

1. NOTES ON THE SKELETONS OF WHALES IN THE PRINCIPAL MUSEUMS OF HOLLAND AND BELGIUM, WITH DESCRIPTIONS OF TWO SPECIES APPARENTLY NEW TO SCIENCE. BY WILLIAM HENRY FLOWER, F.R.S., F.R.C.S., CONSERVATOR OF THE MUSEUM OF THE ROYAL COLLEGE OF SURGEONS.

Having had an opportunity during the autumn of examining personally the extensive collections of skeletons of Cetacea contained in several public and private museums in the Netherlands, I have put together some notes, chiefly with reference to the *Balænoidea* or Whalebone Whales. I trust that they may be of interest to students of this branch of zoology, as affording an indication of the localities in which the different specimens are to be found, and also as a contribution towards elucidating the difficult subject of the specific and generic characters of these animals, more especially of the subfamily *Balænopterinae*, or Fin-Whales.

Before proceeding further I am glad to avail myself of this opportunity of expressing my thanks to the directors of the various museums which I visited, and especially to Professor Schlegel of Leyden, Professor Van Beneden of Louvain, and M. le Vicomte Du Bus of Brussels, not only for their liberality in giving me unrestricted access to the treasures under their care, but also for numerous personal acts of kindness during my stay in their respective cities.

Certain general observations that have occurred to me during the examination of the osseous remains of Cetacean animals will form a necessary prefix to the special notes, in order to give an idea of the means employed in arriving at conclusions in reference to the specific distinction or identity of different individuals. These will be followed by some remarks upon the classification and nomenclature employed in speaking of the various species of Whales.

The alterations which take place in the bones at different periods of life render it an object of primary importance in investigating the skeletons of Cetacea, to ascertain as near as may be the relative age of the individual under examination. Unless this is carefully recorded, the description cannot be considered as complete. For this purpose the condition of the osseous tissue generally, the development of the various apophyses, especially those of the vertebræ, the state of the sutures of the cranium, and of the epiphyses of the vertebral column and of the bones of the pectoral limb afford the best indications.

In the early periods of life the bones have a peculiarly fibrous or spongy texture, and the apophyses, especially the spines and transverse processes of the vertebræ, are obviously unfinished, being abruptly and roughly truncated. Even to a comparatively late period portions of the cartilaginous skeleton, as the ends of the transverse processes of the cervical vertebræ, the olecranon, and the upper border of the scapula, remain unossified; and the peculiar appearance presented by the surface of the bone in this condition is such that it cannot be mistaken by the careful observer. This applies of course to macerated skeletons; for, as Eschricht has demonstrated, the form of each bone of the adult skeleton is defined at a very early stage of



foetal life in cartilage; and the peculiar characteristics of the mature animal can be obtained far more accurately from the examination of such a specimen, than from that of the bony portion only of the partially ossified skeleton of a half-grown individual.

In young skeletons all the bodies of the vertebræ have readily detached disk-like epiphyses at each end. These commence to unite to the main portion of the bone at the two extremities of the series, the union in the case of the central vertebræ not taking place until most other signs of immaturity in the skeleton have disappeared. I have observed also that in the individual vertebræ it is usually the epiphysis furthest removed from the middle of the column, *i. e.* the anterior one in the cervical region and the posterior one in the caudal region, which first join the body of the bone. It is stated by Professor Owen that "this embryonic condition is not obliterated at any age in these gigantic aquatic mammals, which, being sustained in a medium of nearly their own specific gravity, have more need of flexibility than firmness in the vertebral column"\*.

Certainly in the large majority of museum specimens the vertebral epiphyses, at least in the dorsal and lumbar regions, are still unattached; but their union with the bodies of the vertebræ, and the complete obliteration of all trace of their original autogeny, throughout the vertebral column in the adult animal is well seen in the large skeletons of Common Fin-Whales (*Physalus antiquorum*) in the British Museum, Alexandra Park, Rosherville Gardens, and Antwerp Zoological Gardens.

The humerus has two epiphyses, upper and lower; the radius and ulna also two each. The order in which these unite to the diaphysis is as follows:—That of the lower end of the humerus and upper end of the ulna and radius about the same time, then that of the upper end of the humerus; these are all united before the epiphyses of the bodies of the dorsal and lumbar vertebræ. Lastly, and only at a comparatively late period of life, when the vertebral column is completed, do the peculiar small rough nodules of bone developed in the mass of cartilage which forms the lower end of the radius and ulna become united to the shaft.

The obliteration of the sutures of the cranium affords some indications as to age: for instance, the distinctness of the basisphenoid from the presphenoid and basioccipital bones, and of the exoccipitals from the supraoccipital, indicates a very early condition; but after the union of these, very little change takes place, except the soldering of the supraoccipitals with the parietals and frontals, the majority of the bones remaining, as far as I have yet had an opportunity of observing, distinct and separable throughout life.

We are able from these indications to divide, for practical purposes, all the skeletons that may be met with into three stages of growth. I. In the first, all the epiphyses of the vertebral column, and of both ends of the humerus, radius, and ulna, are still separate, and the processes of the vertebræ are very incomplete. The animal remains in this condition until it has attained to more than half the length of

\* Descrip. Cat. Osteol. Series, Mus. Roy. Coll. Surgeons, 1853, vol. ii. p. 440.



the adult (e. g. *Balænoptera rostrata*, Mus. Roy. Coll. Surg., 17' long; *Physalus antiquorum*, The Hague, 40' long; *Megaptera longimana*, Leyden,  $28\frac{1}{2}$ ' long; ditto, Louvain, 33' long). This stage of growth may be designated as "young"; towards its close the majority of the bones lose the spongy character of the "very young" animal, and acquire the firm structure characteristic of succeeding ages.—II. In the next stage, both epiphyses of the humerus, those of the upper end of the radius and ulna, and those of the bodies of the anterior cervical and the posterior caudal vertebræ are united, while those of the greater part of the column are still free. The ossification of the transverse processes of the cervical vertebræ, although often still incomplete at the ends, has gone on so far as to give them in great measure the characteristic form seen in the adult. This is a condition in which skeletons are frequently seen in museums. The animal while in this stage, which may be called "adolescent," has attained nearly its full size (*Balænoptera rostrata*, Mus. Roy. Coll. Surg., 25' long; *Balæna mysticetus*, ibid., 47'; ditto, Brussels, 50'; *Megaptera longimana*, ibid., 46'); the reproductive functions have also come into action (*Balæna mysticetus*, ♀, Mus. Roy. Coll. Surg., pregnant).—III. The last stage, or the perfectly "adult," in which all the vertebral epiphyses are ankylosed, I have met with among the Balænoidea only in the large Fin-Whales of the common species mentioned before. Adult Hyperoodons and other Delphinoids are not uncommon in collections.

It is possible that variations may occur in different species or different individuals in the order of completion of the several parts of the skeleton. The foregoing observations are founded upon a careful examination of upwards of twenty skeletons of Whalebone Whales of different species. If not complete, they at least indicate a line of inquiry important to the exhaustive study of the anatomy and zoology of the Cetacea.

The next point to which I would draw attention is the amount of variation found among different individuals of the same species—a point which will assist greatly in determining what differences in similar specimens may be considered as specific; and yet it is one which cannot absolutely be settled until the limits of the species themselves are definitely fixed. Some years ago, when many species which we now know to be very different were thrown together into one, the individuals of a supposed species were found to vary extremely among themselves. It is possible that the same error may be made at present, and species still confounded which more critical examination will show to be distinct. We must feel our way cautiously, and I shall therefore under this heading only take for illustration some of the best-known and most generally accepted species, and see what can be derived from an examination of some of their best-marked characteristics.

First, as to variations in size. It will help much in determining specific identity of new or little-known species, if we can show, among those that are well known, what is the usual amount, and what the limit, of variation in this direction; for we may assume that it is at



least probable that the same laws govern the different members of a group so well-defined as the Whales. No species of Balænoid Cetacean is so well determined as the Northern Right Whale (*Balæna mysticetus*), and of none are we able to adduce so many instances of the size that various individuals of the species have attained. A skeleton in a late stage of the adolescent period in the Museum at Brussels measures a little over 50' in length; and Scoresby, as is well known, states that out of 322 examples examined by him no one exceeded 60' in length; indeed the largest measured was 58', being one of the longest, to appearance, that he ever saw. The adult animals must then have a tolerably limited range of variation, within a few feet of either side of 55'. Again, the common and well-marked species *Balænoptera rostrata*, the dwarf of the family, is still in the adolescent stage at 25' long, and there is no instance recorded in which it exceeded 31'. The adult Hump-backed Whale (*Megaptera longimana*) appears to range within 45' and 50' in length. In the Common Fin-Whale (*Physalus antiquorum*) we have evidence of variation at an adult age and in the same (male) sex, of from 60' (Rosherville Gardens) to nearly 70' (Alexandra Park and Antwerp Zoological Gardens). It is possible that this species may sometimes attain a few feet longer, but all the cases in which this is stated require fresh investigation. The alleged length of a Whale in the flesh is rarely to be depended on, and even the given measurements of skeletons are often inaccurate, as much depends upon the method of articulation. Size being in the popular mind a point of vital importance in a Whale, the tendency to exaggerate this quality is a constant obstacle to exact investigation. We may conclude, then, that all the evidence at present available tends to prove that the idea which some naturalists entertain, that Whales have no definite limit to their growth, is incorrect, and that, as in other mammals, there is an average size to which each species attains, subject to individual differences within a moderate range.

The number of vertebræ and number of ribs have been supposed to be subject to considerable individual variation, partly in consequence of several distinct species having been confounded, and partly from the loose way in which these bones have been counted from defective or badly articulated skeletons; but in fact, subject to the exceptional circumstances about to be mentioned, they are quite as constant among the Cetacea as among other Mammalia, and are therefore characters of the highest importance in determining species. Every example of *Balænoptera rostrata* that I have examined in museums, or found recorded, has eleven pairs of ribs, and a total number of vertebræ amounting to 48 or 50. In like manner skeletons of *Physalus antiquorum*, when complete, appear always to have 15 pairs of ribs and 61 or 62 vertebræ. *Megaptera longimana* has 14 pairs of ribs and 53 vertebræ; *Balæna mysticetus* 12-13 pairs of ribs and 54 vertebræ. It frequently happens that the last pair of ribs only attain a rudimentary condition, and, their heads not articulating with the vertebræ, they are lost in preparing the skeleton. This condition of the last (15th) pair of ribs is well seen in the ske-



leton of *Physalus antiquorum* in the Alexandra Park, prepared by Mr. Gerrard, jun.; they measure, the one  $19\frac{1}{2}$ " in length, the other 27", and taper to a point at their upper extremity, being suspended in the position they originally occupied, far removed from the vertebral column. A small rudimentary additional rib, or pair of ribs, attached to the first lumbar vertebræ is sometimes developed; but a fully formed pair of ribs above the normal number is, I believe, never met with.

As to the number of vertebræ, a small amount of latitude may usually be allowed on account of the difficulties connected with the terminal bones of the tail. Very often in specimens in museums several of these are wanting, owing to carelessness in preparing the skeleton; and by a less excusable carelessness the circumstance may not be noted in published accounts of the number of vertebræ possessed by the specimen. But even if all are present, slight discrepancies in enumeration readily occur. In early periods of life, the last vertebra, although certainly formed in cartilage, is not ossified, and the penultimate has so much the appearance afterwards assumed by the last, as frequently to be taken for it; or, again, later in life two or even three of the terminal vertebral elements grow together so as to form a single osseous mass, which is counted as one or several bones according to the discretion of the observer. Therefore, even in well-described skeletons, a discrepancy of one or two in the given number of caudal vertebræ is of no great consequence; but there is no evidence to prove the occurrence of any greater variation in any given species.

It would be interesting to collect an account of the numerous and various differences in detail found in the osteological structure of several individuals of each well-determined species; but to do this with advantage would cause me greatly to exceed the limits originally proposed to this paper. I shall have occasion to mention some of them hereafter, and will next proceed to give such a sketch of the arrangement of the genera of the Whalebone Whales as may explain the names assigned to the different specimens mentioned in the following notes. The materials at our disposal are still so scanty, that I do not suppose that the classification now offered may not hereafter require modification; but it has not been attempted without a personal examination and a very careful consideration, at all events, of all the more important osteological characters of several individuals of each genus.

I perfectly concur with those naturalists who divide the Cetacea into two primary sections, which merit, it appears to me, the rank of suborders. The BALÆNOIDEA or MYSTICETE, or Whalebone Whales, and the DELPHINOIDEA or ODONTOCETE form two natural and equivalent groups, separated from each other by the following (among many others of less importance) trenchant distinctions:—

I. BALÆNOIDEA. Teeth never functionally developed, but always disappearing before the close of intra-uterine life. Upper jaw provided with plates of baleen. Sternum composed of a single piece, generally broader than long, and connected only with the first rib.



No costo-sternal bones. All the ribs at their upper extremity articulating only with the transverse processes of the vertebræ; their capitular processes, when developed, rudimentary, and not forming true articulations with the bodies of the vertebræ. Rami of mandible curved, their anterior ends meeting at an angle, and connected by fibrous tissue, without any true symphysis. Skull symmetrical. Maxilla produced in front of, but not over, the orbital process of the frontal. Nasal bones well developed, symmetrical. Lachrymal bones distinct from the jugal\*.

II. DELPHINOIDEA. Teeth always developed after birth, and generally numerous, sometimes few and early deciduous. No baleen. Sternum elongated, composed of several pieces placed one behind the other, to which are attached the ossified cartilages of several pairs of ribs. The anterior ribs with capitular processes developed, and articulating with the bodies of the vertebræ, as in other Mammalia. The posterior ribs without head, and only articulating with the transverse processes. Rami of mandible straight, the two coming in contact in front by a surface of variable length, but always constituting a true symphysis. Upper surface of the skull generally, if not always, unsymmetrical. Upper end of the maxilla expanded, and produced over the orbital process of the frontal bone. Nasal bones rudimentary and unsymmetrical. Lachrymal bone confluent with the jugal.

In conforming with all the above characters, the Sperm Whales are true Delphinoids; but into the further divisions of this group I do not at present propose to enter.

The *Balænoidea* fall naturally into two families, the *Balænidæ* or *Leiobalæniæ* (Eschricht), Smooth Whales or Right Whales, and the *Balænopteridæ* or *Ogmobalæniæ* (Eschricht), Furrowed Whales or Rorquals.

1. The *Balænidæ* have a very large head (exceeding one-fourth of the total length of the body); no dorsal fin; the under surface of the throat and chest smooth. The bones of the cranium greatly arched, so as to leave a wide interval between the upper and lower jaws. The rostrum narrow and compressed at the base. The orbital processes of the frontals very much prolonged, and extremely narrow and rounded on their upper surface. Tympanic bones broad, rhomboid. The coronoid process of the lower jaw scarcely perceptible. Baleen-plates long and narrow. All, or the greater number of the cervical vertebræ ankylosed together. Hand broad and pentadactylous.

The members of this family are not sufficiently distinguished from

\* The statements, in works of comparative anatomy and zoology, regarding the lachrymal bone of the *Balænoidea*, afford a curious example of the difficulty of eradicating a mistake when once it has become incorporated in scientific literature. The defective condition of most of the skulls preserved in museums was undoubtedly the original source of error; but, notwithstanding Cuvier's distinct description, in the skull of the Rorqual, of the bone "qui ne peut être que l'analogue du lacrymal" (Oss. Foss., edit. 1836, t. viii. p. 275), the absence of the lachrymal is repeated as a character of the section in many of our most valued treatises.

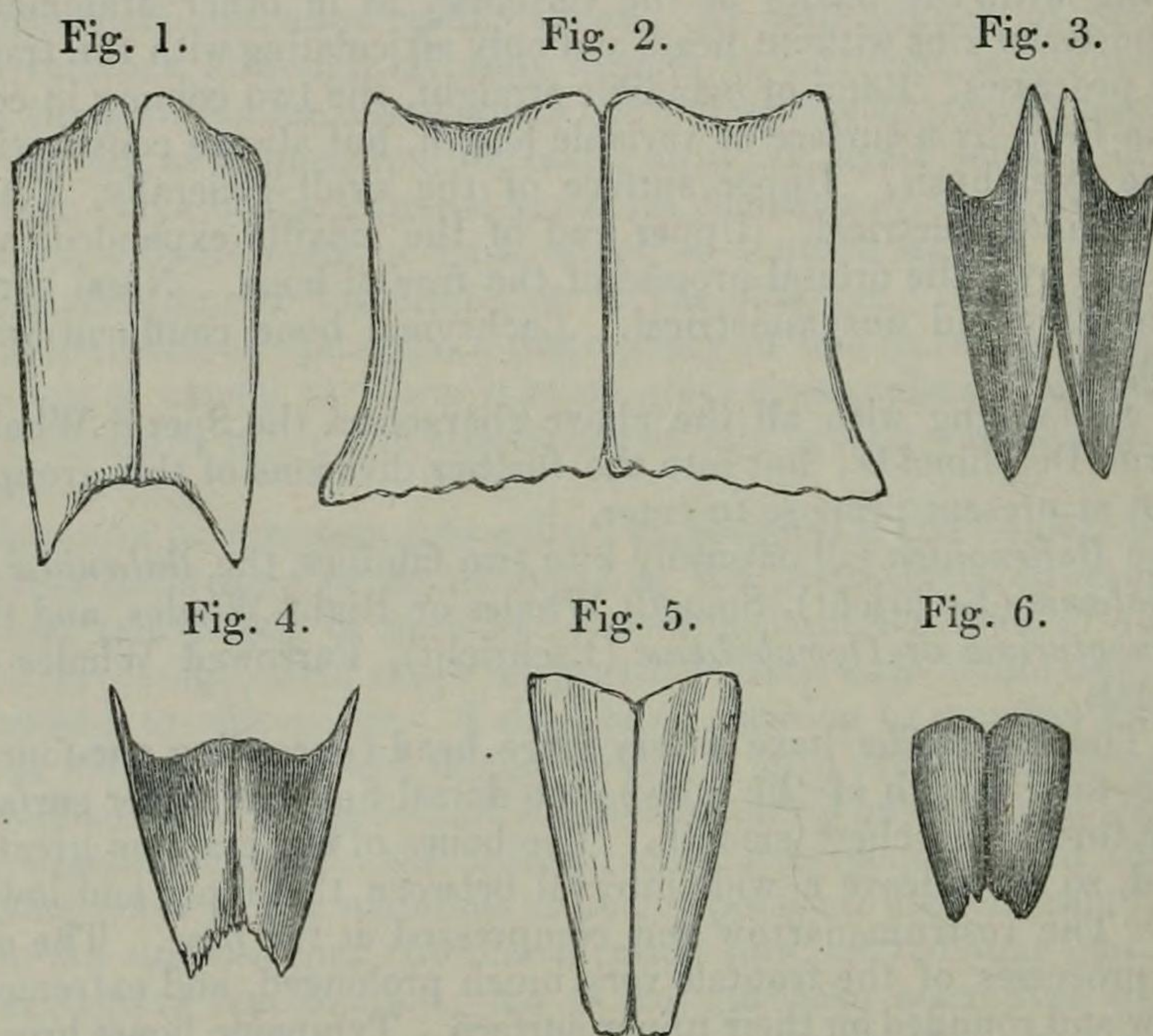


each other to warrant their division into subfamilies; but they constitute two tolerably well-marked genera (*Balæna*, Linn., *pars*, and *Eubalæna*, Gray), which present the following among other less-marked distinctive characters:—

(1.) *Balæna*. Total number of vertebræ 54. Pairs of ribs 13. Head more than one-third of the total length of the body. Nasal bones long and narrow (fig. 1). Orbital processes of frontals much elongated, sloping backwards, and very little dilated at their extremity. Cervical vertebræ all ankylosed. Baleen-plates very long, and narrow at the base.

Type species *B. mysticetus*, Linn., at present the only one known. The most specialized in structure of all the Whales.

(2.) *Eubalæna*\*. Total number of vertebræ 57–58. Pairs of ribs 15. Head less than one-third of the total length of the body.



Upper surface of nasal bones of Whales of different genera,  $\frac{1}{10}$ th nat. size.

- Fig. 1. *Balæna mysticetus*. Mus. Roy. Coll. Surg.  
 2. *Eubalæna australis*?. Mus. Leyden.  
 3. *Megaptera longimana*. Mus. Brussels.  
 4. *Physalus antiquorum*. Mus. Roy. Coll. Surg.  
 5. *Sibbaldius schlegelii*. Mus. Leyden.  
 6. *Balænoptera rostrata*. Mus. Roy. Coll. Surg.

\* The very few skeletons of members of this genus in Europe present considerable discrepancies, which have never been satisfactorily investigated. As the Leyden specimens are the only ones I have seen, the above characters are taken from them; but I have now reason to believe that they do not belong to *E. australis* (Desm.). Dr. Gray, in a recent paper (Ann. and Mag. Nat. Hist. Nov. 1864), makes three genera of the Southern Whales—*Eubalæna*, *Hunterus*, and *Caperea*.



Nasal bones short and broad (fig. 2). Orbital processes of frontals moderately long, and widening considerably at their outer extremity, directed nearly horizontally outwards. First five cervical vertebræ only ankylosed (?). Baleen-plates moderately long, and broad at the base.

Type species, *E. australis* (Desm.). Probably several other species, including *Balæna biscayensis*, Eschr.; but these are not yet well determined\*.

2. *Balænopteridæ*. The head less than one-fourth of the total length of the body. A dorsal fin. Skin of the under surface of the throat and chest provided with numerous parallel longitudinal furrows. The bones of the cranium very slightly arched. The rostrum broad at the base, gradually tapering, depressed. The orbital processes of the frontal moderately prolonged, broad, and flat on the upper surface. Tympanic bones elongated, ovoid. The coronoid process of the lower jaw more or less developed. Baleen-plates short. Cervical vertebræ usually all free. Hand narrow and tetradactylous.

This family may be divided into two minor groups or subfamilies, the *Megapterinæ* (genus *Kyphobalæna*, Eschricht), or Humpbacked Whales, and the *Balænopterinæ* (genus *Pterobalæna*, Eschricht), or Fin-Whales.

(1.) *Megapterinæ*. Dorsal fin low, obtuse. Orbital process of frontal much narrowed externally. Scapula high and narrow; acromion and coracoid process absent or rudimentary. Metacarpus and phalanges greatly elongated.

This division contains, as far as is known at present, but one genus—*Megaptera*, Gray, characterized, in addition to the above, by a total number of vertebræ amounting to 53, and 14 pairs of ribs. Coronoid process of lower jaw low, obtuse. Nasal bones narrow, pointed at both ends, rising to a sharp ridge in the middle line, and deeply hollowed at the sides (fig. 3).

Type species, *M. longimana* (Rudolphi).

(2.) *Balænopterinæ*. Dorsal fin falcate. Orbital process of frontal nearly as broad at the outer extremity as the base, or somewhat narrowed. Scapula low, broad, with a long acromion and coracoid process. Metacarpus and phalanges of moderate dimensions.

Van Beneden ("Faune Littorale de Belgique," Acad. Roy. Belg. vol. xxxii. 1860) has recognized the distinctive characters of three species belonging to this group, which he calls *Pterobalæna communis*, *P. gigas*, and *P. minor*. Dr. Gray (Proc. Zool. Soc., May 24th, 1864) constitutes these three species as the types of distinct genera, which he has named *Physalus*, *Sibbaldius*†, and *Balænoptera*; he also

\* In a valuable monograph ('Om Nordhvalen,' Copenhagen, 1861), lately published in the Danish language, by Eschricht and Reinhardt, and about to be translated into English under the auspices of the Ray Society, it is conclusively proved that the habitat of the *Balæna mysticetus* is, and always has been, exclusively confined to the Polar Seas, and that it has therefore no claim to a place in the European fauna. The Right Whales of the North Atlantic, formerly chased by the Basque whalers, belonged to this section of the family.

† I hope my kind friend Dr. Gray will excuse me, if I venture thus to modify the generic name "*Sibbaldus*," originally proposed by him.



makes a fourth genus, *Benedenia*. Although I am as little disposed as any one to multiply generic names (a tendency of modern times of which we are all apt to complain), I cannot help admitting that, if the genera of Whales are to be at all equivalent in value to those now generally received in other groups of mammals, the first three of these are perfectly valid. Of the genus *Benedenia* I speak with more hesitation, as it is constituted only upon the examination of a very young individual, which I confess I am unable to distinguish from a *Physalus*. As the diagnostic characters given by Dr. Gray are brief, and limited to certain parts of the organization, I may be permitted perhaps to give more detailed characters taken from the skeleton generally, which will, I think, fully confirm his views as far as these genera are concerned. Into those characters, taken from the external form, position of dorsal fin, or from the visceral anatomy, it is not my purpose to enter at present.

A. *Physalus*, Gray. Total number of vertebræ 61–64. Ribs 15 pairs\*. Orbital process of frontal bone considerably narrowed at its outer end. Nasal bones short, broad, deeply hollowed on their superior surface and anterior border (fig. 4). Rami of the lower jaw massive, with a very considerable curve, and a high, pointed, curved coronoid process. Neural arches of the cervical vertebræ low; spinous processes very slightly developed. Transverse process of the atlas arising from the upper half of the side of the body, long, tapering, conical, pointed directly outwards. Upper and lower transverse processes, from the second to the sixth vertebræ, well developed, broad, flat (and united at the ends in the adult, forming complete rings?). Head of the first rib simple, articulating with the transverse process of the first dorsal vertebra. Second, third, and sometimes the fourth ribs with capitular processes, reaching nearly to the bodies of the vertebræ. Sternum broader than long, in the form of a short broad cross, of which the posterior arm is very narrow; it might perhaps be compared to the heraldic trefoil (fig. 7); it is subject, however, to considerable individual modifications.

Type species, *P. antiquorum*, Gray.

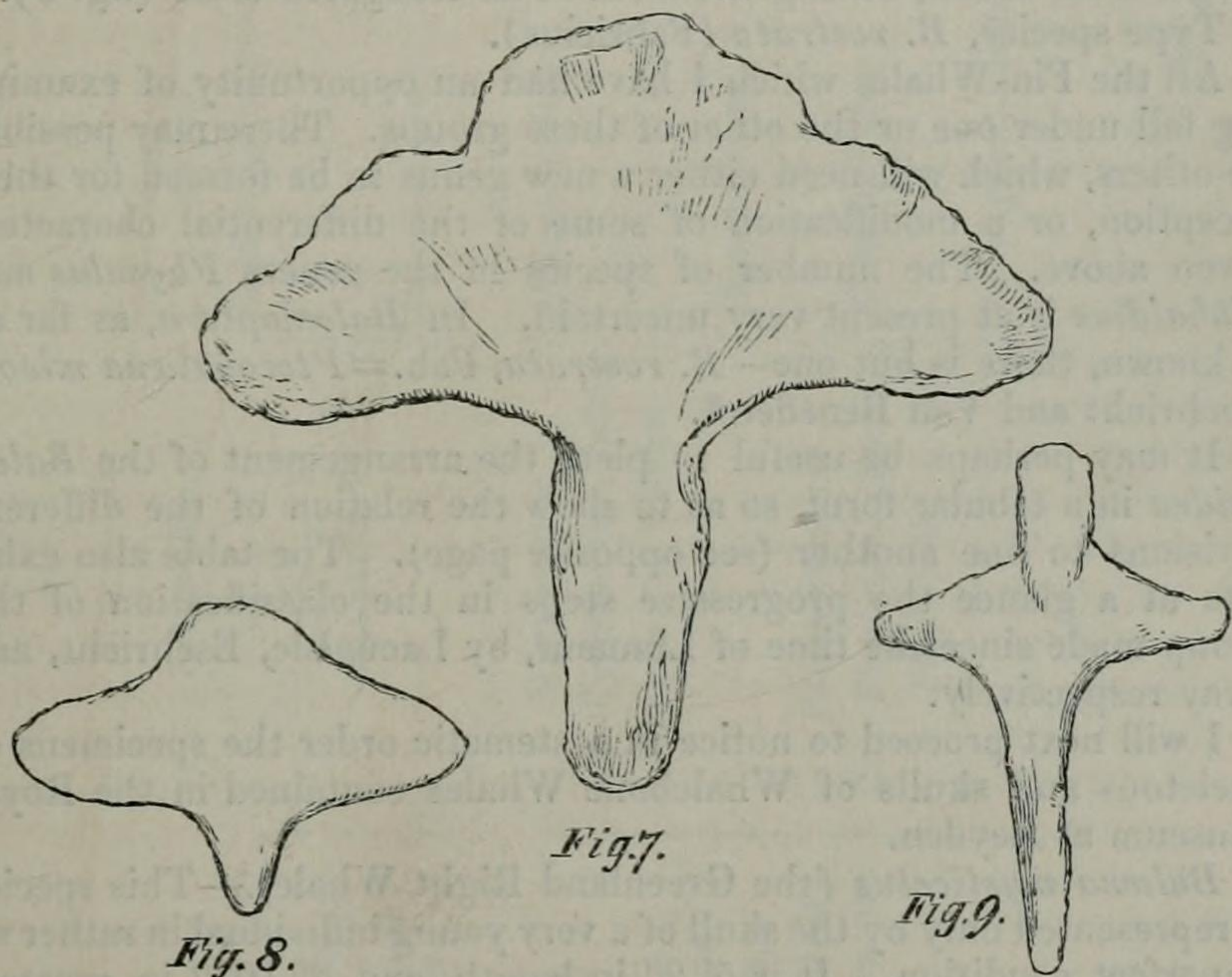
B. *Sibbaldius*, Gray. Total number of vertebræ 56–58. Ribs 14 pairs. Orbital process of frontal bone nearly as broad at outer end as at the base. Nasal bones elongate, narrow, flat, or very slightly hollowed on the sides of the upper surface, obliquely truncated at the anterior end (fig. 5). Lachrymal bones thickened and rounded at the outer end. Lower jaw with a comparatively slight curve, and a low, obtusely triangular coronoid process. Neural arches of the cervical vertebræ high, and their spines well developed. Transverse process of atlas arising from upper two-thirds of side of the body, short, and deep from above downwards (figs. 10, 11). On the hinder border of the under surface a median pointed triangular process, directed backwards and articulating with the axis. Upper

\* A specimen (*Physalus sibbaldii*, Gray) in the museum of the Hull Philosophical Society is said to have sixteen pairs of ribs—the highest number recorded in any Whale. If constant to the species, a modification of the above generic character will be required.



and lower transverse processes of the second to the sixth vertebræ inclusive well developed, broad, and flat (united at their ends in the adult, except the sixth?). Lower process of the sixth short, broad, and much twisted on itself. Head of the first rib bifurcated into an anterior and posterior division, articulating with the extremities of the transverse processes of the seventh cervical and first dorsal vertebræ respectively. Second, third, and fourth ribs with short capitular processes. Sternum very small, short, and broad, somewhat lozenge-shaped (fig. 8). Stylohyals very broad and flat (fig. 17).

Type species, *S. laticeps*, Gray\*.



Sternal bones of Fin-Whales of different genera.  $\frac{1}{10}$ th nat. size.

Fig. 7. *Physalus antiquorum*. Alexandra Park.

8. *Sibbaldius schlegelii*. Mus. Leyden.

9. *Balænoptera rostrata*. Mus. Roy. Coll. Surg.

C. *Balænoptera*, Lacépède, *pars*. Total number of vertebræ 48-50. Ribs 11 pairs. Orbital process of frontal almost as broad at the outer end as the base. Nasal bones rather narrow and elongate, truncated at their anterior ends, convex on the upper surface in both directions (fig. 6). Rami of lower jaw much curved, and with a high, pointed coronoid process. Cervical vertebræ usually separate; but this family character not unfrequently departed from

\* Dr. Gray, with good reason, refers the Whale stranded at Charmouth, in 1840 (Sweeting, Proc. Zool. Soc. 1840), to this genus. There is not, as far as I am aware, a skeleton or skull of a *Sibbaldius* preserved in any of the museums in this country; we possess, however, at the College of Surgeons a lower jaw, pair of first ribs, pair of scapulæ, atlas, and some other vertebræ. Their origin is unknown.



by the union of the second and third, or the third and fourth, by their arches. Neural arches high; spines moderately developed. Transverse process of atlas arising from the middle of the body, elongated, tapering, directed outwards, and slightly upwards. Upper and lower transverse processes of axis and succeeding vertebræ, to the sixth inclusive, well developed. Those of the axis broad, flat, and in the adult united at their extremity; those of the other vertebræ slender, and never united at their extremity, except occasionally in the sixth and more rarely in the fifth vertebra. Head of the first rib simple; capitular processes scarcely developed upon any of the ribs. Sternum longer than broad, having the form of an elongated cross (fig. 9).

Type species, *B. rostrata* (Fabricius).

All the Fin-Whales which I have had an opportunity of examining fall under one or the other of these groups. There may possibly be others, which will need either a new genus to be formed for their reception, or a modification of some of the differential characters given above. The number of species in the genera *Physalus* and *Sibbaldius* is at present very uncertain. In *Balænoptera*, as far as is known, there is but one—*B. rostrata*, Fab.=*Pterobalæna minor*, Eschricht and Van Beneden\*.

It may perhaps be useful to place the arrangement of the *Balænoidea* in a tabular form, so as to show the relation of the different divisions to one another (see opposite page). The table also exhibits at a glance the progressive steps in the classification of the group made since the time of Linnæus, by Lacépède, Eschricht, and Gray respectively.

I will next proceed to notice in systematic order the specimens of skeletons and skulls of Whalebone Whales contained in the Royal Museum at Leyden.

*Balæna mysticetus* (the Greenland Right Whale).—This species is represented only by the skull of a very young individual in rather an imperfect condition. It is 5' 2" in length, and 2' 10½" in greatest breadth across the squamosals. The elements of the occipital bone are distinct; but the parietal is already ankylosed with the supra-occipital along the upper margin of the temporal fossa. The basisphenoid is distinct from both the presphenoid and basioccipital, though the union with the latter is the more advanced of the two. At this stage the skull differs much from that of the adult animal. Besides the proportionately greater size of the cranial cavity, the orbital processes of the frontals are shorter, and broader at their extremity, the maxillaries are less arched, and the skull generally much more depressed.

The Southern Right Whale (*Eubalæna australis*?).—Of this species, or perhaps I should say of one of the species confounded together under this name, the collection contains a very fine skull of an

\* Barkow (Das Leben der Walle, &c., Breslau, 1841) has described another species under the name of *Pterobalæna pentadactyla*; but much uncertainty hangs over the origin and composition of the single skeleton in the Museum at Breslau, on which it is founded. If genuine, it would necessitate a considerable modification of both the family and generic characters.



Order.	Suborder.	Families.	Subfamilies.	Genera.	Type species.
CETACEA.	BALÆNOIDEA seu MYSTICETE. Gen. <i>Balæna</i> , Linn. (Whalebone Whales.	BALÆNIDÆ. Gen. <i>Leïobalæna</i> , Esch. Smooth Whales, or Right Whales.	BALÆNINÆ.	{ <i>Balæna</i> , Linn., pars. <i>Eubalæna</i> , Gray.	<i>B. mysticetus</i> , Linn. Greenland Right Whale.
					<i>E. australis</i> (Desm.). Southern Right Whale.
		BALÆNOPTERIDÆ. <i>Ogmobalæna</i> , Esch. Gen. <i>Balenoptera</i> , Lacép. Furrowed Whales, or Rorquals.	MEGAPTERINÆ. Gen. <i>Kyphobalæna</i> (Esch.). Humpbacked Whales.	{ <i>Megaptera</i> , Gray.	<i>M. longimana</i> (Rud.). Northern Long-finned or Humpbacked Whale.
					<i>P. antiquorum</i> , Gray. Common Fin-Whale.
					<i>P. laticeps</i> , Gray. Rudolphi's Fin-Whale.
				{ <i>Sibbaldius</i> , Gray. <i>Balenoptera</i> , Lacép., pars.	<i>B. rostrata</i> (Fab.). Lesser Fin-Whale.



adult and a nearly complete skeleton of a young individual, both obtained from the Cape of Good Hope by Dr. Horstok. These are briefly described by Schlegel in his 'Abhandlungen aus dem Gebiete der Zoologie, &c.' (Leiden, 1841), part 1, p. 37.

The skull is 13' 5" in extreme length. To any one accustomed to the appearance of the skull of the adult *B. mysticetus*, the differential characters exhibited by this specimen are very striking. The size is much inferior, both absolutely and as compared with that of the body of the animal. Its general contour is less regularly arched, as it rises abruptly in the occipital region to a very prominent and rounded eminence at the junction of the supraoccipital, frontal, and nasal bones, and then slopes gradually down to the apex of the beak. The articular processes of the squamosals are broader and less elongated. The supraorbital processes of the frontal are, as noticed by Schlegel, directed more horizontally outwards, shorter, and very much stouter, especially at the extremity. The orbital processes of the maxillary are also stouter. One of the most marked differences from *B. mysticetus*, and one which I have not before seen noticed, is the great breadth and comparative shortness of the nasal bones (fig. 2), and consequent great width of the posterior margin of the nasal aperture. The part of the upper surface of the two nasal bones uncovered by the frontal is  $13\frac{1}{2}$ " broad and 11" long; in a skull of *B. mysticetus*, 17' in length, they are but 7" broad and 11" long. The malar, lachrymal, and tympanic bones are absent from this skull.

The skeleton is that of a young animal; the epiphyses of all the vertebræ and of both ends of the humerus, radius, and ulna are not united. It wants the lachrymals, malars, sternum, hyoid and pelvic bones. The entire length is 31' 4", of which the head occupies 7'. The total number of the vertebræ is fifty-six; and one, or perhaps two, may be wanting from the end of the tail. The first five of the cervical vertebræ are united together; the bodies of the other two are greatly compressed and close together, but not ankylosed. There are fifteen pairs of ribs. The first, as described by Schlegel, is of very singular shape, being divided at the upper end for a distance of 6" into two broad flat heads, anterior and posterior, and widening exceedingly at the lower end, in the middle of the border of which is a deep notch. It is 34" in length, measured in a straight line, 4" in breadth at the middle, and  $12\frac{3}{4}$ " at the lower end. The two divisions of the upper end are attached to the transverse processes of the first and second dorsal vertebræ, which disposition induced Schlegel to assign sixteen dorsal vertebræ to this specimen; but this is probably an error of the articulator, as in the Fin-Whales with double heads to the first rib, these are connected with the seventh cervical and first dorsal vertebræ; and in *B. mysticetus* the head of the first rib is placed altogether in front of the transverse process of the first dorsal vertebra, being intimately connected with the seventh cervical.

The second rib is very thick and broad at the lower end. The last rib is much shorter and more slender than the others. There are nine chevron bones present. The scapula is 26" broad and 24"



high, with very short acromial and coracoid processes. The humerus 15" long. The radius  $16\frac{1}{2}$ " long, and 10" broad at its distal end. The ulna 8" broad at the same part. The thumb is absent; the digits differ but slightly from each other in length. The second, third, and fifth have, besides the metacarpal bones, each four phalanges; the fourth has five; but, as they are artificially articulated, these numbers are not entirely to be depended on.

*Megaptera longimana*.—A nearly complete skeleton of a young animal, obtained from Greenland through Eschricht. It is 28' 7" long, of which the skull is 7' 7". There are but thirteen ribs present.

Genus *Physalus*.—A skull of a young specimen, agreeing in all its characters with *P. antiquorum*, Gray; marked "*Balænoptera physalus*, Mer Sept." Its length, from the condyles to the tip of the beak in a straight line, is 10' 6".

Genus *Sibbaldius*.—A skeleton marked "*Balænoptera physalus*, Vinvisch, Zuider Zee." This is no. 17 of Eschricht's list (*Untersuchungen über die Nordischen Wallthiere*, Leipzig, 1849), according to which it was taken in the Zuider Zee, near Monnikendam, Aug. 29th, 1811, its length being 32' Rheinland. The skeleton is perfect, with the exception of the hyoid and pelvic bones. The malars, lachrymals, and tympanics are present. The entire length (including the skull, which is 6' 7") is 29' 7"; but the bodies of the vertebræ are placed close together, so that 2 or 3 feet should be added for the intervertebral spaces. The animal was young; the epiphyses of all the vertebræ, including that of the hinder surface of the axis, are separate from the bodies, as well as those of both ends of the humerus, radius, and ulna. The vertebral formula is C. 7, D. 13 or 14, L. 16 or 15, C. 19=55; but the last caudal is elongated, and really consists of two bodies ankylosed, with even a minute rudimentary third. The cervical vertebræ exhibit all the characters peculiar to the genus; but their lateral processes are, as the surface of the bone shows, incomplete at the ends. The atlas has a deep, compressed-from-before-backwards, short transverse process, and a backward-directed, median triangular projection on the under surface of its body for articulation with the axis. The five following vertebræ have each an upper and lower transverse process, but not united together at their ends in any of them—not quite, even in the second. The processes are of tolerably equal length throughout, except the lower one of the sixth vertebra, which is shorter and broad, and twisted on itself so that its flat surface is horizontal at the end. The upper processes are slenderer than the lower, and become more so posteriorly. The spaces between the upper and lower processes, in vertical height, are in the second 2"·2, in the third 4"·2, in the fourth 4"·2, in the fifth 4"·1, in the sixth 4"·7. The spines are comparatively well developed, especially that of the axis.

There are thirteen pairs of ribs present; but it is probable that the posterior pair are wanting. The first has a bifid articular head, the cleft extending to the depth of 5 inches. It articulates by this with the transverse processes of the seventh cervical and first dorsal. Its extreme length in a straight line is 21"; its breadth at the middle



$2\frac{3}{4}$ ", at the lower end  $4\frac{1}{4}$ ". The second, third, and fourth have short capitular processes, not reaching halfway to the bodies of the vertebræ. These processes are absent in all the others. The longest rib (the fifth) is 41" in a straight line, the twelfth is 31", and the thirteenth 30". There are ten chevron bones present. The sternum is remarkably small for the size of the animal, a transversely elongated lozenge in shape, 4" in antero-posterior and 8" in transverse diameter.

The scapula is, as usual in the family, much elongated transversely, and has a long acromion process. Its length is 14", its breadth 25". The humerus is 10" long; the radius  $18\frac{1}{2}$ ", and proportionately slender. The hand, artificially articulated, is 18" long; the second digit has, besides the metacarpal, three bones, the third three bones, the fourth six bones, the fifth three bones. These numbers are probably not correct, as they do not correspond with a natural skeleton of the hand of the same species at Brussels.

The upper surface of the orbital plate of the frontal is almost of a rhomboid form. The malars are very thin; the outer end of the lachrymals forms a thick, projecting, rounded knob. The nasal bones are almost straight across their anterior ends, slightly longer at the middle, and sloping away at the sides; their upper surface tolerably flat, but raised to a low ridge in the middle towards the anterior end, and slightly hollowed on each side of this. The dimensions of the cranium are given in the table at p. 402, compared with those of other specimens of the genus. The inferior maxillaries have low, obtusely triangular coronoid processes. They are articulated too close to the head, and their upper edge rotated too much inwards. This position greatly diminishes their curve as seen from above, and causes their extremity to bend downwards. I was much interested in observing this, as it explains away a great peculiarity in the figure of the Whale in the Berlin Museum by Rudolphi (*Abhandlungen Acad. Berlin*, 1822), in which the same mode of articulating has caused some misconception as to the character and relation of these bones, the more important to be rectified, as this is the only figure extant of the skull of any member of this genus.

The question now naturally arises, to what species is this skeleton to be referred, and what should it be named? There can be little doubt that it is identical with the above-mentioned specimen described by Rudolphi; at least a careful perusal of his description and figure (for I have not seen the skeleton) leaves this impression on my mind. In habitat, age, size, number of vertebræ and ribs, and all other important osteological characters they agree. There are certainly slight differences in the proportions of the parts of the cranium, but not greater than are found among different individuals of undoubtedly the same species; and it is possible that even these may arise from inaccuracies on the part of the artist. Some of the evidence also is wanting to make the comparison complete; for instance, the sternum from the Berlin specimen, and the hyoids from the one at Leyden. In assigning only five vertebræ to the cervical region, Rudolphi is obviously in error, being probably misled by the mode in which the skeleton was articulated. He states that the transverse



processes of the cervical vertebræ have all (that is, the first five) very large holes. If this is strictly correct (that is, if the holes are completely surrounded by bone), it indicates a more advanced state of ossification than in the Leyden specimen—a circumstance, of which the peculiarity is somewhat diminished by the fact that the skeleton of a Whale of the same species, and of almost exactly the same size, in the Brussels Museum is in a condition intermediate between the two, the processes of the second and third vertebræ being completely united, but not those of the fourth and fifth. In calling his specimen *Balæna rostrata*, Rudolphi was acting upon the idea, then prevalent, of the specific unity of many of the northern Fin-Whales now known to be distinct. Dr. Gray seems to have been the first to point out that it differed from all Whales which had been previously described with anything like definite accuracy, and gave it the name of “Rudolphi’s Finner Whale,” *Balænoptera laticeps* (Zoology of the Erebus and Terror, 1846); this name therefore has the right of priority for the species. Unfortunately it is anything but expressive of the character of the species, the head not being broader than in other Fin-Whales, as the following table, compiled chiefly from my own measurements, will show.

In the first three columns are given the actual length of the cranium, greatest breadth (at the squamosals behind the orbit), and breadth across the middle of the beak, in inches; and in the last two, the proportionate breadth of the skull and beak to the total length, the latter being reckoned at 100.

	Length of cranium.	Breadth of cranium.	Breadth of beak.	Proportion to length.	
				Breadth of skull.	Breadth of beak.
<i>Physalus antiquorum.</i>					
Adult. Antwerp.....	184	96	33	52	18
Adult. Louvain.....	179	78	32	44	18
Adult. Alexandra Park.....	186	86	36	46	19
Adult. Rosherville Gardens.....	168	75	34½	45	20
Young. Leyden.....	126	60	26	48	21
Young. Mus. R. Coll. Surg. ....	111	56	22½	50	20
<i>P. — ?</i>					
Utrecht. (Mus. Lidth. de Jeude) ..	118	60	32	51	27
<i>Sibbaldius.</i>					
Adult. Ostend. (Approximation from Dubar's measurements) .. }	256	118	..	46	..
Adolescent. From Java, in Ley- den Mus. .... }	116	57	22	49	19
Young. Leyden.....	79	40	16	51	20
Young. Brussels.....	80	38	15	48	19
Young. Berlin. (Approximation from Rudolphi's figure) .. }	78	36	18	46	22
<i>Balænoptera rostrata.</i>					
Adolescent. Brussels.....	63	34	13	54	21
Adolescent. Mus. R. Coll. Surg. ..	65	35	15	54	23
Young. Mus. R. Coll. Surg.....	48	24	9½	50	20



It is seen by this that the individual differences among specimens of *Physalus* and *Sibbaldius* are considerable, the proportionate breadth of skull ranging in the first case between 44 and 52, and of the beak between 18 and 21, and in the second genus between 46 and 51, and 19 and 22; and these differences do not seem at all to be regulated by age. A slight allowance must certainly be made for errors arising from the difficulty of measuring straight lines with exactness, especially single handed, upon these large irregular objects. On the whole, however, the specimens of *Sibbaldius* have no advantage on the score of breadth. The examples of *Balænoptera rostrata* are slightly broader than the others in proportion to their length.

Van Beneden is of opinion that this specimen, as well as that at Berlin, is referable to the same species as the very large female Whale taken near Ostend in 1827, the skeleton of which was exhibited some years ago at Charing Cross; and as this animal was 87 feet in length (larger than the ordinary size attained by the Common Fin-Whale), he has given it the specific name of *gigas*. Unfortunately this skeleton is no longer available for examination\*; and the only descriptions and drawings we have of it are not made with the scientific accuracy necessary to settle the question. It certainly agrees in many important points—the number of vertebræ (54, a few wanting from the end of the tail) and of ribs (14), the double head of the first rib, and the small broad sternum. Its generic identity is therefore undoubted.

One difficulty which arises in my mind is about the size. The 32'-long examples of *Sibbaldius* at Leyden and Brussels are, as I have said, in the *young* stage; but still the general condition of the bones shows them to be by no means in the earliest period of youth. A Common Fin-Whale (*Physalus antiquorum*) that I examined at the Hague, 40' long, had the bones much softer, more spongy, and incomplete at the ends of the processes than in either of these; whereupon I should *à priori* have said that the latter belonged to a species which, when adult, was smaller than the common one. As far as we know at present, the young of Fin-Whales are from one-fourth to one-third of the length of the mother at the time of birth, which would give a very early age to our specimens if derived from such a parent as the Ostend Whale. As these speculations upon the size and growth of Whales are, however, based upon very slight foundation, I must still admit the possibility of the specific relationship of the Ostend Whale with the representatives of *Sibbaldius laticeps* in the Museum of Berlin, Leyden, and Brussels.

During the present year the Leyden Museum has received the skeleton of a Fin-Whale taken on the north-west coast of the island of Java, and of which I am, with Professor Schlegel's permission, enabled to give the following description. According to the statement received with the specimen, Whales are of rare occurrence upon that coast, the present one having been an object of great curiosity to the natives.

\* It was shipped for the United States; perhaps some naturalist in that country may be able to discover whether it is still in existence.



The hands, from the carpus downwards, the pelvic bones, and some of the terminal caudal vertebræ are wanting, also the lachrymals and malars from the skull; in other respects the skeleton is complete. Not being yet articulated, the separate bones could be examined with great facility. Both epiphyses are ankylosed to the bodies of the three first cervical vertebræ; the anterior epiphyses only are united on the fourth and fifth. From this as far as the ninth caudal, inclusive, they are detached; on the tenth caudal the hinder, and on the succeeding ones both epiphyses are firmly united. On the humerus the upper epiphysis is partly, and the lower one completely united to the shaft, all traces of the original separation of the latter having disappeared. The upper epiphyses of the radius and ulna are in the same condition; but those at the lower end are separate. The transverse processes of the cervical vertebræ show, from the condition of their terminal surfaces, that they are not quite complete. The upper edge of the scapula appears completely ossified in the middle, but must have been cartilaginous towards the two extremities. These conditions taken together show that the animal was in the adolescent stage, and had probably attained very nearly its full size.

The skull is 9' 8" long in a straight line; the vertebræ, placed close together and without their epiphyses, measured 30'; so that, allowing for the epiphyses, intervertebral spaces, and the end of the tail, the animal could not have been less than 45 feet long.

The number of vertebræ present is 54; and 3, or probably 4 of the caudal are wanting, raising the total number to 57 or 58. Of these, 7 are cervical, 14 dorsal, and about 13 or 14 lumbar; but, the articular surfaces for the anterior chevron bones not being well marked, I could not be certain where the tail should be considered to begin. There are 14 pairs of ribs.

The skull presents the general characters of the genus *Sibbaldius*. The only important difference that I could find between it and the specimen last described is in the form of the orbital process of the frontal bone, which is narrower at its outer end, approaching more to the form characteristic of *Physalus*, although by no means so narrow as in this. The nasals (fig. 5) are long and narrow, nearly flat on their upper surface, and slightly shelving downwards from the middle line. Their anterior border is rather less produced near the middle line than at the sides—the reverse in this respect to the Zuyder Zee specimen. The tympanic bones are 4''·6 long, 3''·5 in greatest breadth, and 2''·5 thick: their form is seen in the annexed woodcut (fig. 16). The lower jaw has a very slight curve and a low coronoid process, the highest part of which is 20'' from the hinder end of the bone. It is triangular in form, rounded at the apex, with a base about 4'' in breadth, and rising about 2½'' in height. The principal dimensions of the skull, in inches, are given in the following table, compared with those of the skulls of the two other specimens of the genus mentioned in this notice.



	Java: Leyden Museum.	Zuyder Zee: Leyden Museum.	North Cape: Brussels Museum.
Length of skull in straight line.....	116	79	80
Breadth of condyles .....	10 $\frac{1}{2}$	10	9
Breadth of exoccipitals .....	41	26	27
Breadth of squamosals (greatest breadth of skull) .....	57	40	38
Length of supraoccipital .....	29 $\frac{1}{2}$	21 $\frac{1}{2}$	21
Length of articular process of squamosal .....	22	15	16
Orbital process of frontal, length .....	22	13	13
Orbital process of frontal, breadth at base .....	24 $\frac{1}{2}$	16	15
Orbital process of frontal, breadth at outer end .....	15	12	11
Nasals, length .....	10 $\frac{1}{2}$	6 $\frac{1}{2}$	6 $\frac{1}{4}$
Nasals, breadth of the two, at posterior end .....	2	2 $\frac{1}{2}$	3
Nasals, breadth of the two, at anterior end .....	6	4	4
Length of beak, from middle of curved border of maxillary to the tip of premaxillary .....	82	53	50
Length of maxillary .....	90	57	55
Projection of premaxillary beyond maxillary .....	6	5	3
Greatest width of nasal aperture .....	10	6 $\frac{1}{2}$	
Breadth of maxillaries at posterior end .....	11	9	8
Breadth of maxillaries across orbital processes (following the curve) .....	63	43	43
Breadth of beak at base (following the curve) .....	42	30	30
Breadth of beak at middle (following the curve) .....	22 $\frac{1}{4}$	16	15
Breadth of maxillary at same point .....	6	4	4
Breadth of premaxillary at same point .....	4	3	2 $\frac{1}{2}$
Length of lower jaw in a straight line .....	117	78 $\frac{1}{2}$	76
Height at coronoid process .....	14	9	9
Height at middle .....	9 $\frac{1}{2}$	7 $\frac{1}{4}$	
Amount of curve* .....	8 $\frac{1}{2}$	6	6

The atlas presents the characteristic features of this bone in other members of the genus in a very marked degree. The transverse process is particularly deep from above downwards, and much twisted. The spinal canal is contracted in the middle; the articular surfaces for the axis are not confluent at their lower margins, but between them is a distinct, oval, transversely elongated facet, and another smaller round one is situated on the upper surface of a pointed triangular projection from the hinder border of the inferior surface of the bone, which runs under the body of the axis. There are thus four distinct articular surfaces in connexion with the second vertebra. The extreme width of the bone is 16 $\frac{1}{4}$ ''; the length of the inferior surface of the body 4''·4 including the triangular process, which is 1''·5. The other dimensions are shown in the sketches (figs. 10 and 11).

The axis (fig. 12) has the usual form of this bone in the Fin-Whales. The odontoid process is represented by a slight rounded elevation, with a depression in the centre; and besides the two large lateral articular surfaces for the atlas, there are two small median facets, one on the lower part of the anterior and one on the inferior

\* Greatest distance of the inner surface of the jaw from a straight line drawn between the extremities.



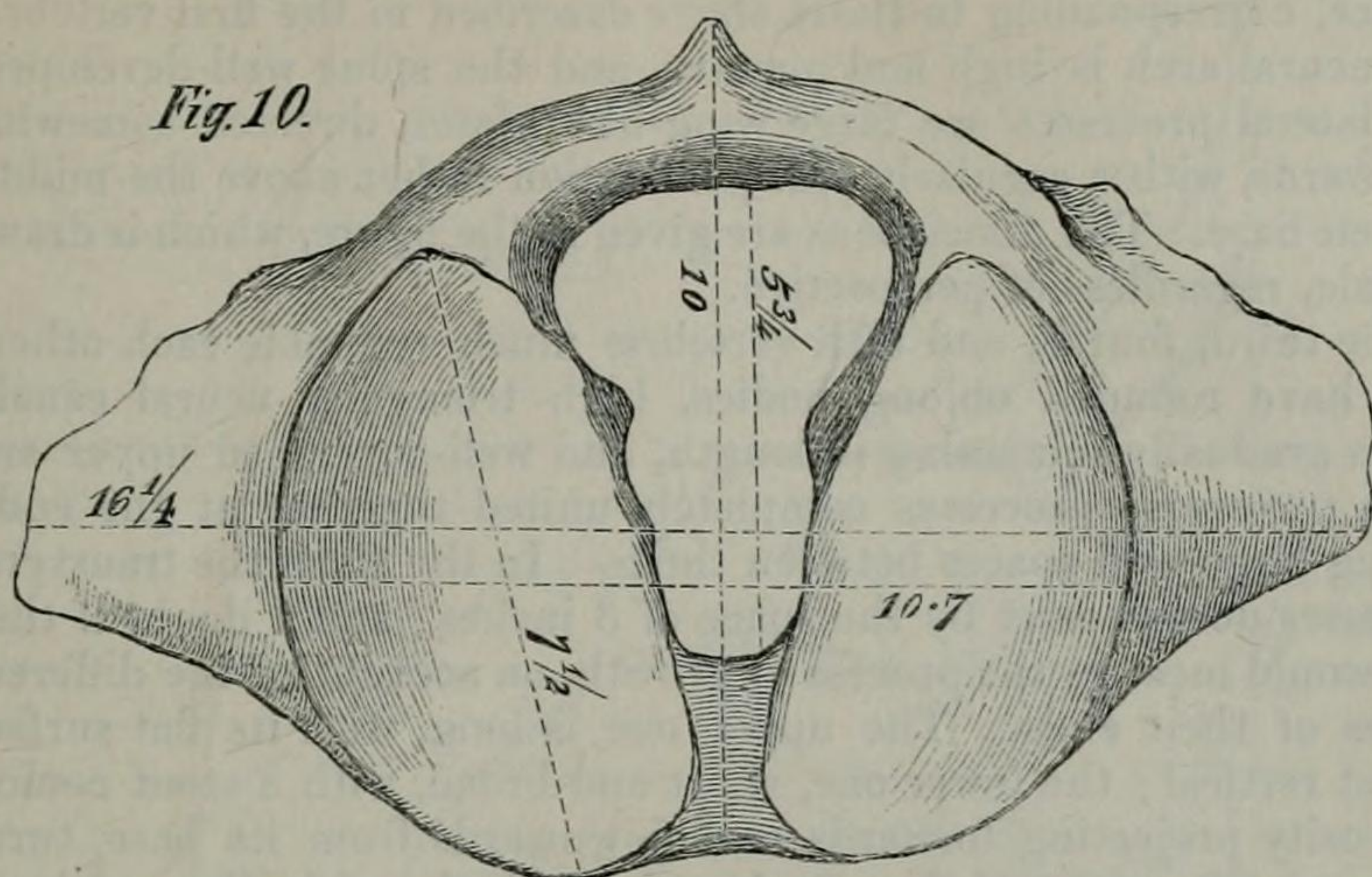
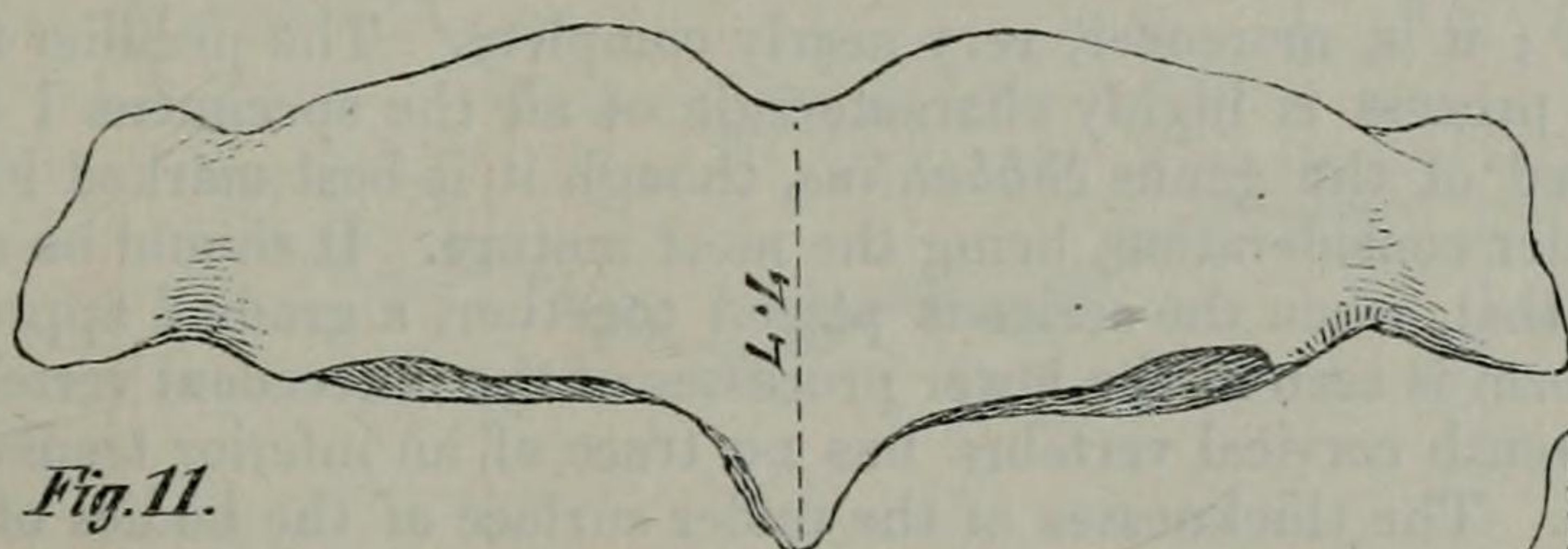
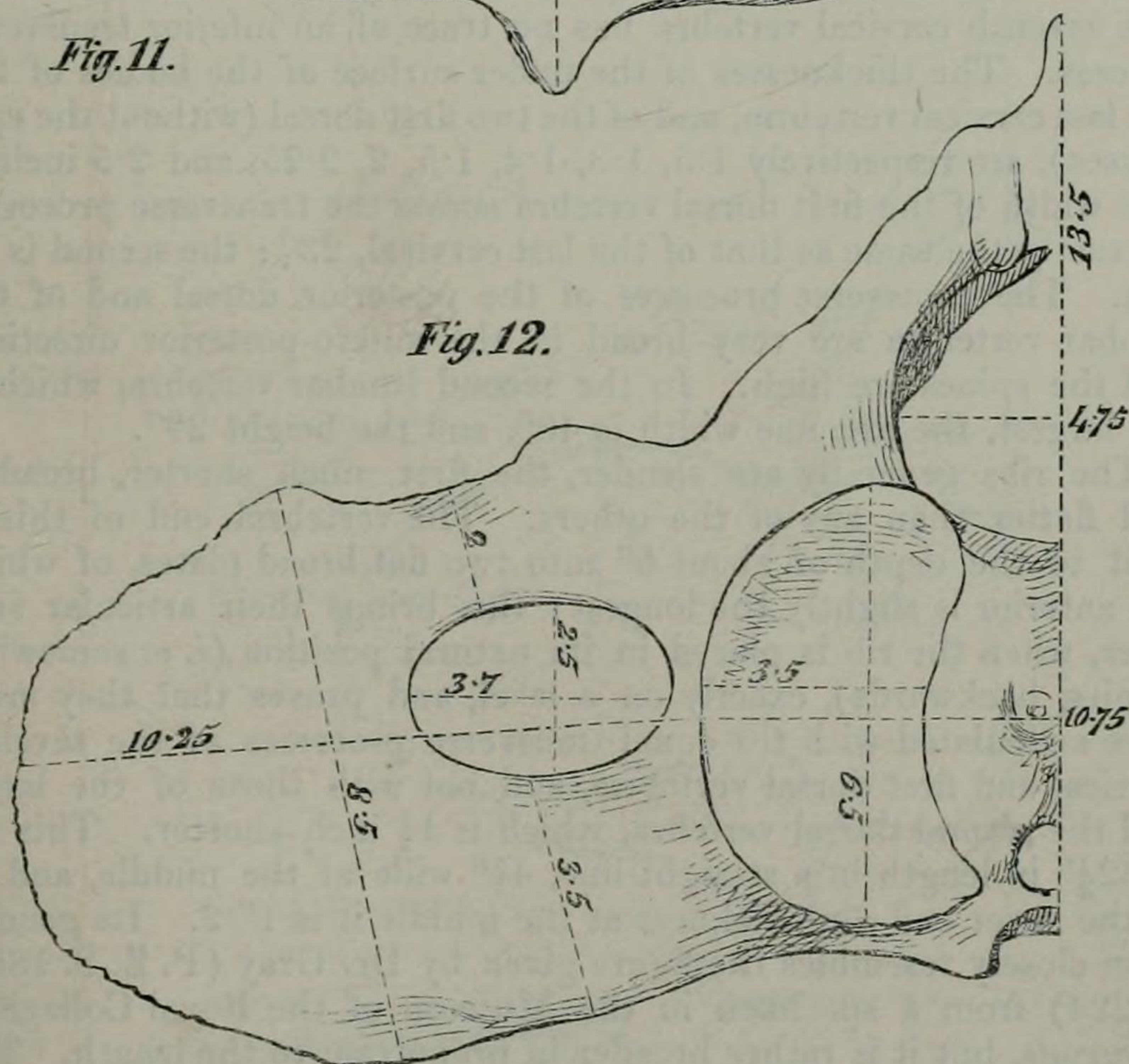
*Fig. 10.**Fig. 11.**Fig. 12.*

Fig. 10. Atlas; anterior surface.  
 11. Atlas; under surface.  
 12. Axis; anterior surface.

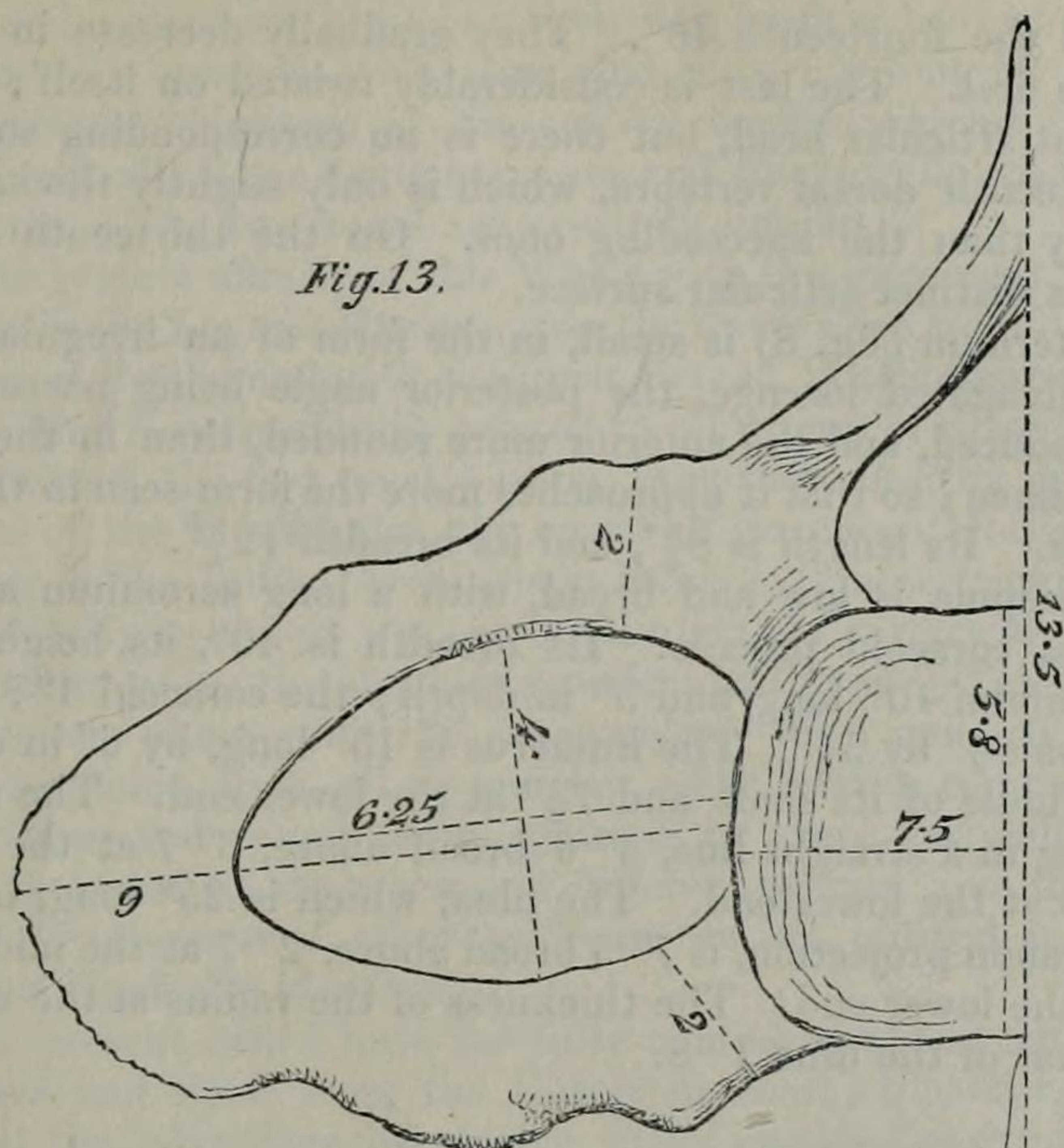
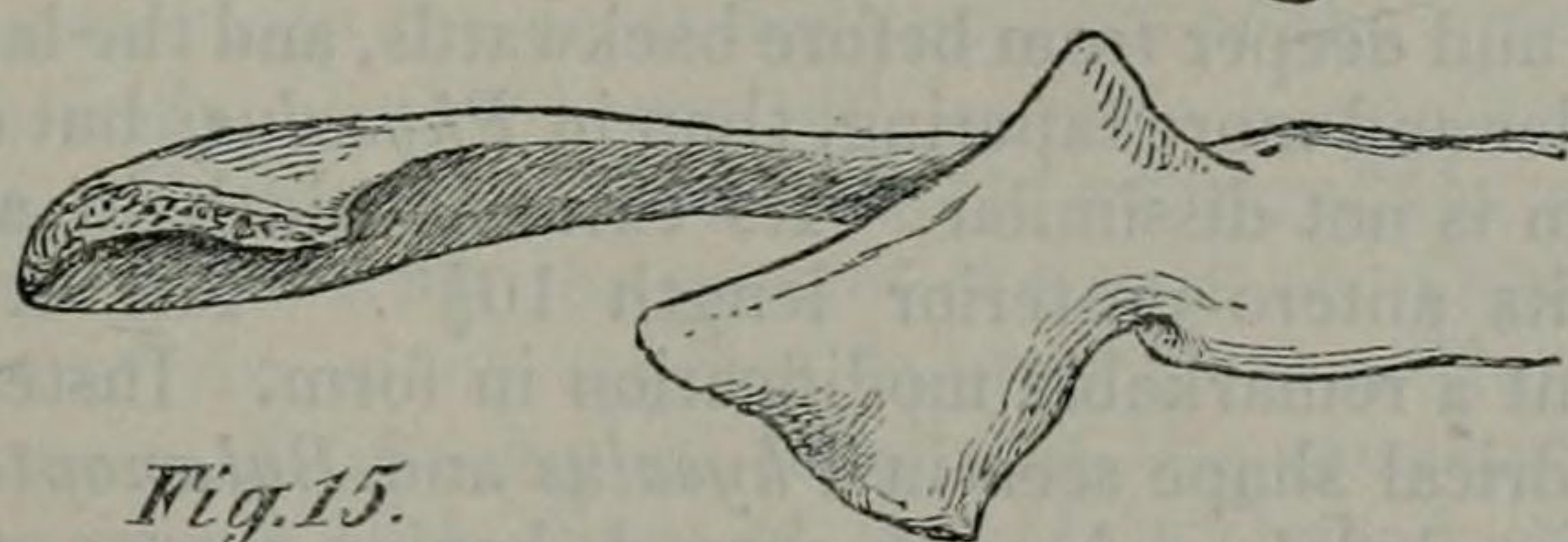
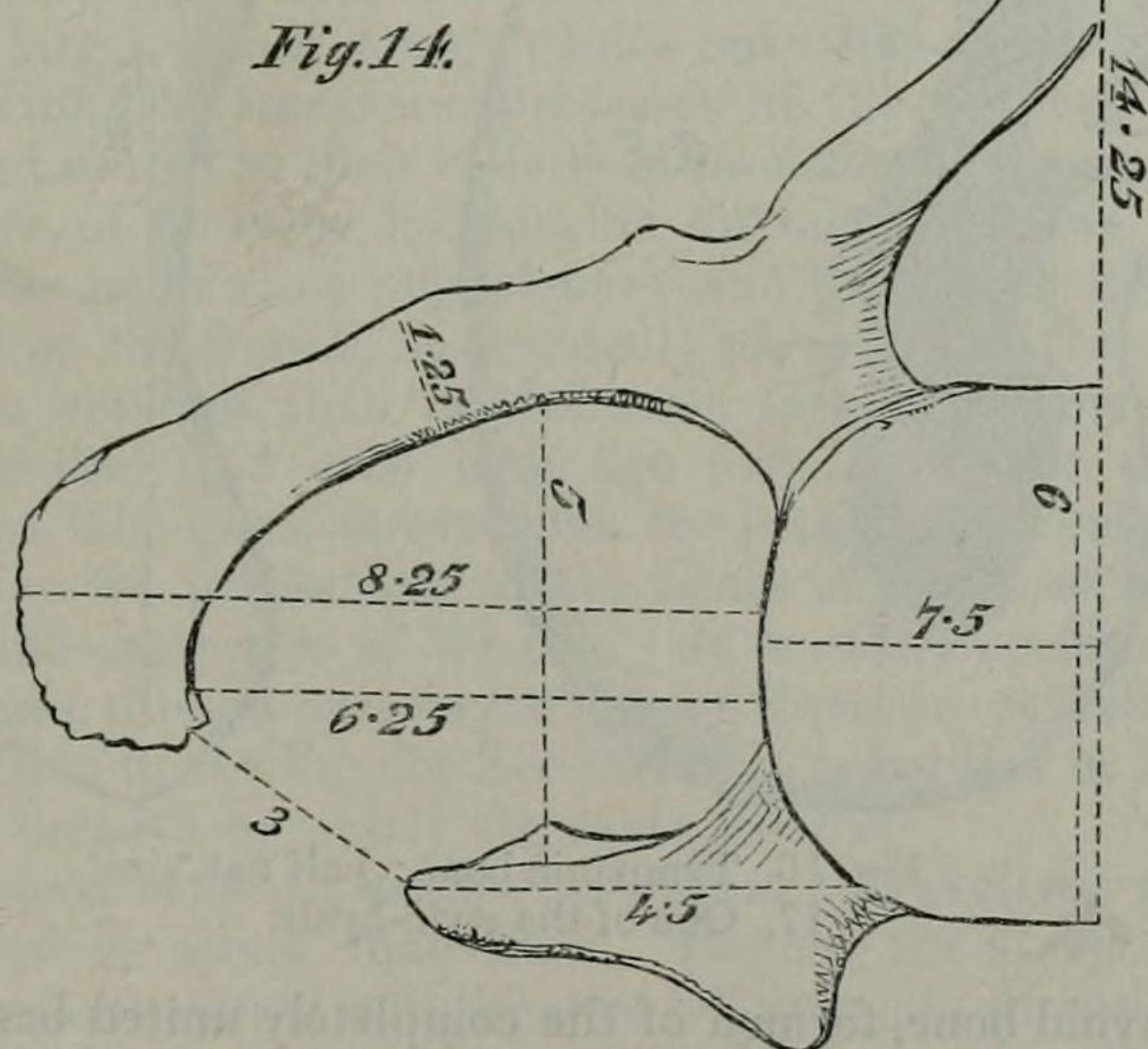


surface, corresponding to those above described in the first vertebra. The neural arch is high and massive, and the spine well developed. The lateral processes are large wing-like plates, directed somewhat backwards, with a regularly oval perforation rather above the middle of their base. The dimensions are given in the figure, which is drawn to scale, regardless of perspective.

The third, fourth, and fifth vertebræ much resemble each other; they have rounded oblong bodies, high triangular neural canals, spines gradually increasing in length, and well-developed upper and lower transverse processes completely united together at the ends, leaving large oval spaces between them. In the sixth the transverse processes do not meet by the space of 3 inches; and I doubt if they ever would meet in the process of growth, on account of the different planes of their ends. The upper one is long, with its flat surface almost vertical; the lower one, short and broad, with a stout conical tuberosity projecting forwards and downwards from its base, turns so completely on itself that its broad terminal end is directed horizontally; it is, moreover, very nearly complete. The peculiar form of this process is highly characteristic of all the specimens I have examined of the genus *Sibbaldius*, though it is best marked in the one under consideration, being the most mature. It should be mentioned that, when the series is placed together, a gradual approach to its form is seen in the lower processes of the antecedent vertebræ. The seventh cervical vertebra has no trace of an inferior transverse process. The thicknesses of the under surface of the bodies of the five last cervical vertebræ, and of the two first dorsal (without the epiphyses), are respectively 1.5, 1.3, 1.4, 1.5, 2, 2.25, and 2.5 inches. The width of the first dorsal vertebra across the transverse processes is exactly the same as that of the last cervical, 23"; the second is 3" less. The transverse processes of the posterior dorsal and of the lumbar vertebræ are very broad in the antero-posterior direction, and the spines are high. In the second lumbar vertebra, which is the largest, the extreme width is 40", and the height 29".

The ribs generally are slender, the first much shorter, broader, and flatter than any of the others. The vertebral end of this is split to the depth of about 6" into two flat broad plates, of which the anterior is slightly the longest; this brings their articular surfaces, when the rib is placed in its natural position (*i. e.* somewhat sloping backwards), exactly on a level, and proves that they must have articulated with the equal transverse processes of the seventh cervical and first dorsal vertebræ, and not with those of the latter and the second dorsal vertebra, which is  $1\frac{1}{2}$  inch shorter. This rib is  $32\frac{1}{2}$ " in length in a straight line,  $4\frac{1}{2}$ " wide at the middle, and 8" at the lower end; in thickness at the middle it is 1".2. Its general form closely resembles the figure given by Dr. Gray (P. Z. S. 1864, p. 224) from a specimen in the Museum of the Royal College of Surgeons, but it is rather broader in proportion to the length. The second, third, and fourth ribs have large articular heads and only slightly produced capitular processes. The second rib is 45" in length, the third 60", the fourth 61", the fifth  $62\frac{1}{2}$ ", the sixth  $61\frac{1}{2}$ ", the seventh  $61\frac{1}{4}$ ", the ninth 57", the twelfth 51", the thirteenth



*Fig.13.**Fig.14.**Fig.15.*

- Fig. 13. Fifth cervical vertebra; anterior surface.  
 14. Sixth cervical vertebra; anterior surface.  
 15. The same; inferior surface.



49", and the fourteenth 48". They gradually decrease in breadth from the first. The last is considerably twisted on itself; it has a small, flat articular head, but there is no corresponding surface on the fourteenth dorsal vertebra, which is only slightly thicker at the extremity than the succeeding ones. On the thirteenth vertebra there is a distinct articular surface.

The sternum (fig. 8) is small, in the form of an irregular transversely elongated lozenge, the posterior angle being narrower and more produced, and the anterior more rounded, than in the Zuyder Zee specimen; so that it approaches more the form seen in the genus *Physalus*. Its length is  $8\frac{3}{4}$ ", and its breadth  $12\frac{3}{4}$ ".

The scapula is low and broad, with a long acromium and well-developed coracoid process. Its breadth is 40", its height  $22\frac{3}{4}$ "; the acromium 10" long, and 3" in depth; the coracoid 4"; the glenoid fossa  $8\frac{1}{2}$ " by  $5\frac{1}{2}$ ". The humerus is 15" long, by 6" in diameter in the middle of its shaft and  $7\frac{1}{2}$ " at the lower end. The radius is  $24\frac{1}{4}$ " long in a straight line, 4"·6 broad above, 3"·7 at the middle, and 5"·3 at the lower end. The ulna, which is 25" long, including the olecranon projection, is 7"·5 broad above, 2"·7 at the middle, and 4"·5 at the lower end. The thickness of the radius at the middle is 2"·2; that of the ulna 1"·8.

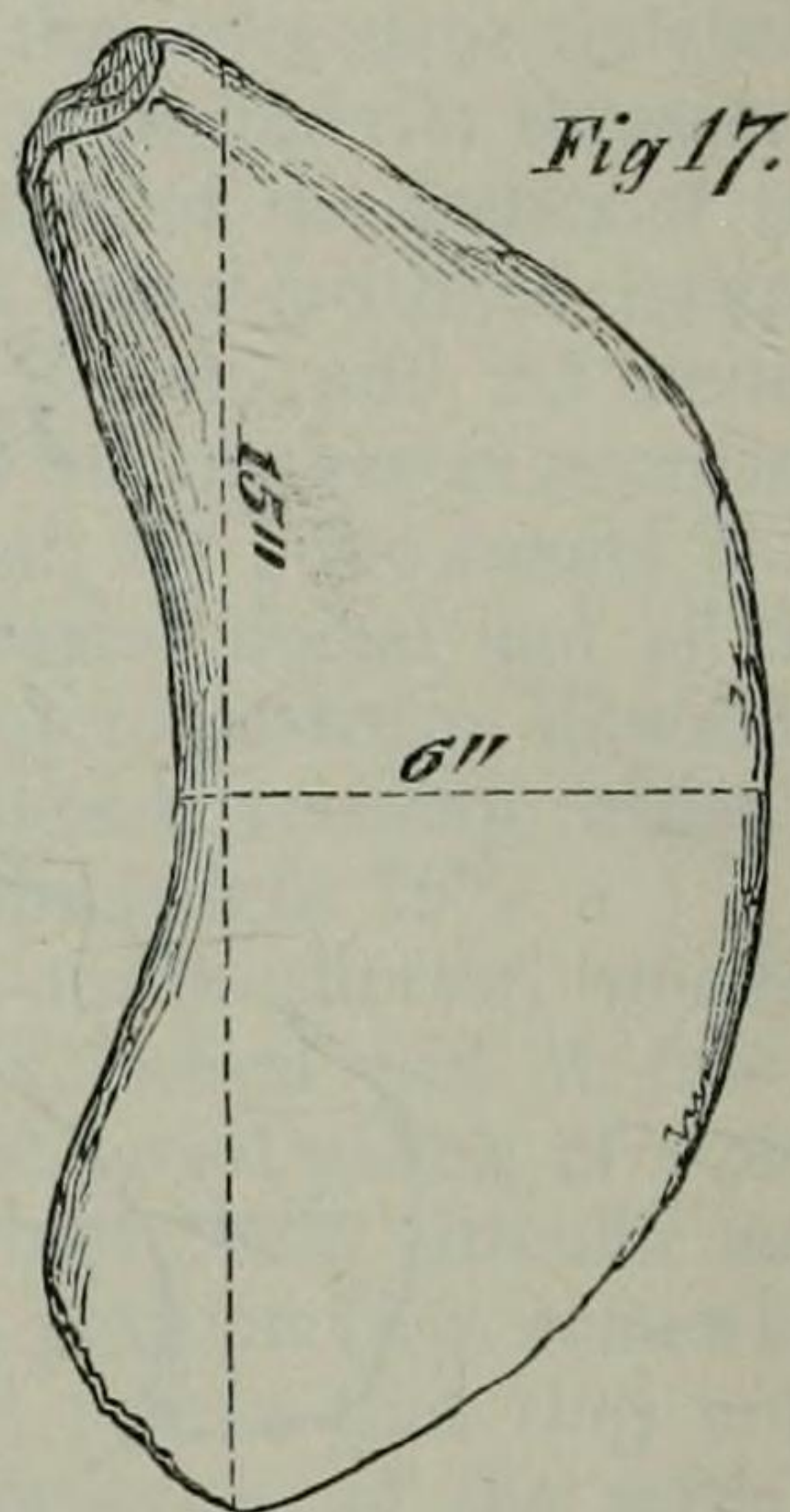
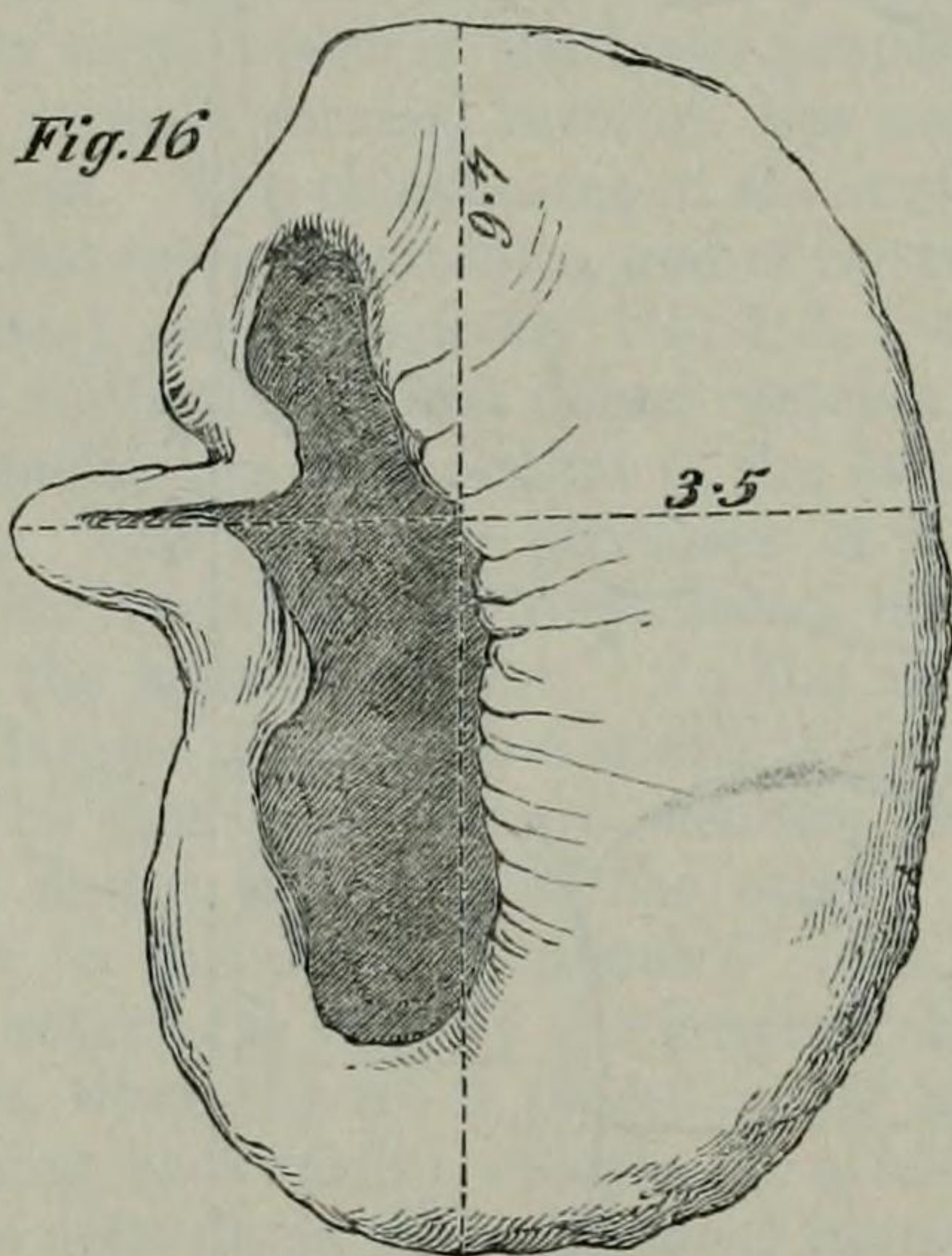


Fig. 16. Tympanic bone; half nat. size.  
17. One of the stylo-hyals.

The hyoid bone, formed of the completely united basi- and thyrohyals, is flatter and deeper from before backwards, and the lateral processes are smaller and more tapering, than in *Physalus*; but otherwise its general form is not dissimilar. Its extreme width in a straight line is 25"; its antero-posterior length  $10\frac{1}{2}$ ". The stylo-hyals (fig. 17) present a remarkable modification in form. Instead of the usual subcylindrical shape seen in *Physalus* and *Balænoptera*, they are very broad and flat, and much curved, having a convex rounded



border and a concave thin edge, their flat surface having somewhat the form of a crescent with truncated ends, 15'' long by 6'' broad. Their greatest thickness at the convex border is about  $1\frac{1}{2}$ '' . The ends are not alike, one being narrower and thicker, the other broader and flatter. The two bones are precisely similar.

Of the generic affinity of this Whale with the previously described specimen in the Leyden Museum from the Zuyder Zee, with Rudolphi's specimen at Berlin, and with the great Ostend Whale there can be no doubt. But is it specifically related to all or any of these? If this can be proved, the fact must have an important bearing on the distribution of the Fin-Whales, the coasts of European Holland and of its colony in the Indian Archipelago being as remote geographically and physically as almost any two spots upon the surface of the globe. Of course, to prove the absolute specific identity of two animals from the skeletons alone would be impossible. With only so much to found an opinion upon, all we can say, after having compared them bone by bone and found them agreeing in every particular, is that there is no proof of their being of different species, and that therefore, in the absence of other evidence, we are obliged to consider them as zoologically identical.

In the present case I have carefully compared the skeletons (that from Java and those from the European coast) together. I have even had the advantage of placing many of the bones of the two in the Leyden Museum side by side; and I confess that, allowing for difference of age, it is difficult to fix upon any characters in which they decidedly differ. The stylo-hyoids in the first, it may be said, are broader than in the Berlin or Brussels specimens, the sternum larger and of more definite cross-like form than in the Leyden skeleton, the transverse processes of the vertebræ are more developed and united at their ends than in either of these; but such characters are of no value for specific distinction. One, however, does appear to me of some importance; and that is the form of the orbital plate of the frontal, so decidedly narrower at the outer end in the Javan cranium than in the three specimens from Europe; but it is possible that even here age may cause the difference. Eschricht has laid great stress upon the little dependence that can be placed upon the proportions of the bones of the head in making out the specific characters of Whales. It is rather curious that the tympanic bones, though agreeing in general form, are actually smaller in the Java than in the Zuyder Zee skeleton, being less in length by 0''·3, and in breadth by nearly the same amount.

As I have said before, I cannot but regard this skeleton as having nearly attained its adult dimensions. Besides the special age-characteristics before pointed out, the general character of the vertebral column, especially the great development of the processes compared with the body of the bones, all indicate a condition approaching maturity. Whatever may be said, therefore, of the preceding specimen, I cannot identify the present one with the Ostend Whale: the difference of size alone appears to preclude it. Moreover, although a comparison of osteological details of the immature bones of the other specimens with those of the adult Ostend example was not



likely to throw much light upon the subject, here the case is different; and, as far as can be made out from the descriptions and drawings given by Dubar of that skeleton, there are notable differences, as in the form of the atlas, of the first rib, of the stylo-hyoid, in the statement that the second and three following ribs have heads reaching the bodies of the vertebræ, and in the statement that the transverse processes of the third, fourth, and fifth cervical vertebræ do not unite to form a complete hole as in the second, which last, however, would be of greater importance, if the figure did not throw some doubt upon its accuracy.

On the whole I have no hesitation in rejecting the name of *gigas* for this Java specimen, and, on account chiefly of its peculiar habitat, have some difficulty in placing it with *laticeps*. The question can only be definitely solved when far more is known of the habits and wanderings of the Cetacea than at present. The tendency of modern naturalists is decidedly to the idea that the geographical range of each species is much more strictly limited than was formerly supposed. Even Eschricht, who at one time strongly held the opposite opinion, and maintained that some species were cosmopolitan, was, as Prof. Van Beneden informs me, decidedly changing his views before his lamented death. We have, however, here an important alternative: either a species of Whale found in the North Sea, between the North Cape and the south coast of England, is found also on the coast of Java, without being known (at present at least) in any intermediate locality, or, on the other hand, in the specimen which I now bring before the notice of this Society we have a species new to science. As I know that the latter opinion will be adopted by many cetologists, I propose to call this specimen provisionally by the name of *schlegelii*, in honour of my distinguished friend, by whose influence the specimen has been made accessible to European naturalists, and who has himself made valuable contributions to this department of zoology\*.

The next specimen to be noted in the Leyden Museum is a skull of a very young Whale, of great interest as having also been brought from Java, by the late Dr. Reinwardt. It is labelled "*Balænoptera longimana*," and has in consequence been quoted in some of our most esteemed catalogues as evidence of the extensive geographical range of that species (Van Beneden, 'Faune Littorale de Belgique,' p. 38, and, after him, Gray, Proc. Zool. Soc. 1864, p. 208). The cranium is now in an extremely imperfect condition, the maxillaries, premaxillaries, and nasals being absent. There is, however, enough to show that it is not a *Megaptera*, but belongs to the subfamily *Balænopterinæ*, and probably, on account of the great width of the external part of the orbital process of the frontal bone, to the genus *Sibbaldius*. The lower jaw is 52" long, which would indicate an animal of about 18 feet, perhaps a young individual of the species last described.

\* Mr. Blyth (Journal of the Asiatic Society of Bengal, xxviii.) has noticed a Whale, said to have been 84 feet long, cast ashore on Juggu or Amherst Islet (lat. 19° N.) in 1851, and of which some bones are preserved in the museum at Calcutta, under the name of *Balænoptera indica*. The description of the coronoid process of the lower jaw indicates that it did not belong to the genus *Sibbaldius*, but was probably a *Physalus*.



Of *Balænoptera rostrata* there are two specimens, but neither of them yet articulated. The first is young and not very perfect; it formed part of the old anatomical collection of the University. The second and third cervical vertebræ are ankylosed by their arches; all the rest are free; the transverse processes are not fully developed.

The second is a fine perfect skeleton of an adolescent individual obtained more recently from the Norway coast. The cervical vertebræ are all free from each other; the upper and lower transverse processes fully developed; those of the axis and the sixth vertebra united together on both sides; the others all separate. A small tubercle represents the inferior transverse process on both sides of the body of the seventh vertebra.

The wealth of the collection of Cetacea in the Leyden Museum may be judged of when I mention that, in addition to the above, there are mounted skeletons of a very fine adult Hyperoodon, 23 feet long, a Grampus (*Orca gladiator*), two *Globiocephali*, a Beluga, two Narwhals, male and female, three examples of *Delphinus tursio*, eleven skeletons of smaller species of Dolphins, and a considerable series of skulls of members of this family.

In December 1841 a male Fin-Whale about 40 feet long was stranded at Katwijk-aan-Zee, six miles from Leyden. Dr. Schlegel gave a figure and description of its external characters, with some notes on its anatomy, in the second part of his 'Abhandlungen.' The skeleton passed into the hands of a person at Scheveningen, at which place it was for some time exhibited. As the rare opportunity here offered, of being able to connect a detailed and truthful account of the external appearance with the osteology of the same individual, I was highly desirous of making an examination of this specimen. It had been moved from Scheveningen; and it was not until after considerable trouble that I discovered the skeleton packed away in boxes in a store-room in the roof of a house at the Hague. I was enabled, however, to make some notes, though circumstances did not permit a very careful examination. This is less to be regretted, as I trust that by this time it has been transferred to a more appropriate resting-place in the Leyden Museum.

The skeleton was evidently that of a very young individual of the genus *Physalus*, agreeing in every particular, as far as I could ascertain, with *P. antiquorum*. The bones were spongy, and the epiphyses on the limb-bones and vertebræ all non-united, even that on the hinder surface of the axis. The skull was about 9 feet long; the nasals were deeply excavated; the orbital process of the frontals narrowed at the extremity. The lower jaw had a considerable curve, and a long coronoid process. As mentioned by Schlegel, the vertebral formula was C. 7, D. 15, L. 14, C. 24=60. The form of the atlas and of the bodies of the cervical vertebræ were as in *Physalus* generally; the transverse processes were not developed, being in fact mere stumps. The upper and lower processes were not united even in the axis. The lower process of the fifth very short. Ribs, 15 pairs; the first with a simple head. Sternum small, undeveloped, with two broad lateral lobes at the anterior part, and a deep notch between



them on the front border; prolonged posteriorly into a handle-like process; its entire length was 9", its breadth 10". Scapula 20" in height, and 32" in breadth. Humerus 14" long. Radius 22" long.

In the magnificent private collection at Utrecht, formed by the late Professor Lidth de Jeude, is a fine skeleton of a Fin-Whale, of which, through the kindness of the Professor's widow, I had an opportunity of making a detailed examination. I could not learn either the time or place of its capture, except that it was obtained on the coast of Holland. It was from a young animal. The epiphyses were detached from both ends of the bodies of all the vertebræ between the axis and the last two or three of the tail; also from both ends of the humerus and bones of the forearm. The exoccipital, parietal, and squamosal bones were non-united; and moreover the processes of the vertebræ were imperfectly ossified, as shown by the condition of their ends, and their shortness compared with the large size of the bodies of the bones. It was more advanced, however, than the specimen examined at the Hague.

The length of the cranium is 9' 10"; of the vertebral column, the bones being placed close together, without the epiphyses, 31' 2"; to this must be added at least 5 feet for the thickness of the epiphyses and the intervertebral spaces; so that the whole animal could not have been much short of 50 feet in length. The number of vertebræ is C. 7, D. 15, remainder (of which 15 or 16 are lumbar)  $42=64$ . The column is quite complete, and ends, not in an elongated bone composed of two or three centrums ankylosed, but in a small flat circular disk-like bone half an inch in diameter. The penultimate vertebra is simple, short, rounded at the edges, and about an inch in diameter. The one before this is much larger in every direction, increasing rapidly at its anterior end.

The cranium presents many of the characters before attributed to the genus *Physalus*, but with some peculiarities that I have not met with in any other specimen. The most remarkable of these is the great width of the rostrum, which, instead of gradually and steadily contracting from the base to the apex, as in *P. antiquorum* and the members of the genera *Sibbaldius* and *Balænoptera*, continues as far as the middle with very little diminution of width, so that the outer border is much more strongly convex in the anterior half. This is occasioned by the width of the maxillary bone, which more resembles that of *Megaptera longimana*. The great difference of the proportional breadth of the beak to the length of the cranium in this specimen, as compared with other Fin-Whales, is seen in the table at p. 399, and in the table of dimensions below. I may mention also that the breadth of the palatine surface of the maxillary, measured in a straight line, at the middle of the beak, is 16", whereas in the cranium of a Common Fin-Whale (*P. antiquorum*) in the Museum of the Royal College of Surgeons, of almost the same length (viz. 9' 3"), it is but  $11\frac{1}{2}"$ . The nasal bones are very broad and short, raised to a ridge in the middle line, and hollowed on each side on the upper surface and anterior border, though to a less extent than in the common species. The orbital plate of the frontal resembles



in its general form that of *Physalus antiquorum*, but is rather less narrowed externally. The lower jaw is massive, has a high, pointed coronoid process, and a considerable but not excessive curve.

*Dimensions (in inches) of Skulls of different examples of Physalus antiquorum and of the specimen at Utrecht.*

	Utrecht.	Antwerp Zoological Gardens.	Alexandra Park.	Louvain.	Young: Leyden.	Young: R. Coll. Surgeons.
Length of skull in straight line .....	118	184	186	179	126	111
Breadth of condyles .....	15	12	14	12	$14\frac{1}{4}$	$11\frac{1}{2}$
Breadth of exoccipitals .....	36	56	55	54	39	38
Breadth of squamosals (greatest breadth of skull) .....	60	96	86	78	60	56
Length of supraoccipital .....	27	41	$37\frac{1}{2}$	38	26	26
Length of articular process of squamosal....	28	36	34	35	25	24
Orbital process of frontal, length .....	$19\frac{1}{2}$	32	30	29	..	19
Orbital process of frontal, breadth at base*..	22	34	32	35	25	21
Orbital process of frontal, breadth at upper surface of outer end .....	13	18	17	18	$12\frac{1}{2}$	$12\frac{1}{2}$
Nasals, length .....	$6\frac{1}{2}$	$8\frac{1}{2}$	7	$8\frac{1}{2}$	$8\frac{1}{2}$	7
Nasals, breadth of the two, at posterior end .	$5\frac{1}{4}$	6	$4\frac{1}{2}$	3	4	3
Nasals, breadth of the two, at anterior end..	6	$9\frac{1}{4}$	$7\frac{1}{2}$	9	$6\frac{1}{2}$	6
Length of beak† .....	73	133	132	119	79	75
Length of maxillary .....	86	145	$142\frac{1}{2}$	137	86	87
Projection of maxillary beyond premaxil- lary .....	5	9	$10\frac{1}{2}$	8	9	..
Breadth of maxillaries at hinder end .....	15	17	17	15	14	13
Breadth of maxillaries across orbital pro- cesses (following curve).....	64	89	88	84	60	57
Breadth of beak at base‡ .....	..	56	54	55	38	39
Breadth of beak one-quarter of its length } from base .....	..	45	45	42	..	30
Breadth of maxillary at the same point ....	$13\frac{1}{4}$	$13\frac{1}{2}$	$14\frac{1}{2}$	$13\frac{1}{2}$	..	10
Breadth of premaxillary at the same point..	3	6	5	6	..	$3\frac{1}{4}$
Breadth of beak at middle .....	32	33	36	32	26	$22\frac{1}{2}$
Breadth of maxillary at middle .....	11	$9\frac{1}{2}$	10	10	$7\frac{1}{2}$	$7\frac{1}{4}$
Breadth of premaxillary at middle .....	4	$5\frac{1}{2}$	6	5	4	3
Breadth of beak at three-quarters of its } length from base .....	22	$18\frac{1}{2}$	23	21	..	13
Breadth of maxillary at same point.....	$5\frac{1}{2}$	5	5	$4\frac{1}{2}$	..	3
Breadth of premaxillary at same point ....	$4\frac{1}{2}$	$3\frac{1}{2}$	5	$4\frac{1}{2}$	..	$2\frac{1}{2}$
Length of lower jaw in a straight line ....	112	180	177	..	..	112
Height at coronoid process .....	18	21	23	..	..	15
Height at middle .....	..	..	13	..	..	$7\frac{3}{4}$
Amount of curve§ .....	11	..	24	..	..	15

In all the characters by which the atlas of *Physalus* differs from that of *Sibbaldius*, the present specimen agrees with the former.

\* From curved border of maxillary to hinder edge of orbital process of frontal.

† From curved border of maxillary to tip of beak.

‡ All the measurements across the beak include the curve of the upper surface.

§ Greatest distance of the inner surface of the jaw from a straight line drawn between the extremities.



The transverse processes are short, thick, and rounded, growing straight out of the upper half of the sides of the body of the bone, but, as said before, incomplete at their ends. It measures  $14\frac{1}{2}$ " in height, and 23" in extreme width; 16" across the articular surface for the skull, each facet being  $12\frac{1}{4}$ " in height and 6" in width; at their lower end these do not meet by a space of 2". The neural canal is 10" in height,  $5\frac{1}{4}$ " wide at the upper end, contracts rather above its middle to  $3\frac{1}{4}$ ", then expands somewhat again. The body of the axis measures 16" across and  $7\frac{1}{2}$ " in depth; with the processes, it is  $24\frac{1}{2}$ " wide and  $16\frac{1}{2}$ " high; the neural canal is  $6\frac{1}{4}$ " wide by  $5\frac{1}{2}$ " high. The upper and lower transverse processes do not completely unite, although they approach on one side within half an inch, on the other not quite so much; their extremities, however, are not ossified. The opening between them is regularly oval,  $4\frac{1}{4}$ " long and  $3\frac{1}{4}$ " wide.

The bodies of the remaining cervical vertebræ are rounded oblongs, their arches are low, and their spines little developed; the neural canals transversely elongated, and flattened above; from the third to the sixth, each has an upper and lower transverse process, the upper ones rising somewhat from the body of the vertebræ, before taking their outward and downward course, very thin, especially at their concave margin, gradually and very slightly decreasing in length. The lower processes somewhat shorter, and considerably broader, though thin; with a tuberosity on their under edge near the base; decreasing regularly in length, that of the sixth vertebra being notably shorter than the others. In the seventh vertebra the upper process is wider than in the others, and the lower one is reduced to a mere tubercle.

*Dimensions of the Cervical Vertebræ, in inches.*

	Extreme height.	Extreme width.	Height of body.	Width of body.	Height of neural canal.	Width of neural canal.
Third .....	14	23	8	13	$4\frac{3}{4}$	$6\frac{1}{2}$
Fourth .....	14	22	$8\frac{1}{4}$	$12\frac{1}{2}$	4	$6\frac{1}{2}$
Fifth .....	$14\frac{1}{4}$	22	$8\frac{1}{4}$	12	4	
Sixth .....	15	$21\frac{1}{2}$	$8\frac{1}{4}$	$11\frac{1}{2}$	$3\frac{1}{2}$	
Seventh .....	$15\frac{1}{2}$	22	$8\frac{1}{2}$	$11\frac{3}{4}$	$3\frac{1}{2}$	$7\frac{1}{4}$

There are 15 pairs of ribs. The first has an undivided head. The tuberosity is prominent but narrow, and a thin crest extends from it for some distance along the convex border of the rib. The greatest length in a straight line is 34"; the breadth at the middle 3", at the lower end 6". The second and third ribs have both well-developed capitular processes extending towards the bodies of the vertebræ, longer and more slender in the third. In the fourth this process is nearly obsolete, and absent in all the succeeding ones. There are rough surfaces on the infero-lateral portions of the hinder edges of the bodies of the first and second dorsal vertebræ, to which those processes of the ribs were connected, probably by the intervention of a strong ligament. The length of the second rib is 49"; of the third 59".



A bone which, from its general appearance, texture, and surface, I presume must be the sternum, especially as there was no other which could have represented this portion of the skeleton, presents most anomalous characters. It is very flat on both surfaces, a little more than 1" in thickness, of an irregularly oval form, being larger on one side than the other, and slightly produced at what I suppose would be the posterior border, and notched in the anterior. It is only  $5\frac{3}{4}$ " in its greatest diameter (transverse), and 4" in the other direction. Certainly the condition of the edges gave evidence of a bone incompletely ossified; but its very small size, especially in the antero-posterior direction, for a *Physalus* of the dimensions of the one under examination, is very remarkable.

The body of the hyoid I was unable to find; but the stylo-hyals are slightly curved, compressed, with a thick convex border, and a thinner concave border, rather larger at one end than the other; 14" in length,  $4\frac{1}{4}$ " in greatest width, and 2" in thickness—presenting, in fact, the usual form seen in the genus *Physalus*. The scapula and arm-bones had also the ordinary form: the former is 21" in height, and  $35\frac{1}{2}$ " in breadth; the acromium  $7\frac{1}{2}$ " long, and  $3\frac{1}{2}$ " in breadth; the coracoid  $2\frac{1}{2}$ " long; the glenoid fossa  $10\frac{1}{2}$ " by 7". The humerus is 17" long,  $7\frac{1}{2}$ " in longest diameter, and 20" in circumference at the middle. The radius is 27" long, 6" in breadth at the upper end,  $4\frac{3}{4}$ " at the middle and  $7\frac{1}{2}$ " below, and 3" thick at the middle. The ulna is 25" long, 7" across at the top,  $3\frac{1}{2}$ " at the middle (and 2" in thickness), and  $5\frac{1}{2}$ " at the lower end. The circumference of the two bones together at their middle is  $20\frac{3}{4}$ ". The metacarpal bones are long for the size of the animal, being respectively, beginning at the radial side, 6", 8",  $6\frac{1}{2}$ ", and  $4\frac{1}{4}$ "; whereas the same bones in the adult Common Fin-Whale in the Antwerp Zoological Gardens are  $4\frac{1}{2}$ ", 6", 6", and  $4\frac{1}{2}$ ", and in the specimen in the Alexandra Park  $4\frac{3}{4}$ ", 6", 5",  $3\frac{3}{4}$ ". The phalanges are long and rather different in number to those in the specimens of the Common Fin-Whale which I have examined, being 4, 5, 5, and 3 in the several digits, commencing on the radial side with No. II. In the Antwerp *Physalus* they are 2, 7, 6, and 3. But, as in both cases they have been artificially articulated, much importance cannot be attached to these numbers.

This skeleton differs in some respects from any other that I have seen, nor can I identify it with any published description sufficiently detailed for exact comparison. That it belongs to the genus *Physalus* as above defined there is little question. The only difficulty is in the form of the sternum. It must be remembered that the individual was young, and the bone, being slow of development, is subject to considerable variation in form during growth, and also, when fully grown, to great individual diversities of form. It scarcely seems advisable, therefore, on account of this one specimen to modify the generic diagnosis as regards this bone, though such a course might be necessary if a very small oval transversely elongated sternum were found characteristic of the adult animals belonging to the species. I think that there can be no question that this character, together



with the additional two caudal vertebræ, the wide maxillaries, the more elongated metacarpals, and the slight differences in the form of the cervical vertebræ and the ribs are sufficient to establish a well-marked species; and, unless it can be identified with any that has been previously described, I would suggest the name of *latirostris* as an appropriate designation.

In the Zoological Gardens at Antwerp is a very fine articulated skeleton of a male Common Fin-Whale (*Physalus antiquorum*, Gray), of which, with the courteous assistance of M. Vekemans, the Assistant Director of the establishment, I made a careful examination. The specimen has already been the subject of a paper by Professor Van Beneden, entitled "Sur une Baleine prise près de l'île Vlieland, et dont le squelette est monté au Jardin Royal de Zoologie d'Anvers" (Bull. Acad. Bruxelles, 2<sup>e</sup> sér. tome i. 1857, p. 390).

The skeleton is complete, with the exception of one of the pelvic bones, the tympanic bones, the last pair of ribs (probably), and one or two caudal vertebræ. As at present mounted, the intervertebral spaces appear to me too wide, especially in the cervical and caudal regions; and yet the skeleton measures in a straight line but 67' 6", viz. 15' 4" for the skull and 52' 2" for the vertebral column. The length of the animal is given by Van Beneden at 22 metres, or 72' 1". It exhibits all the signs of adult though not extreme age. All the epiphyses of the vertebræ are completely joined, as well as those of the humerus and the upper end of the radius and ulna. Those of the lower end of the last two bones are partially united. The upper border of the scapula is still incomplete towards the two extremities. The number of vertebræ is sixty-one, the last being modelled in wood; but from the character of the sixtieth I should say that there ought to be two behind it. Seven are cervical and fifteen dorsal, and, according to Van Beneden, fourteen or fifteen lumbar, though the place of attachment of the first chevron bone in the skeleton indicates but thirteen as belonging to this series. The characters of the atlas and the other cervical vertebræ are quite typical of the species; the upper and lower transverse processes, from the second to the sixth inclusive, are united to form complete rings. The breadth of the atlas is 25"; of the axis 44"; of the third 37". The aperture in the base of the great wing-like lateral process of the axis is 6½" long and 3" deep. The inferior process of the seventh is represented by a tubercle.

The cranium and lower jaw present little worthy of special notice, except that the articular processes of the squamosals are unusually developed laterally, giving great breadth to the posterior part of the head. The dimensions are given at p. 411. A circumstance that I have not observed in any other Whalebone Whale is that a considerable mass of bone of irregular form projects forwards from below the nasal bones in the trough of the vomer, to the extent of about two feet, only attached posteriorly. This is evidently an ossification developed in the ethmoidal cartilage.

There are fourteen pairs of ribs present; but as the fourteenth has not the characters usually met with in the last rib, and as the fifteenth



vertebra has the end of the transverse process thickened and showing traces of an articular surface, it is most probable, as Van Beneden supposes, that the fifteenth pair has been lost, and therefore that the skeleton, if complete, would present no exception to the normal number. The first rib is simple, 51" in extreme length, and  $13\frac{3}{4}$ " in breadth at its lower end. The second and third have capitular processes which reach nearly to the bodies of the vertebræ; that of the second is rather the longest. There are corresponding rough tuberosities on the sides of the bodies of the first and second dorsal vertebræ. The neck becomes rudimentary in the fourth, and obsolete in the fifth and all succeeding ribs.

The sternum is trifoliate, differing from the one figured at p. 393 chiefly in having the posterior process shorter, broader at the base, and more tapering to the point. Its extreme length is 19", and breadth 24". The hyoid has the usual shape; its extreme breadth is 38", and length 14". The stylo-hyals are 19" in length, and  $5\frac{1}{2}$ " in greatest breadth.

One pelvic bone is present, suspended on the left side; the other is modelled in wood. It is 15" long and 3" in greatest breadth, simple, straight, much compressed, slightly twisted on itself, broader generally at one end than the other, but pointed at both extremities. One edge is smooth and rounded, but furrowed by a deep linear groove; the other is irregularly tuberculated and spiculated. This form is quite different from that of the pelvic bones of the specimen in the Alexandra Park, where they are each  $18\frac{1}{2}$ " long, gently curved, flattened, quite smooth along the edges, and with a prominent angular projection from near the middle of the convex border.

The scapula is 31" in height and 51" in breadth; the acromium is 12" long; the coracoid  $5\frac{1}{2}$ ". The humerus 19" long, 9" in greatest diameter, and  $26\frac{1}{2}$ " in girth at the middle. The radius is 32" long,  $7\frac{1}{2}$ " in breadth at the upper and 9" at the lower end. The ulna 36" in extreme length, from the end of the olecranon, 30" from the middle of its surface for articulating with the humerus, 10" in breadth above and  $6\frac{1}{2}$ " below. There are six ossifications in each carpus. The phalanges appear complete: their number and the lengths of the metacarpals are given at p. 413. It should be stated that the latter are not very exact, as the ends of the bones are more or less concealed by the composition which replaces the cartilage. The baleen is present in both sides. The largest plates measure about 28" in length.

The recent discovery of a large number of fossil remains of Cetaceans in the excavations occasioned by the fortification of the city of Antwerp has given a great impulse to the study of the osteology of the existing members of the order in Belgium; and, chiefly by the exertions of Professor Van Beneden of Louvain, a very fine collection has been brought together, in great part obtained from the Northern seas, through the co-operation of the late Professor Eschricht of Copenhagen. Many of the specimens enrich the admirable anatomical collection of the University of Louvain; but most of the larger ones have passed from the hands of M. Van Beneden to the Royal



Museum of Natural History at Brussels, where they are arranged and displayed to great advantage, under the able direction of M. Du Bus. Of this collection I shall speak first.

The first object that meets the eye on entering the room is a magnificent skeleton of *Balæna mysticetus*, the only one to be seen at present in any museum in Europe, except at Copenhagen. The singular effect produced by the enormous size of the head, as compared with the remainder of the skeleton, must be seen to be fully realized.

The cranium is 18' 9" long in a straight line, the vertebral column 31' 6", making a total of 50' 3". The epiphyses of the arm-bones are united at both ends, as are those of all the caudal vertebræ, but not those of the lumbar and dorsal vertebræ; so that the animal was in a late period of the adolescent stage. The vertebral formula is C. 7, D. 14, L. 10, C. 23=54. The tail is quite complete. This is the normal *total* number, according to Eschricht and Reinhardt; but an individual peculiarity consists in the development of an additional rudimentary rib on the left side, about 18" long, and articulating with the transverse process of the fourteenth vertebra behind the neck. This vertebra is therefore reckoned among the dorsal instead of the lumbar series. The ordinary number of dorsal vertebræ and pairs of ribs is thirteen. The two last lumbar and three first caudal vertebræ are enveloped in an immense mass of exostosed bone. The skeleton appears quite perfect; even the pelvic bones are present, though not yet articulated. There are two bones on each side, differing considerably in the details of their conformation from the same bones in the skeleton which has been lately received, though not yet mounted, at the Museum of the Royal College of Surgeons.

The osteology of the Northern Right Whale has been so fully described by Eschricht and Reinhardt that no further remarks upon this skeleton (which furnished part of the material for their memoir) are necessary.

*Megaptera longimana*.—A very fine and complete skeleton, 46' long, of a nearly adult individual. The vertebral formula is C. 7, D. 14, L. 11, C. 21=53. Ribs 14 pairs. The enormous size of the fins is grandly displayed in this specimen; they measure 12' from the head of the humerus to the tip of the phalanges. The cervical vertebræ are all free; the second to the fifth have the upper and lower transverse processes separate in all, but they are not complete at the ends. Those of the second are short, thick, and convergent, but still with a wide interval between their ends; this, according to Eschricht, is completed in the living animal by cartilage, which may in old age become ossified; but this process must take place at a relatively later period of life than in the *Balænopteridæ*. According to the same excellent authority, the processes of the succeeding vertebræ are not continued in cartilage so far as to meet; so that we could never expect to find osseous rings on them. In the Brussels specimen the upper processes increase and the lower ones decrease in length, from the third to the fifth. There is no inferior process on the sixth or seventh.



*Sibbaldius*.—Of this genus there is a very interesting skeleton, almost the exact counterpart in size to that in the Leyden Museum. It was obtained by Eschricht from the North Cape. The condition of the epiphyses shows that it is young, they being all non-united both in the vertebral column and long bones; but the ossification of the transverse processes of the cervical vertebræ has proceeded further than in that at Leyden. The skeleton is well articulated, and gives now a total length of 31' 8"; but about 6" must be added for the end of the tail, which is wanting. The dimensions of the skull are given in the Table at p. 402. The nasals are narrow, cut off nearly straight at their anterior ends, slightly hollowed on each side above. The lachrymals are thickened at their outer edge. The orbital processes of the frontals broad externally. Lower jaw light, little curved, and with a short triangular coronoid process.

There are 7 cervical, 14 dorsal, and 32 lumbo-caudal vertebræ present; about 5 of the latter are absent, which would make a total of 58. The atlas has the usual characteristics of the genus. The transverse process of the axis forms a complete ring, the aperture of which has a length of  $2\frac{1}{2}$ " and height of 2". The whole process is  $5\frac{1}{2}$ " long, but is incomplete at the end; it is  $5\frac{1}{2}$ " in height at the middle, and the opening is situated much nearer the upper than the lower margin of the process. In the third vertebra also the upper and lower processes are united; in the fourth, fifth, and sixth they are separate. The lower one of the sixth is shortest, broad, and twisted on itself. In the seventh the inferior process is represented by a small tubercle.

There are 13 ribs present on the right side, and 14 on the left. The fourteenth is very much thinner than the others, twisted backwards at its lower end, with a very slender head, articulated to the transverse process of the vertebra. The first pair of ribs have double heads; but the anterior head on both sides is very incompletely developed, and on the right side completely detached from the remainder of the bone; it has a pointed end below, merely applied to the main part of the rib; so that if it had been lost in maceration, this rib might have been supposed to be simple. On the left side it is ankylosed, but very slender. It would be interesting to ascertain, by the examination of younger specimens, whether this anterior head has always a separate centre of ossification, as it is not improbable that this singular double-headed bone is in reality formed by the coalescence of two originally distinct ribs. The second, third, and fourth ribs have small capitular processes. The stylo-hyals are very flat, but not so broad proportionately as in the Java Whale, being 11" long and  $3\frac{1}{2}$ " in greatest width. The bones of the fore limbs present the same general characters and proportions as in the Leyden specimen from the Zuyder Zee. The sternum is absent.

This specimen has been previously mentioned in this paper as an example of *Sibbaldius laticeps*, Gray, presenting some interesting individual deviations from that at Leyden, referable to the development of the two skeletons not having proceeded *pari passu* in all parts of the system.



Of the Lesser Fin-Whale (*Balænoptera rostrata*) there are two skeletons—the first a very beautiful and perfect specimen, from the same locality as the last-mentioned skeleton. The baleen is *in situ* on both sides of the mouth, never having been removed. The animal was in the adolescent stage. The epiphyses of the upper end of the radius and ulna are united, but that of the head of the humerus is still separable. The entire length is 23' 2", of which the head occupies 5' 2". The vertebral formula is C. 7, D. 11, L. 12, C. 17=47; but one or more bones are wanting from the end of the tail. The cervical vertebræ are all free. The upper and lower transverse processes of the sixth are united on the right side, but separate on the left.

The other skeleton of the same species is rather larger, but not so complete. The cervical vertebræ are all free, and none of the transverse processes (excepting those of the second) are united at their ends.

The second division of the Cetacea (the *Delphinoidea*) is represented in the Brussels Museum by two skeletons of *Hyperoodon* (one nearly adult, 23' long, with two small sharp teeth at the extremity of the lower jaw, and the other young), the unique skeleton of *Mesoplodon sowerbiensis* (described by Du Mortier and afterwards by Van Beneden), *Orca gladiator* (an adult and young), *Globiocephalus svineval* (adult), *Beluga leucas*, *Monodon monoceros*, and five examples of the genus *Delphinus*.

The resources of the museum of the University of Louvain being, of course, not equal to those of a national establishment, its collection of Cetacean skeletons, though illustrative of most of the principal types, and all in excellent condition, is necessarily limited to individuals of moderate dimensions. Hence the *Balænoidea* are not so well represented as the *Delphinoidea*; and, as they all belong to well-known species, few notes will be sufficient.

*Eubalæna australis*? (Cape Whale).—Imperfect skull, 8' 4" long, of a young individual.

*Megaptera longimana*.—Complete skeleton of young, 32' 2" long, of which the head is 8' 6". Vertebræ, C. 7, D. 14, L. and C. 31=52. Ribs 14 pairs. Sternum with a very deep notch in the middle of the upper border. Upper and lower transverse processes of the axis further apart at the ends than in the Brussels specimen. Upper processes of the third, fourth, fifth, and sixth slender, almost straight, and of nearly equal length. Lower processes much shorter, and gradually diminishing from the third to the sixth; absent in the seventh.

*Physalus antiquorum*.—A fine cranium from the Jutland coast, about 15' in length. It is rather narrow posteriorly in proportion to its length; and the nasal bones, though of the general form characteristic of the genus, are very narrow, and pointed at their hinder ends.

*Balænoptera rostrata*.—Skeleton of a young individual, marked *B. minima*, and said to belong to a small variety only found among the Right Whales of Greenland. The total length is 17' 3"; but several vertebræ are wanting from the end of the tail. The skull is 4' long. There are 7 cervical, 11 dorsal, and 12 lumbar vertebræ, and 11 pairs of ribs. The cervical vertebræ are all free, and the



upper and lower transverse processes are not united at their ends in any of them; but in the axis the union is almost complete.

There is also a skull, 3' 8" long, of a younger specimen of this species.

The skeletons of the *Delphinoidea* include a very fine perfect adult *Hyperoodon rostratum*, 24' 4" long, of which the cranium is 5' 4". The vertebral formula is C. 7, D. 9, L. 8, C. 20=44. Ribs 9 pairs. One of the sharp-pointed teeth is left *in situ* at the end of the lower jaw, nearly covered by the dried gum. Also *Orca gladiator* (adult), *Globiocephalus svineval* (two adult and one foetal), *Lagenorhynchus albirostris*, *Delphinus eschrichtii* and *D. guianensis* (Van Beneden, Mém. de l'Acad. Roy., coll. in-8vo., tome xvi., figure), *Beluga leucas*, *Monodon monoceros*, and *Phocæna communis*. Of the last-named there are several specimens, including two beautifully prepared foetal skeletons. Among the collection of crania is the unique *Ziphius indicus*, Van Beneden (Mém. de l'Acad. Roy., coll. in-8vo., tome xvi., figure).

In conclusion, it may be useful to put down a list of the different species above noted, arranged systematically, with an indication of the collections in which they are contained.

#### Suborder BALÆNOIDEA.

*Balæna mysticetus*.—Skeleton, Brussels. Skull, Leyden.

*Eubalæna australis*?—Skeleton, Leyden. Skull, Leyden. Skull, Louvain.

*Megaptera longimana*.—Skeleton, Leyden. Skeleton, Brussels. Skeleton, Louvain.

*Physalus antiquorum*.—Skeleton, Antwerp. Skeleton, The Hague. Skull, Leyden. Skull, Louvain.

*Physalus latirostris*.—Skeleton, Utrecht.

*Sibbaldius laticeps*.—Skeleton, Leyden. Skeleton, Brussels.

*Sibbaldius schlegelii*.—Skeleton, Leyden.

*Balænoptera rostrata*.—Skeletons (two), Leyden. Skeletons (two), Brussels. Skeleton and skull, Louvain.

#### DELPHINOIDEA.

*Hyperoodon rostratum*.—Skeleton, Leyden. Skeletons (two), Brussels. Skeleton, Louvain.

*Mesoplodon sowerbiensis*.—Skeleton, Brussels.

*Ziphius indicus*.—Skull, Louvain.

*Globiocephalus svineval*.—Skeletons (two), Leyden. Skeleton, Brussels. Skeletons (two adult and one young), Louvain.

*Orca gladiator*.—Skeletons, Leyden, Brussels (two adult and young), Louvain.

(Specimens of the genera *Delphinus*, *Lagenorhynchus* and *Phocæna* not always noted.)

*Beluga leucas*.—Skeletons, Leyden, Brussels, Louvain.

*Monodon monoceros*.—Skeletons, Leyden (male and female), Brussels, Louvain.

It is remarkable that, in all these fine collections, that genus of



gigantic Delphinoids, *Catodon* or Sperm-Whale, is represented only by an atlas, and the lower jaw of a very young individual, at Leyden, and, if I remember rightly, an atlas at Brussels. There is, however, in a church at Scheveningen, in Holland, a skull, in a very imperfect condition, of one of these animals, washed ashore near that place in the year 1617.

2. ON A NEW SPECIES OF GRAMPUS (*ORCA MERIDIONALIS*) FROM TASMANIA. BY WILLIAM HENRY FLOWER, F.R.S., F.R.C.S., ETC., CONSERVATOR OF THE MUSEUM OF THE ROYAL COLLEGE OF SURGEONS.

The Museum of the Royal College of Surgeons has lately received from Mr. W. L. Crowther, of Hobart Town, two skulls belonging to an animal there called "Blackfish," a term, it may be remarked, which has been applied by sailors to many different species of Cetaceans. On showing them to Dr. Gray, whose extensive experience in regard to this order is well known, he immediately pronounced them to belong to a species unknown to him. At the same time he pointed out their resemblance to the skull found in a semifossil state in Lincolnshire, described and figured by Professor Owen under the name of *Phocæna crassidens*\*, to which species Professor Reinhardt of Copenhagen has recently referred a Cetacean still existing in the North Sea†. I have since had an opportunity of examining the extensive collections of skeletons and crania of Cetacea in the Museums of Leyden, Louvain, and Brussels, and have not found in them any similar specimen.

In reply to some queries respecting the animal from which the skulls were obtained, which I addressed to my esteemed correspondent Mr. Crowther (who, besides being one of the leading medical practitioners in the colony, is also the owner of several whaling-vessels), that gentleman writes as follows:—

" 'Blackfish.'—This fish is in reality a miniature Sperm-Whale in its habits, &c., feeding upon the same food ('squid'), geographically occupying the same localities as the Sperm-Whale, following the great equatorial currents so long as they retain their warmth, and met with in the greatest numbers in the southern hemisphere at those points where the equatorial meet the polar currents, eddies being formed in which no doubt the squid collects. I am not aware that the Blackfish preys upon anything but squid; it is essentially gregarious, countless hordes being met with where food is abundant. Length 12 to 15 feet; diameter 3 to 4 feet. Colour, black on the back and sides, lighter below. Males much larger than the females. Head obtuse, after the fashion of the Sperm-Whale. Pectoral fins small. Dorsal fin hook-shaped, and situated about two-thirds along the body towards the tail. Weight two to three tons, the former about the average. Oil, the only kind that will mix with sperm."

\* A History of British Fossil Mammals and Birds: 1846, p. 516.

† "Pseudorca crassidens, et for den Danske fauna nyt Hvaldyr" (Særskilt Aftryk af Oversigten over d. K. D. Vid. Selsk. Forhandl. Nov. 1862).