.
Least diameter of shaft below proximal end,-----	3.1
Greatest diameter of metacarpal, at distal end,-----	5.5
Least diameter,-----	3.75

The known remains of this species are from the same locality and geological horizon as the preceding, and were also discovered by John G. Meirs, Esq.

Graculavus anceps, sp. nov.

The only fossil bird remains secured during the explorations of the Yale College party of 1870 in the Cretaceous beds of Kansas, although special search for them was made, was the distal extremity of a left metacarpal, which is so well preserved and so characteristic a part of the skeleton, that it indicates with considerable certainty the affinities of the bird to which it belonged. A careful comparison of this specimen with the corresponding bone in recent birds has made it apparent that the species was a near ally of the Cormorants, and it may therefore be referred provisionally to the genus *Graculavus*, until further discoveries determine its position more accurately. The specimen implies a species about the size of the Violet-green Cormorant (*Graculus violaceus* Gray) of the Pacific coast, and one somewhat larger than *Graculavus velox*, described above. From the metacarpal of the former it differs essentially in having the articular face for the external digit broader and nearly flat, the face for the small inner digit considerably smaller and oval in outline, and the intervening tubercle much more prominent.

Measurements.

Greatest diameter of distal end,-----	6.75 mm.
Least diameter of distal end,-----	5.
Transverse diameter of outer articular face,-----	5.
Vertical diameter,-----	2.25

This specimen was found by the writer in the gray, upper Cretaceous shale, on the North Fork of the Smoky Hill River, in Western Kansas.

Palæotringa vagans, sp. nov.

The existence of a new wading bird in the Cretaceous greensand of New Jersey is plainly shown by an interesting fossil recently presented to the Yale Museum. The specimen is the greater portion of the shaft and distal end of a left tibia, somewhat injured, but with its more characteristic portions still preserved. It indicates a bird somewhat smaller than *Palæotringa littoralis*, described by the writer from the same locality,* but is probably a closely allied form. From the tibia of that species, the present specimen may readily be distinguished by the proportionally more narrow and shallow tendinal canal, on the anterior face of the distal end, and by the more depressed supra-tendinal bridge. The trochlear surface, also, on the posterior side contracts more rapidly, and at its superior margin passes directly, and not abruptly, into the shaft.

Measurements.

Length of portion preserved,-----	62. mm.
Approximate width of condyles in front,-----	8.
Width of bridge at center,-----	2.15
Transverse diameter of lower outlet,-----	1.5
Transverse diameter of shaft where broken,-----	5.
Antero-posterior diameter,-----	4.

This unique specimen was discovered at Hornerstown, New Jersey, about ten feet below the surface of the marl, and was presented to the Yale Museum by John G. Meirs, Esq.

Yale College, New Haven, April 10th, 1872.

ART. XLIX.—*On a proposed method of estimating Ethylic Alcohol when present in Methylic Alcohol*; by M. CAREY LEA, Philadelphia.

WHILE engaged in the study of some methyl compounds, I met with a method, which has recently been published in England, for effecting the above object with approximate correctness. As any simple means of accomplishing this result

* This Journal, vol. xlix, p. 208, March, 1870.