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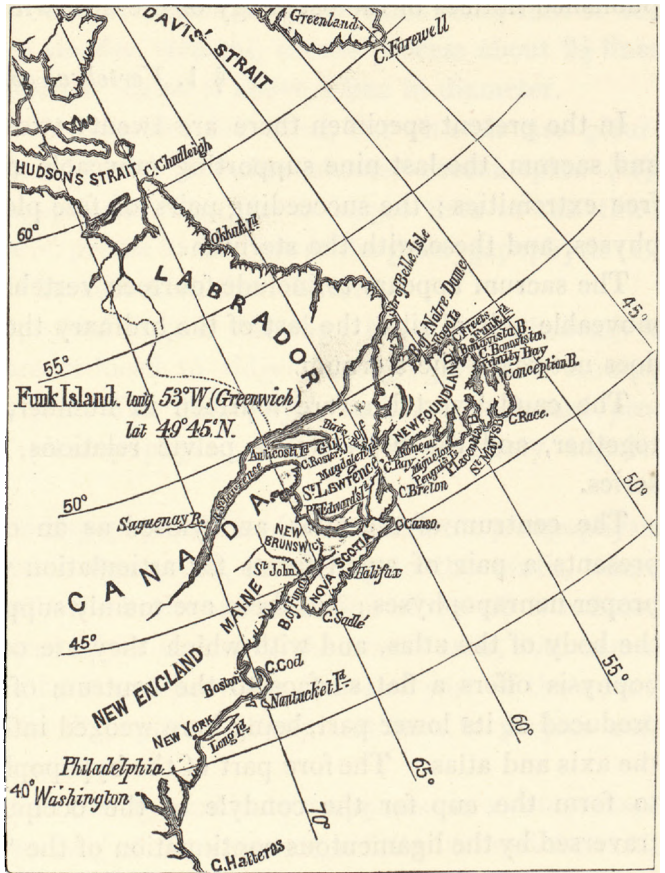
EXTINCT WINGLESS SEA-BIRD, OR GARFOWL,

INCLUDING A

DESCRIPTION OF THE SKELETON OF THE

ALCA IMPENNIS, L.

MR. ALFRED NEWTON, M.A., F.L.S., who, with his friend the late lamented and accomplished naturalist Mr. J. Wolley, has contributed valuable materials¹ for the history of the Garfowl (*Alca impennis*, L.), prosecuting his endeavours to obtain additional materials for that history, has received the body of a specimen, dried, flattened, featherless, and mummified, like the Penguins from the guano-masses of the Peruvian islands. This specimen was obtained from one of the old breeding-places of the extinct bird, Funk Island, long. 53° W., lat. 49° 45' N., off the coast of Newfoundland, by the Bishop of that colonial diocese, and was transmitted by his Lordship to Mr. Newton, who has kindly confided it to me for description, with permission to treat the specimen as might best serve the interests of science.



Old breeding-ground of *Alca impennis*.

A preliminary photograph of the mummy having been taken, it was

¹ See abstract of Mr. Wolley's "Researches in Iceland respecting the Garfowl, or Great Auk (*Alca impennis*, Linn.)," by Alfred Newton, Esq., M.A., F.Z.S., 'Ibis,' October 1861, p. 374.

accordingly macerated for the extraction of the skeleton, and has yielded the skull, bones of the trunk, scapular arch, and furculum, right humerus, right femur, tibia, and fibula.

Learning that Mr. John Hancock, the accomplished and artistic taxidermist of Newcastle-on-Tyne, had extracted the bones of the extremities from a rare skin of *Alca impennis*, I wrote for the loan of those of the left side, and was favoured by a prompt and kind acquiescence, the bones being stated to be from a mature female bird.

I have thus at command the materials for a description of the complete osteology of this most rare and now generally regarded as extinct bird.

In my 'Descriptive Catalogue of the Osteological Series contained in the Museum of the Royal College of Surgeons of England,'¹ I have briefly noticed characteristics of the cranium, dorsal vertebræ, scapula, coracoid, femur, and tibia of an *Alca impennis* which the founder of the collection, John Hunter, had succeeded in procuring; Mr. Blyth had previously made known the fact that the humerus "possessed a very small internal cavity, while the tibia was completely filled with marrow"²; and these are the only published notices of the osteology of the bird with which I am acquainted.

§ 1. *Vertebral column.*

In the present specimen there are twenty-two moveable vertebræ between the skull and sacrum, the last nine supporting moveable ribs, of which the first two pairs have free extremities; the succeeding pairs of free pleurapophyses articulate with hæmapophyses, and these with the sternum.

The sacrum appears to include fourteen vertebræ, of which the first supports a tenth moveable pair of ribs, the last of the ordinary thoracic costal series: its hæmapophysis does not reach the sternum.

The caudal vertebræ are fourteen in number, of which the last three are blended together, and the first, by its pelvic relations, might claim to belong to the sacral series.

The centrum of the atlas, ankylosed as an odontoid process to the axis vertebra, presents a pair of small facets for articulation with the posterior basal angles of its proper neurapophyses; but these are mainly supported by the hypapophysis, simulating the body of the atlas, and with which they are confluent. The back part of the hypapophysis offers a flat surface to the centrum of the axis, beneath which it is slightly produced at its lower part, being here wedged into the notch between the true bodies of the axis and atlas. The fore part of the hypapophysis combines with the neurapophyses to form the cup for the condyle of the occiput; the cup is emarginate above, and traversed by the ligamentous continuation of the "odontoid" in its way to adhere to the upper part of the occipital ball. The atlantal neurapophyses diverge as they rise, and are joined together above by a broad plate slightly arching across from one to the other

¹ 4to, 1853, vol. i. p. 221, preps. nos. 1150-1160.

² Proc. Zool. Soc. November 14, 1837, p. 122.

neurapophysis. A process extends backward from each place of junction. There is no neural spine. The neural canal has a wide transversely elliptical area.

The body of the axis is elongate, compressed and carinate below, the keel being slightly produced and curved at the hind part. The expanded anterior end of the centrum has a small notch near or at the junction of the neurapophyses. These develop postzygapophyses, above which are produced strong trihedral anapophyses; there is a thick, obtusely ended, slightly recurved neural spine.

The third cervical develops a compressed hypapophysis, slightly thickened and flattened below, from the hinder half of the centrum. From the sides of the base of the hypapophysis ridges diverge to parapophyses at the expanded fore part of the centrum, which is flat and triangular below; above each ridge the centrum is concave. Below the præzygapophysis a diapophysis coalesces with the short pleurapophysis, which circumscribes a vertebrarterial canal, the foremost of the series; above the postzygapophysis there projects a trihedral anapophysis, less thick than that of the axis. A sharp horizontal ridge passes from the post- to the præ-zygapophysis, having a small vertical perforation behind; the neural spine is a little higher and less thick than that of the axis. The pleurapophysis projects as a slender, straight, obtuse process about $2\frac{1}{2}$ lines backward; the intervening "vertebrarterial" canal is above a line in diameter.

The fourth cervical (Pl. II. figs. 4 & 5) resembles the third, but with shorter pleur- (*pl*), hyp- (*hy*), and an-apophyses (*a*), and with a rather shorter neural spine (*ns*). The vertical foramen in the interzygapophysial ridge (*iz*) is larger than in the third vertebra; and below this a shorter ridge (*r*) passes to the base of the præzygapophysis (*z*). The posterior part of the neural arch is broader than the interior.

In the fifth vertebra the interzygapophysial ridge is wanting; but the one beneath is more developed. The anapophyses are reduced to ridges diverging from a stumpy neural spine to the postzygapophyses (*z'*). The diapophysis makes a backward projection distinct from and above the pleurapophysis; there is an obtusely angular hypapophysial keel (Pl. II. fig. 6, *hy*).

In the sixth to the ninth cervicals the hypapophysis is obsolete, and the parapophysis (Pl. I. fig. 1, *p*) sends a stumpy projection downward, increasing to the ninth, where it forms the side of a quasi-hæmal canal; the backward extension of the rib is reduced to a mere angle. On the broad depressed upper surface of the neural arch, both neural spine and anapophyses are represented by low ridges: the posterior part of the neural arch is narrower than the anterior. The diapophysis (*ib. d*) continues to project outward, and becomes bifurcate by a groove.

In the tenth cervical the hypapophysis (*ib. hy*) suddenly reappears as a compressed quadrate plate from the whole under surface of the centrum, a little inclined forward, especially at the front angle.

In the eleventh cervical there is a similar but rather shorter hypapophysial plate, and the pleurapophyses begin again to project backward, and the neural spine (*ns*) to reappear.

In the twelfth cervical the hypapophysis is reduced to a short triangular process, and the neural spine forms a low thick knob; the pleurapophyses are still ankylosed as mere processes.

In the thirteenth cervical they elongate, but are fixed; the hypapophysis is a mere ridge; the parapophyses reappear as ridges; the diapophysis is widely cleft, and the hinder and lower portions afterwards alone represent this process; the neural spine is a higher tubercle than in the twelfth vertebra.

The fourteenth vertebra, retaining its pleurapophyses as free elements, may be reckoned as the first dorsal (Pl. I. fig. 1, *d*); its centrum is broader than it is long, with a medial and two marginal ridges below: the first ridge is hypapophysial; the latter are parapophysial, and are most produced, each bounding a concavity on the under surface of the vertebra. The pleurapophysis (ib. *pl*) is a simple, straight style, 6 lines in length, articulated to the under part of the base of the diapophysis, which is now a broad, triangular, depressed plate. The neural spine is a strong, compressed, quadrate plate in this and the succeeding dorsals.

In the second dorsal the parapophysial or lateral hypapophysial ridges are more produced, especially at the hinder angle. The pleurapophysis is a long, nearly straight style of about 3 inches in length, and supports at the beginning of its lower or distal third an epipleural plate curving upward. The head of the rib is expanded and articulates to much of the under part of the diapophysis. The quadrate neural spine gains in fore-and-aft extent.

In the third dorsal the lateral hypapophysial plates are longer and narrower, and begin to be supported as processes from the descending inferior part of the centrum. The pleurapophysis, 3 inches 7 lines in length, articulates above by a head and tubercle with the centrum and under part of the diapophysis, and below with a straight hæmapophysis, 1 inch 5 lines in length, and expanding at its sternal end to articulate with an oblong cavity, transverse to the broad costal margin of that bone. The epipleural is a plate 1 inch in length, and from 1 to 2 lines broad.

In the fourth dorsal (Pl. II. fig. 7), the parapophyses are converted into a hypapophysis in the form of a broad bifurcate process, the prongs diverging at a wide angle as they descend from the common produced base (*hy*). The pleurapophysis, with the head more distinct from the tubercle, and supported on a longer neck, is 4 inches in length, and articulates with a hæmapophysis 1 inch 10 lines in length. The diapophyses (ib. *d*) are long and broad; the zygapophyses (ib. *z*, *z'*) small and short. The neural spine (ib. *ns*) increases in antero-posterior but not in vertical diameter, and preserves the quadrate form.

In the fifth dorsal, the stem of the bifurcate hypapophysis lengthens. The pleurapophysis, 4 inches 10 lines in length, continues as slender as the preceding, and articulates with a hæmapophysis 3 inches 2 lines in length, and slightly bent.

The sixth dorsal has a longer and narrower stem of its bifurcate hypapophysis; but

the fork is broken off. The pleurapophysis is as in the fifth, but with a longer and more curved hæmapophysis, 4 inches in length, and with a rather shorter epipleural lamina.

In the seventh dorsal the hypapophysis is a compressed subquadrate plate, a little expanded at its lower margin. The pleurapophysis, 6 inches in length, retains its slenderness; the hæmapophysis is 4 inches 8 lines in length.

In the eighth dorsal, the hypapophysis is suddenly reduced to a low triangular process. The pleurapophysis, 6 inches 3 lines in length, articulates with a hæmapophysis of more slender proportions, 5 inches 2 lines in length.

In the ninth dorsal, the hypapophysis is again represented by a low median ridge. The pleurapophysis, 6 inches 6 lines in length, articulates with a hæmapophysis (*h*) 5 inches 6 lines in length; and this is the last of those that directly articulate with the sternum.

The tenth dorsal becomes, by confluence of its centrum, the first sacral (*ib. s*), but retains its neural spine distinct from, though contiguous with, the long sacral ridge; its pleurapophysis (*pl*) is 6 inches 2 lines in length, and articulates with a hæmapophysis (*h*) 5 inches 2 lines in length, the distal end of which is applied to the preceding hæmapophysis about one inch from its articular end.

In the dorsal region, the articular facets of the centrum are simplified to a very slight convexity in front and a corresponding concavity behind (Pl. II. fig. 7, *c*).

The sacrum (Pl. I. fig. 1, *s*), 4 inches 2 lines in length, and including about thirteen vertebræ, presents at its beginning rather long and narrow centrums; but these expand laterally, and subside vertically to the sixth, whence they gradually again contract in breadth to the antepenultimate vertebra: the centrums are all confluent. The hinder half of the expanded rhomboid portion of the under surface of the sacrum is broadly and slightly grooved.

Transverse processes, from the second to the sixth sacral inclusive, abut against the ilia: in the next three vertebræ these processes are scarcely marked; they reappear in the following sacrals, with articular surfaces for the ilia, increasing in vertical extent. The first free caudal has also a short thick transverse process, which abuts against the ilio-ischial part of the os innominatum.

The length of the iliac element (Pl. I. fig. 1, *62*) of this bone is 4 inches 6 lines; its extreme breadth, an inch from the fore margin, is 9 lines. That margin is rounded; the outer one is at first convex, then concave, contracting before expanding again, and thickening (at *62*) to contribute to the acetabulum. The expanded fore part of the ilium is a very thin lamella. The acetabulum, widely open, is overtopped by an articular facet adapted to the upper part of the neck of the femur. The ilium quickly contracts in breadth behind the acetabulum, beyond which it extends nearly 2 inches, as far back as the third caudal; it coalesces with the ischium about an inch behind the acetabulum, circumscribing an elliptic ischiadic foramen (*i*) 9 lines in length and 4 lines in short diameter.

The ischium (*63*), after the iliac confluence, extends backward as a pointed styloid

process an inch in length. The ischium forms the back part of the acetabulum, the pubis the under part; the obturator vacuity (*o*) between ischium and pubis is only 5 lines in length and 2 lines in short diameter. The ischio-pubic harmonia beyond this is $1\frac{1}{2}$ inch in length; the slender pubis (*64*) then extends freely backward and slightly outward and downward for 2 inches 6 lines, of a rib-like shape; its total length is 4 inches.

The first free caudal has a depressed subquadrate centrum, broad and depressed diapophyses inclined backward, with terminal pelvic articulations as above stated. The second, third, and fourth caudals diminish in size, and more so in the breadth of the diapophyses, which end freely.

A small hæmapophysial tubercle is wedged between the second and third caudal centrams; a larger plate is between the third and fourth caudals; it begins to be compressed between the fourth and fifth caudals. The next hæmapophysis resembles a short compressed spine, inclined forward; the fifth and sixth hæmapophyses diminish in size; the seventh and eighth are elongate bones underlying the centrams, with which they are nearly coextensive. One sees that the under and fore part of the terminal ankylosed mass of caudals is a confluent hæmapophysis of like shape.

The diapophyses increase in length from the fourth to the seventh caudals¹; these decrease in the eighth and ninth, and disappear in the tenth. The neural spines are stumpy and thick on the anterior caudals, look longer, because thinner, on the succeeding ones to the ninth, are short on the tenth and eleventh, and are represented by a continuous ridge on the terminal coalesced vertebræ. The length of the caudal region is 3 inches 9 lines.

From the position of the acetabula, and prior to sacral confluence, there would be shown eighteen free caudal vertebræ in the young Garfowl: one sees that if these vertebræ had continued free and participated in the rate of growth of the antecedent centrams, how similar a caudal appendage to that of the *Archæopteryx*¹ would have resulted.

The sternum (Pl. I. *hs*, 60; Pl. II. figs. 1 & 2) is long, narrow, entire, with the keel (*hs*) equalling in depth the breadth of the mid part of the bone. The "episternum" (*e*) is short, compressed, wedge-shaped, with its thin obtuse apex curved a little down and back. The "coracoid" grooves (*b*) are separated from each other by the base of the episternum (*e*): each is divided into an inner and an outer articular facet; the inner one (Pl. II. fig. 2, *b*) is the largest, and is subtriangular, the broadest part being sustained by a kind of buttress-like prominence, each buttress (*f*, *f*) diverging from the fore part of the origin of the sternal keel (*hs*). The outer facet (ib. *b'*) is bounded by a short plate in front, and by the base of the costal process behind.

The "costal" process² (*d*) is subcompressed, triangular, with an obtuse apex directed

¹ Phil. Trans. 1863, p. 44, pl. 1.

² See the definition of this and the other processes in art. *Aves*, 'Cyclopædia of Anatomy and Physiology,' vol. i. 8vo, 1836. The sternum of the bird is not the homologue of the plastron of the Tortoise; it is never

upward, the base intervening between the coracoid (*b*) and costal (*a*) surfaces. The latter, occupying 1 inch 9 lines of the sternal border behind the costal process, presents seven articulations (Pls. I. & II. fig. 1, *a*, *a*) for as many hæmapophyses (ib. *h*), progressively decreasing in size as these likewise diminish at their sternal ends. The sternum is continued 4 inches 5 lines behind the costal borders, slightly expanding before it is rounded off to the end, which is truncate, and reduced to a breadth of 9 lines.

The front border of the sternal keel, 1 inch 10 lines in depth, is concave and carinate (Pl. II. fig. 2), the obtuse anterior angle of the keel being produced toward the furculum (Pl. I. fig. 1, *ss*), but not reaching or coalescing with that bone. The keel extends, gradually losing depth, to within an inch of the hind end of the sternum, and at its subsidence a pair of curved lines (Pl. II. fig. 1, *l*), convex backward, diverge to near the lateral borders, and are reflected forward, three or four lines from the border, to the end of the costal surface (*a*). The total length of the sternum is 7 inches 8 lines; its greatest breadth is 2 inches 3 lines.

§ 2. *Skull.*

The skull is long and narrow, the rostral part forming nearly the two anterior thirds, compressed, and deep; the orbits are large, with only the upper half of their bony rim defined. The cranium is very small, and chiefly seen at the upper half of the posterior fifth part of the entire skull (Pl. I. fig. 2). The interorbital region slopes to the base of the upper mandible, which, rising at its compressed part, leaves a wide concavity in the contour line between the mandible and the cranium proper. Both the temporal (*t*) and the superorbital glandular (*so*) depressions are deep and sharply defined, meeting, but separated respectively, at the mid line by a low, sharp crest.

There is a large lower and a small upper vacuity in the interorbital septum, the former continuous posteriorly with the optic vacuity, the latter with the olfactory vacuity: in the anterior cranial wall there is a pair of vacuities, one on each side of the orbito-sphenoidal base of the ossification, dividing the upper from the lower vacuity in the bony interorbital septum.

The occipital tubercle is subhemispheroid, projecting below the level of the basi-occipital (ib. fig. 3, 1). This is transversely extended, subcarinate, divided by a pair of transverse curved ridges from the basisphenoid (ib. 5). The paroccipitals (ib. 4) are broad, obtuse, trihedral, the narrowest surface being mesiad; the fore surface is concave; the outer margin is continued as a ridge upon the occipital surface, defining the share

developed from longitudinally consecutive series of lateral elements such as represent the hæmapophyses of certain dorsal segments in *Chelonia*. In most birds ossification of the sternum begins from a pair of centres, which, meeting and coalescing at the mid line, thence extend into the cartilaginous basis of the keel. The extra pair in the anomalous sternum of Gallinæ is special and exceptional in the Bird class. The application of the names of the elements of the Chelonian plastron to parts of the Avian sternum is to be deprecated, save in the case of the episternum, the bifurcate character of which is shown by bone in Passerines.

thereto contributed by the mastoid: the fore part of the base forms the posterior tympanic cup. The mastoid (Pl. I. fig. 3, 8) is short, obtuse, inclined downward and forward. The inner and back part of its base is excavated by a deep transverse oval fossa for the anterior condyle of the tympanic element (ib. 28).

The occipital surface of the cranium is vertical, subsemicircular; its upper and lateral border forms a deep and sharp ridge, dividing it from the temporal fossæ. Each fossa is divided into an anterior (ib. fig. 1, 11) and posterior (ib. *t*) compartment; the latter divisions meet above and define a short low "parietal" ridge (ib. fig. 2, 7).

The fore or postorbital part of the temporal fossa is divided from the deeper back part by a low ridge descending from the hind angle of the smooth convex frontal tract to the fore part of the mastoid. The interorbital supracranial space is occupied by the deep oblong fossæ (ib. *so*) of the superorbital glands, between which fossæ is a sharp median ridge. A lateral ridge defines each fossa from the superorbital ridge itself, which is very narrow. There is an oval vacuity for the duct of the gland at the outer and fore part of each superorbital fossa, 4 lines, by 2 lines in diameter; and there are two or three foramina at the back part of each fossa, leading to the orbit. The postorbital process (12) is depressed and triangular, impressed above by the fore part of the temporal fossa, which is there divided by a short longitudinal ridge from the superorbital glandular fossa.

The prefrontals (ib. fig. 1, 14) send outward a triangular antorbital plate, which inclines a little forward to join the lacrymal, but leaving an intermediate lacrymal vacuity about the same size as that for the duct of the superorbital gland.

The basisphenoid rapidly narrows as it advances forward, and does not send out processes (pterygoid processes) for the tympanic or pterygoid bones; its presphenoid prolongation (ib. fig. 3, 9) diminishes in transverse but increases in vertical extent, developing upward the lower part of the interorbital ridge, which is continuous with the ossified anterior part of the interorbital septum, and, by means of its backward extension, with the orbitosphenoids (ib. 10). The lower border of the presphenoid is convex, and rests upon the groove formed by the approximated palatines (20) and intervening vomer (13).

The very thin fore part of the cranial wall shows four large vacuities, one medial and superior, triangular, and giving exit to the crura of the olfactory lobes, which slightly groove the under surface of the interorbital part of the frontals on their way to the prefrontals. On each side and a little below the olfactory aperture is an irregular oblong vacuity. An ossified tract of the interorbital septum extends from the confluent orbitosphenoids, between the above vacuities and below the olfactory one, forward to the anterior ossified part of the septum: a narrow unossified tract lies above, and a broader unossified oblong space is beneath this upper ossified part of the septum. The inferior vacuity gives exit to the optic and orbital nerves.

The palatines (ib. fig. 3, 20) are broadest behind, and present each towards the palate a long triangular surface sloping from within outward and downward, and defined mesially by a low vertical plate bounding an angular cavity thus formed on that surface. The

narrower anterior prolongations of the palatines are confluent with the palatal processes of the maxillaries (Pl. I. fig. 3, 21), near to which they also develop from their inner border a low vertical ridge. The upper surface of each palatal, near its middle part, develops the curved outer wall of the posterior nostril, which is convex externally; the palatal terminations of these nostrils are longer and narrower, and are divided by the compressed elongate vomer (13).

The nasals, confluent behind with the frontals, prefrontals, and lacrymals, soon divide into their premaxillary (ib. fig. 2, 15) and maxillary (15') branches; the former, at first divided by a fissure from the nasal part of the premaxillary (22), coalesce therewith anteriorly; the longer styliform maxillary processes coalesce by their lower end with the maxillary.

The broad part of the palatal plate of the maxillary (ib. fig. 3, 21), whence its palatine, malar, nasal, and premaxillary processes diverge, is perforated by the oblique foramen (*l*) conveying the lacrymal and superorbital secretions to the angle of the mouth. The premaxillary processes are divided by the back part of the long prepalatine fissure (*f*), about 2 lines in breadth. The malar process is depressed, about an inch in length, and underlaps the fore half of the malar. The nasal process rises to the inner side of, and is partly confluent with the maxillary process of the nasal bone; which process (ib. fig. 1, 15') is subcylindrical, and extends downward and forward from the interspace between the lacrymal bone and the premaxillary part of the nasal, dividing the large external nostril (15') from the antorbital (21') vacuity.

The premaxillary chiefly forms the compressed, subarcuate, pointed upper mandible, which is grooved on the narrow palatal surface (ib. fig. 3, 22'') for an extent of 1 inch 6 lines from the apex, where the prepalatal vacuity commences. The fore end of the groove is divided by a short delicate median ridge. The nasal process of the premaxillary (22) assumes behind the rostral part of the bone a trihedral shape, gradually becoming flat and then concave below; it is grooved above, the groove deepening to a fissure, and dividing the back part of the process where it joins the frontal. The nasals (15) are also partly divided by linear fissures from this part of the premaxillary, with which they are confluent at both ends.

The pterygoids (fig. 3, 24) are slender, slightly bent, trihedral bones, articulating anteriorly to short pterygoid processes at the inner and back part of the palatines, and posteriorly with an articular tubercle on the inner side of the base of the inner division of the lower articular end of the tympanic (28). The limits of the styliform malar (ib. fig. 3, 26) and squamosal (27) are indicated by grooves; the latter articulates with the outstanding lower and outer angle of the tympanic.

The tympanic articulates by two convex condyles with the mastoid and paroccipital; its body slightly contracts below these, and sends from its fore part a long compressed triangular process, with the apex obliquely truncate; its lower end is much expanded, and supports two articular surfaces: the outer one (fig. 3, 28) is oblong and oblique,

convex anteriorly, and concave posteriorly, where it is extended upon a short posterior process, forming the squamosal cup; the inner and smaller facet is convex, and above this is the pterygoid tubercle.

The lower tympanic condyles are adapted to two corresponding cavities on the articular part of the mandibular ramus, which developes behind them a vertical triangular surface, the outer and inner margins of which are produced into cristæ. There is a small coronoid process external and anterior to the outer articular surface. The surangular part of the ramus shows an oval vacuity, about 3 lines by 2 lines; the groove defining the surangular from the angular part widens as it advances, and leads to an oblong fissure between the surangular and dentary elements.

The splenial element retains its distinctness posteriorly, and a groove upon the lower margin of the ramus indicates the extent of its forward production: the posterior limits of the posteriorly bifurcate dentary element are clearly defined. The right and left of these elements coalesce to form a compressed, pointed symphysis, 1 inch long, half an inch deep at the back part, gradually contracting forwards to a point, with a grooved upper surface; the upper margin of the symphysis is slightly convex lengthwise, the under margin slightly concave lengthwise.

The outer surface of the symphyseal part of the jaw is roughened by numerous small perforations and grooves, indicating the vascularity of the periosteum in connexion with the reproductive matrix of the horny sheath of the beak: the tip of the premaxillary has a similarly sculptured surface.

The basihyal, including the urohyal, is 10 lines in length; the fore end of the basihyal is slightly expanded, and occupied by a trochlear articular surface, convex transversely, concave vertically. The bone again expands to form the pair of concave oval articular facets for the thyrohyals, beyond which it is continued as a slender pointed style (urohyal) for about 4 lines; the part anterior to this is the true basihyal. The thyrohyals (hyobranchyals) are slender, slightly bent styles, 2 inches long, swelling into a small knob at both ends, the one articulated to the basihyal being rather the largest.

§ 3. *Scapular Arch and Appendage.*

The bladebone (Pl. I. fig. 1, 51), 3 inches 8 lines in length, extends backward to the ninth rib, gradually expanding vertically and more quickly flattening laterally to its free extremity, which is truncate obliquely from above downward and backward. The proximal end has opposite dimensions, being much expanded laterally or transversely to the axis of the trunk, and narrowest vertically; it presents a broad transverse condyle, which is a little expanded at each end, to the coracoid. The outer end is the broadest; the inner one the most produced. The shaft of the scapula quickly contracts to a transverse diameter of 3 lines, and then begins to grow thin and broad, but as if with a kind of twist, the inner or medial border near the head of the bone

becoming the upper border about a fifth of the way from that end. The inner end of the condyle is connected by a strong ligament with the end of the furculum.

The coracoid (Pl. I. fig. 1, 52) has a breadth at its sternal end of 14 lines: the medial side of this end is thick, with the posterior angle produced; the outer side is thin, and sends off above the sternal articulation a lamelliform process. The inner side of the sternal expansion is slightly concave. The coracoid contracts to a diameter of 5 lines, continuing thick and convex along its medial border; it sends off from the inner and back part of its proximal end a strong compressed process, which is perforated, and which develops the articular cavity for the inner condyle of the scapula, and is attached by a short ligament to the end of the furculum: the main continuation of the body of the bone supplies the rest of the joint for the scapula, with the major part of that for the humerus, and then arches forward as a strong process to abut against the articular surface of the clavicle (furcular prong), situated upon the upper and outer part of that bone, about 6 lines from the extremity, which is ligamentously connected with the scapula and inner part of the clavicular process of the coracoid. The body of the coracoid is, as usual, straight and inclined from the sternum upward, forward, and slightly outward, losing breadth, gaining thickness, and assuming the trihedral form as it rises.

The clavicle (ib. 53), anterior to the coracoid articulation, becomes compressed, curves with a strong convexity forward, and then bends inward and backward, thickening and expanding to become confluent with its fellow, in the form of an inverted but somewhat narrow arch (Pl. II. fig. 3). The length of each half of the so-formed furculum, following the curve, is 4 inches 6 lines; a short convex ridge is developed from the point of confluence, which does not reach the anterior apex of the sternal keel.

The humerus (Pl. I. fig. 1, 53; Pl. II. figs. 8, 9, 10), 4 inches 2 lines in length, is much expanded at the proximal end (Pl. II. fig. 8), where it measures 1 inch across: the shaft is compressed, measuring 6 lines in long diameter, and only $2\frac{1}{2}$ lines in short diameter, midway between the two ends (as in the outline above the fig. 9).

The articular head (*a*) is a semioval convexity, 8 lines by $4\frac{1}{2}$ lines, overhanging the concavity (*d*) on the anconal side, with the long axis extending from the radial (*b*) to the ulnar (*c*) side, and with the ends continued upon the beginning of the radial and ulnar (*c'*) crests, of which the former is upper, the latter lower, in the natural position of the bone. The radial crest or tuber is directly continued, contracting, into the pectoral ridge. The ulnar crest is prominent, subtriangular, convex palmad, concave anconad, and sending off on this surface a thick ridge (*c'*) which divides the concavity into a proximal depression (*d*), and a deeper distal one (*e*), into which an air-cell has entered, but without pushing itself into the interior of the bone. From near the radial end of the articular convexity, a thick ridge or raised rough surface (*f*) extends about 8 lines down the bone; it gives insertion, by a well-marked narrow elliptical depression, to the second pectoral muscle, the raiser of the wing. Below this ridge the convexity

of the shaft rapidly subsides into the almost flattened outer or radial surface. The opposite surface at the proximal end of the shaft is concave, but becomes slightly convex, transversely, down the rest of the shaft. The borders bounding the flattened shaft, of which the radial one is formed chiefly by the pectoral ridge, describe very slight sigmoid curves. The pectoral ridge is long and low, much less developed than in birds of flight. A short ridge (Pl. II. fig. 9, *g*), abruptly rising from the end of the radial border, extends to the middle of the distal anconal side of the radial condyle. This (fig. 10, *h*) is long and narrow, extending further proximad by half its length than the ulnar condyle (ib. *i*) does. The ulnar condyle is shorter and thicker: both project towards the palmar aspect, and do not terminate the bone distally. The broad articular surface of the ulna is adapted to both condyles, but covers only the distal half of the radial one, the radius gliding upon the upper half. The breadth of both condyles is 5 lines. The anconal surface (fig. 9) is divided into two grooves by three ridges, the ulnar one (*k*) being the longest, the radial one (*l*) the shortest; and the ulnar anconal groove is consequently larger than the radial one. All the three anconal ridges project distally beyond the condyles. There is a well-marked flat surface above the ulnar condyle for the attachment of a strong lateral ligament.

The shaft of the humerus contains a narrow medullary cavity (fig. 9'). The orifice of the medullary artery is close to the anconal border, about an inch below the ulnar edge.

The radius (Pl. I. 54) and ulna (55), connected only at their extremities, have opposite curves, leaving a wide interosseous space. The radius is but half the thickness of the ulna, and is more bent. A tuberosity projects on the radial side just below the thickened proximal articular end: below this the shaft is slightly contracted; it then expands and becomes compressed, with the radial border more convex than the ulnar one is concave. The anconal surface is longitudinally channelled near the radial edge, deepening towards the wrist, where there is a second but short groove ulnad of the longer one.

The olecranon is short, obtuse, with a longitudinal groove on each side of its base, narrowing the bone between the process and the articular surface of the ulna. A sesamoid in the biceps flexor tendon plays in the palmar groove; it is the homotype of the patella: two other sesamoids in the triceps extensor tendon play in the two grooves in the anconal part of the distal end of the humerus: these answer homotypally to the fibular extension which plays in the popliteal groove of the outer femoral condyle. The shaft of the ulna, though compressed, is at the proximal half three-sided, the narrowest side being toward the radius, and contracting to a sharp border at the distal half. There are no quill-pits. The distal articular surface is convex from the radial to the ulnar side, but slightly concave transversely, and is accordingly somewhat trochlear. A tuberosity projects above it on the outer side, near the radius. The length of the anti-brachium is 2 inches 4 lines.

The radial carpal bone (Pl. I. 56) presents a trochlear surface, concave from the radial to the ulnar end, convex transversely to the magnum, here confluent with the base of the mid metacarpal (III). The ulnar carpal (55') is the smaller bone, and offers a deeper groove to the convex compressed process of the base of the fourth or "annulus" metacarpal (IV). The second or index metacarpal (II) is 6 lines long, compressed, and confluent by its whole length to that of the medius. It supports a phalanx (1), 10 lines long and pointed at the end, which does not quite reach that of the mid metacarpal. This (ib. fig. 1, III) is 1 inch 9 lines long, inclusive of the magnum, and is confluent with the fourth slender metacarpal (IV) at both ends, leaving an interosseous space 1 inch 1 line long and 2 lines wide.

The proximal phalanx of the medius (III. 1) is broader than the metacarpal, having its ulnar border extended into a ridge and slightly produced beyond the distal articular end. To this is joined a second phalanx (ib. 2), terminating, like that of the forefinger, in a point. The length of the hand is 3 inches 6 lines. The broad and flattened general character of the bones of the fore limb relate to the support of a surface in the shortened wing adequate, as a fin, to strike the water with effect.

§ 4. *Pelvic Arch and Appendage.*

The pelvic arch has been described. Its appendage departs less from the general ornithic type than does that of the scapular arch.

The femur (Pl. I. fig. 1, 65; Pl. II. fig. 11), 2 inches 10 lines in length, shows the usual extension of articular cartilage from the head to the upper part of the neck and great trochanter, expanding upon the latter. The ligamentum teres is implanted in the upper part of the head. The trochanter does not rise to a higher level; the ridge at its fore part descends about 6 lines upon the bone, gradually subsiding; the back or outer side of the trochanter is broad and nearly flat; the popliteal side of the shaft of the proximal part is flattened, the rotular side is concave. The shaft soon assumes a full elliptic transverse section, is very slightly bent, with the concavity backward; it slightly expands to the distal condyles. It has a large medullary cavity. The rotular groove is wide, and is partially defined from the intercondyloid or popliteal groove, in which are the depressions for the crucial ligaments. The outer condyle has the usual backward or popliteal production, vertically grooved for the compressed head of the fibula.

The tibia (Pl. I. fig. 1, 66; Pl. II. fig. 12) is 5 inches 2 lines in length. The proximal articular surface is but feebly defined; the tibial or inner division is the largest; the fibular division is convex. The rotular process, of a triangular form, with a base as broad as the tibia, rises half an inch above the articular surface, and sends off a procnemial (Pl. II. fig. 12, *p*) and an ectocnemial (*e*) ridge. The latter is short, thick, and angular; the former is long, thin, and also forms a low angle. The proximal part of the shaft of the tibia is trihedral: there is an oblong tuberosity on the inner or

tibial side. Eight lines below the articular surface commences the fibular ridge, which has a similar extent; the fibula is ankylosed therewith in the skeleton from the mummified specimen, but not in the bones of the Great Auk sent to me by Mr. John Hancock. After an interval of separation of about 3 lines, the fibula (ib. 67) coalesces in both specimens with the tibia, and can be traced to within an inch of the distal end of the bone. The shaft of the tibia soon acquires a form giving an ellipse in transverse section, elongated from side to side; it very gradually diminishes to within an inch of the distal end, and then slightly expands to the condyles. The precondyloid groove (*f*) for the tendon of the extensor communis muscle is bridged over by ligament, not by bone; it subsides upon the shaft an inch below its summit; it is submedian in position; its lower outlet is transversely elliptical, and just above the intercondyloid space. Of the anterior prominent parts of the distal condyles, the outer (fibular) one (*b*) is rather broader than the inner (*a*), and is narrower than the intercondyloid space.

The canal leading to the bridge is wide and bounded by a ridge chiefly on the tibial side. The ectocondyloid surface is almost flat, slightly concave; the entocondyloid surface is made more concave by the prominence of the periphery of the condyle, and is divided by a ridge developing a tubercle towards the posterior part of the condyle. The posterior trochlear surface of the condyle is very slightly concave transversely, with a low median convexity. The transverse and antero-posterior diameters of the distal condyles are equal.

The metatars (Pl. I. fig. 1, 69; Pl. II. fig. 13), 2 inches 2 lines long, has the outer condyloid concavity (*b*) lower than the inner one (*a*) anteriorly; the calcaneal ridge is low and vertically perforated. In the anterior concavity there is a smaller fore-and-aft canal. The inner (tibial) element (*a*, *ii*) is the shortest; the trochlea of the middle one extends 3 lines beyond it; the cleft between this and the outer trochlea extends anteriorly to the lower fore-and-aft canal (*c*), but not posteriorly. The outer condyle (*iv*) ends about a line above the middle one.

The inner toe (Pl. I. fig. 1, *ii*), of three phalanges, is 2 inches 5 lines long; the middle toe (*iii*), of four phalanges, is 3 inches 3 lines long; the outer toe (*iv*), of five phalanges, is 3 inches 2 lines in length, and the slenderest of the three, the middle one being the thickest.

Save in parts of the cranium, no bone in the skeleton of *Alca impennis* is pneumatic; but the humerus has a medullary cavity, as well as the femur and tibia.

§ 5. Comparison of the Skeleton.

In *Alca impennis* there are twenty-two free vertebræ between the skull and sacrum, in *Alca torda* twenty-one; but, in the specimen in the museum of the Royal College of Surgeons¹ yielding that number, the homologue of the twenty-second vertebra in *Alca impennis*, supporting the penultimate pair of free thoracic ribs, has coalesced with the

¹ Catalogue of Osteology, 4to, 1853, vol. i. p. 221, no. 1146.

sacrum. The last pair of ribs, articulated in both species to a sacral vertebra, have hæmaphyses which do not reach the sternum. The chief numerical difference in the vertebral column is in the excess of caudal vertebræ in the Garfowl. The dorsal vertebræ have the same simple shallow ball-and-socket joint, the ball being anterior in *Alca torda*, as in *A. impennis*; and this structure I have also found more feebly developed in the dorsal of *Uria grylle*: in *Phaleris* both co-adapted surfaces are nearly flat. The main difference in the skull is the shortness, greater relative depth, and stronger convex curve of the upper contour of the solid prenasal part of the premaxillary: every other better character of affinity is very closely repeated.

The sternum of *Alca torda* repeats the characteristics of that of *Alca impennis*, with the exception of a notch on each side of the back part, 1 inch long by 3 lines wide. In *Alca* (*Phaleris*, Temm.) *psittacula*, Pallas, the sternum is more dilated posteriorly, and the notches are represented by oblong foramina of a wider form. The interorbital part of the cranial roof is narrower, and the upper end of the lacrymal projects upward and backward as a process. In *Uria grylle* (Pl. II. fig. 14), besides the posterior notches (*f*) answering to those of *Alca torda*, there is a small perforation, sometimes two (ib. *f'*, *f''*), on the inner side of each.

The furcular and scapular arches of *Alca torda* closely correspond with those of *Alca impennis*. The coracoid is similarly perforated for a branch of the pectoral artery.

The humerus closely agrees in shape and proportion; the difference in the wing-bones, in adaptive relation to the power of flight, of *Alca torda*, begins to manifest itself in the antibrachial bones, which are longer and less compressed than in *Alca impennis*, the ulna also having a row of quill-pits or knobs: the bones of the head are shorter relatively to the ulna than in *Alca impennis*.

A closer resemblance is maintained between *Alca torda* and *A. impennis* in the bones of the pelvic limb, and is especially seen in the shape and proportions of the rotular process, with its pro- and ecto-cnemial ridges, and in the proportions and attachments of the fibula.

The sum of the comparisons of the skeleton of *Alca impennis* with that in other Auks, Phalerins, and Puffins, and also in Guillemots, goes to exemplify the close affinity of the Garfowl to those sea-birds, and to indicate that it is a modified apterous member of the *Alcadæ*.

The Penguin, similarly apterous or with wings reduced to the function of fins, shows its essential distinction from the Garfowl in all the flight-giving parts of the skeleton. The number of vertebræ between the skull and sacrum is, indeed, the same; but only eight support moveable ribs, the total number of which is nine pairs, the last pair being sacral. The atlantal hypapophysis is produced below into a compressed process; the anapophyses of the axis and two following vertebræ are mere tuberosities, not elongated into processes. The pleurapophyses are styliiform and produced backward in the third to the tenth cervical, thence are shortened to the fourteenth, when the pleurapophysis

reappears as a separate styliiform rib. The first four cervical vertebræ have each a single posterior hypapophysis; the sixth to the tenth inclusive have a pair of parapophyses simulating anterior hypapophyses.

The parapophyses begin to project downward in the sixth cervical, increase in size and convergence to the ninth, and at the tenth have a common median base, like a bifurcate anterior hypapophysis; in the eleventh cervical they disappear, and are replaced by a true hypapophysis from the mid line of the under surface of the centrum: it is a compressed subquadrate plate, decreasing in length in the three succeeding cervicals, in the last of which the parapophyses reappear as short horizontally extended plates, the origins of which, approximating in the second dorsal, combine in the third to form the lamelliform stem of a pair of diverging plates, which decrease in size in the fourth with antero-posterior increase of the base of the stem, and in the fifth dorsal are reduced to an expansion of the end of the stem, which now has reassumed the character and position of a compressed lamelliform hypapophysis, which gradually diminishes to the last dorsal¹. In the sacrum it is represented by a hypapophysial ridge, which subsides in the fourth of the coalesced series of vertebræ.

In *Alca impennis* the lamelliform hypapophysis first appears on the tenth vertebra, is reduced to a tubercle on the twelfth, and disappears on the thirteenth and fourteenth. The fore part of the sacrum is carinate below in the Penguin, but not in the Garfowl. The number of free caudal vertebræ is eight in the Penguin, eleven in the Garfowl.

The cranial part of the skull is proportionally larger and longer in the Penguin; it is smooth and more convex above; neither the temporal nor superorbital glandular depressions meet at the mid line, and the temporal depression is narrower above, and is not divided into an anterior and posterior facet as in the Garfowl. In *Eudyptes chrysolophus* the glandular depressions are large, deep, and meet for a short extent anteriorly: the temporal fossæ are more than an inch apart on the calvarium. The cerebellar prominence projects much further at the back of the skull in the Penguin than in the Garfowl. The paroccipital process is stronger than the mastoid, whilst in the Garfowl they are equally developed. The condyles of the tympanic are bent more back, the orbital process of this bone is relatively shorter, and the distal articular end is narrower, in the Penguin. The pterygoids are more expanded anteriorly; the palatines are broader, and are convex below, in the Penguin, instead of being concave.

The nasal bone retains its distinctness from the premaxillary and maxillary in the Penguin, and has coalesced only with the frontal and prefrontal posteriorly; its maxillary prong is inclined more forward, at an acuter angle with the premaxillary prong, than in the Garfowl, and it ends in a free point. The lacrymal is broader and longer, reaching the malar below in the Penguin. The premaxillary is comparatively short and rounded: the Penguins have a quite different type of beak from that in the *Alcadæ*. The malo-squamosal zygoma is sigmoidally bent, chiefly concave below, not straight as

¹ Phil. Trans. 1851, pl. 52. figs. 48-51.

in the Garfowl. The mandible retains as instructive marks of its primitive composition in the Penguin as in the Garfowl, and enables one to see that in the former the surangular is relatively longer, the dentary shorter, but with its lower prong more produced posteriorly; the angular is more produced behind the articular; the rostral part of the dentary corresponds in shape with the same part of the premaxillary, and differs in the same degree from that of the Garfowl¹.

The sternum, perhaps the most characteristic of natural affinity of any single bone in the bird's skeleton, exemplifies the essential distinction of the two species, which are alike adaptively modified for marine existence, with abrogation of the power of flight.

In the Penguin the sternum is destitute of episternal process, and has two posterior notches, equalling in depth half the length of the entire bone. The front and lower borders of the keel are straight. The coracoid grooves meet at the mid line, and their posterior wall is developed into a broad triangular process, with an obtuse apex, the outer angle of the base of which answers to the costal process of the sternum in *Alca impennis*. The costal part of the lateral border is relatively shorter in the Penguin, and affords articulation to only six hæmapophyses. The lateral margins behind the costal portion converge to the posterior part of the sternum, the middle part of which between the lateral styles narrows to a point where the keel ends.

The coracoids in *Aptenodytes* are conspicuous for their great length and strength, for their columnar-like convexity transversely on the outer or fore surface, and their flattened hinder or inner surface, which is concave transversely at its lower third. In *Aptenodytes antarcticus* the length of the coracoid is four-fifths that of the sternum; in *Alca impennis* it is less than two-fifths. The inner lamelliform process from the scapular end is more produced in *Aptenodytes*, and is notched in *Eudyptes*, instead of being perforated; the outer lamelliform process from the sternal end is much less produced. The scapula in *Aptenodytes* is remarkable for its unusual breadth as compared with that of other birds; it is nearly twice as long as the humerus, whereas in *Alca impennis* it is shorter than the humerus.

The clavicles in the Penguin are also of unusual breadth towards their upper ends, and converge to their medial union at a more acute angle than in *Alca impennis*. The humerus, besides being relatively shorter in the Penguin, is broader and more compressed, less expanded at both ends, but especially proximally.

¹ In *Sula* the basioccipital is impressed by a pair of large and deep circular pits for the insertion of strong *musculi recti capitis antici*; these pits are bounded externally by strong ridges descending and diverging from the sides of the occipital condyle to the hypapophysial tuberosities. From the outside of the base of each tuberosity a buttress flies upward and outward to the paroccipital, circumscribing the space in which lie the carotid and pneumogastric foramina. The pretympenic fossa between the alisphenoid and mastoid rises vertically for more than half an inch; its inferior subcircular opening or entry is 4 lines in diameter. There are no pterapophyses. The coalesced palatines present a narrow, oblong, flattened surface below; and from the mid line of the posterior part descends a triangular crest of bone, between the pterygoid articulations. The palatal nostril is single, medial, 2 lines wide by 8 lines long.

The pneumatic fossa is much deeper, but does not extend into the shaft ; the two olecranal grooves are relatively narrower, and restricted to the posterior inferior angle of the lamelliform shaft ; a sesamoid in the extensor tendon plays upon each. The articular surfaces for the radius and ulna are feeble convexities upon almost the same transverse line, and the joint scarcely allows of the movements of flexion and extension. In the *Alca impennis* it is adapted for much freer motions.

The radius and ulna are of equal size in the Penguin, are much compressed, straight, and leaving a mere linear interosseous space. The shaft is solid¹. The ulnar carpal bone projects as a flattened triangular plate from that side of the wrist, and simulates by its distal extension a metacarpal bone. The radial (index) metacarpal is feebly indicated by a low ridge from the proximal half of that border of the mid metacarpal—this is broad and flat ; the narrower but similarly shaped “ fourth ” metacarpal coalesces, as usual, by both ends with the third ; each of these supports a proximal phalanx, which is pointed in the “ fourth ” ; that of the mid digit supports a second phalanx, also compressed and pointed. The “ hand ” in the Penguin is longer than the humerus ; in the Garfowl it is shorter.

The iliac bones in the Penguin are remarkable for their divergence as they advance from the acetabula, and for their convergence anteriorly ; they describe a sigmoid curve, and are flattened horizontally : the sacrum is more expanded, and more abruptly so anterior to the acetabula. The crest of the sacrum is more developed throughout its whole length in the Penguin. The more extensive co-ossification of ilium and ischium reduces the ischiadic foramen to a much smaller relative size than in the Garfowl. The obturator foramen is continuous with the linear interval between the ischium and slender pubis, and this is much shorter relatively than in the Garfowl, extending scarcely as much beyond the ischium as this does beyond the ilium.

The femur of the Penguin is thicker in proportion to its length. The rotular process of the tibia is shorter ; the hollow between the pro- and ecto-cnemial crests is deeper ; the patella is relatively larger. The anterior distal tendinous groove is bridged over by bone. The ridge on the tibial side of the back part of the distal trochlea is more produced in the Penguin. But the most marked distinction in the bones of the leg of the Penguin is the shortness, breadth, and persistent amount of distinctness of the three confluent metatarsals. The toes are also relatively shorter and thicker ; and there is a rudiment of a hallux or inner toe², which is entirely wanting in *Alca impennis*.

The result of this comparison is to show that the URINATORS of Blyth (Orr's Cuvier's ' Animal Kingdom,' 8vo, 1840, p. 267) is an artificial group, and that the wingless sea-bird of the southern region is of a family distinct from that to which the wingless sea-bird of the north belonged : but we have not yet found among the winged

¹ Catalogue of Osteology, vol. i. p. 219, no. 1137.

² Descriptive Catalogue of the Osteology, Mus. Coll. Surg. vol. v. p. 216, no. 1117.

sea-fowl of the south any that manifest so close an affinity with the species of *Aptenodytes* as many of the northern winged sea-fowl show to *Alca impennis*. To speculate upon the derivative origin of either bird would be more agreeable than useful or really instructive.

Since the foregoing pages were in type, I have been favoured by SAMUEL LAING, Esq., of Keiss Castle, Wick, N. B., with an inspection of the remains of animals serving as food to an ancient race of men of the flint age, in Caithness-shire.

Amongst the bones of birds in this kitchen-midden, including those of the Gannet (*Sula bassana*), Shag (*Phalacrocorax graculus*), Cormorant (*Phalacrocorax carbo*), and Razor-bill (*Alca torda*), were the following bones of the Garfowl (*Alca impennis*, L.) :—

The anterior or free extremity of the premaxillary ; a right and left humerus ; a left tibia, and parts of three other tibiæ, left and right.

The premaxillary showed a little more vertical diameter than that of the specimen from Newfoundland, here described. In both, the extent from the tip to the fore margin of the bony external nostril is 2 inches ; the vertical diameter in front of the nostril in one is $9\frac{1}{2}$ lines, in the other it is 11 lines.

The more recent testimonies of the Garfowl in the N.W. coasts of Scotland may be seen in MACAULAY, 'History of Kilda,' 1764, and in SIBBALD, 'Scotia Illustrata,' 1684.

DESCRIPTION OF THE PLATES.

PLATE I. (*Alca impennis*).

- Fig. 1. Side view of the skeleton of the Garfowl (*Alca impennis*) : half nat. size.
 Fig. 2. Upper view of the skull : nat. size.
 Fig. 3. Under view of the skull : nat. size.
 Fig. 4. Upper view of the skull of *Uria Grylle* : nat. size.

PLATE II. (*Alca impennis*).

- Fig. 1. Under surface of the sternum of *Alca impennis*.
 Fig. 2. Fore part of the same sternum.
 Fig. 3. Furculum of *Alca impennis*.
 Fig. 4. Under view of fourth cervical vertebra of *Alca impennis*.
 Fig. 5. Upper view of fourth cervical vertebra of *Alca impennis*.
 Fig. 6. Side view of fourth cervical vertebra of *Alca impennis*.
 Fig. 7. Back view of fourth dorsal vertebra of *Alca impennis*.

- Fig. 8. Proximal half of humerus, anconal or outer side, *Alca impennis*.
Fig. 9. Distal half of humerus, anconal side, *Alca impennis*.
Fig. 9'. Outline of section of shaft and medullary cavity of *Alca impennis*.
Fig. 10. Distal end of shaft and medullary cavity of *Alca impennis*.
Fig. 11. Front view of left femur, *Alca impennis*.
Fig. 12. Front view of left tibia and fibula, *Alca impennis*.
Fig. 13. Front view of right metatarsus, *Alca impennis*.
Fig. 14. Under surface of the sternum of *Uria Grylle*.

(All the figures of Plate II. are of the natural size.)