Description of the skeleton of Inia geoffrensis and of the skull of Pontoporia blainvillii, with remarks on the systematic position of these animals in the order Cetacea / by William Henry Flower.

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IV. *Description of the Skeleton of* Inia geoffrensis *and of the Skull of* Pontoporia blainvillii, *with Remarks on the Systematic Position of these Animals in the Order* Cetacea. *By* William Henry Flower, *F.R.S., F.R.C.S., F.Z.S., &c., Conservator of the Museum of the Royal College of Surgeons of England.*

Read November 22nd, 1866.

[Plates XXV. to XXVIII.]

I. *On the Skeleton of* Inia geoffrensis.

Of the several species of Cetaceans which are inhabitants of the waters of the Amazon and its great tributary streams, one has particularly attracted the attention of zoologists on account of certain peculiarities of its external conformation and of its skull and teeth, the only parts of its structure hitherto described.

The *Inia*, so called by M. Alcide d'Orbigny, from the name by which the animal is known to one of the Indian tribes of Bolivia, is chiefly characterized by the long, narrow, and almost cylindrical rostrum, furnished with scattered, stout and crisp hairs, by the broad, long, and obtuse pectoral fins, by the dorsal fin reduced to a mere ridge, and especially by the development of a large lobe on the inner side of all the posterior teeth.

The species is mentioned by Spix and Martius* as *Delphinus amazonicus*; but for the most complete account of its external characters, habits, and geographical distribution we are indebted to d'Orbigny, who described it under the name of *Inia boliviensis*†. He also gives a figure of the animal, and a side view of a skull which he brought home and deposited in the Museum at the Jardin des Plantes, with some details of the teeth. I will quote from this memoir two observations—the first referring to the habits, the second to the structure of this singular Cetacean:—"Toutes ces observations nous font regarder cette espèce comme ayant des mœurs beaucoup plus terrestres qu'aucune des espèces connues."—"Tous ces caractères réunis à une dorsale peu apparente, nous font proposer la formation d'un nouveau genre, qui établerait le passage entre les sousous [*Platanista*] et les stellères" [*Sirenia*].

* Reise in Brasil. t. iii. pp. 1119 & 1133 (1831). Von Martius states that his *Delphinus amazonicus* agrees very closely with Desmarest's description of *D. geoffroyi*, and even suggests that it may possibly belong to the same species. His description of the teeth is sufficient to determine the animal spoken of; but he says "pinna dorsalis distincta, elata." Perhaps he has here confounded it with some of the other species of fresh-water dolphins of the Amazon, the existence of which he did not suspect. The rude little figure he gives (fig. 34) more resembles *Delphinus fluviatilis* (Gervais) of Castelnau's Voyage than the *Inia*.

† Nouv. Ann. Mus. Paris, tom. iii. p. 23 (1834).

In the Zoology of d'Orbigny's 'Voyage en Amérique méridionale,' "Mammifères," by d'Orbigny and Gervais (1847), more careful figures both of the upper and lateral surface, and of the teeth, of the same skull are given (pl. 22), but unaccompanied by any further description. It is, however, suggested that the animal belongs to the same species as a stuffed and painted specimen received at the Paris Museum from the Musée d'Ajuda at Lisbon among the spoils of Napoleon's Peninsular campaign, and described by de Blainville in the Article "Dauphin" in the 'Nouveau Dictionnaire d'Histoire Naturelle,' t. ix. p. 151 (1817), as *Delphinus geoffrensis*, and subsequently by Desmarest* as *D. geoffroyi*.

In a later notice by Professor Gervais, in the Zoology of Castelnau's 'Expédition dans les parties centrales de l'Amérique du Sud,' "Mammifères," p. 90 (1855), this supposition is confirmed, and the name *Inia geoffrensis* definitively adopted. In this notice some further details are given respecting the original skull brought home by d'Orbigny; and a new figure of the external appearance of the animal is added, differing chiefly from that of d'Orbigny in the position of the pectoral limb.

A few years ago that enterprising naturalist Mr. H. W. Bates obtained at Ega two skulls, which are now in the British Museum. Of one of these, Dr. Gray has given the dimensions †.

According to information received from my friend Dr. Peters, there is in the Anatomical Museum at Berlin a skull brought home by Natterer. No description of this, however, has been published.

In the early part of the present year Mr. Edward Bartlett, while collecting zoological specimens on the upper Amazon, above Nauta, succeeded, after encountering many difficulties, in obtaining a complete animal, the carefully prepared skeleton of which has now been purchased for our National Collection. For the opportunity of examining and describing this rare and interesting specimen, before it was deposited in the Museum, I am indebted to the kindness of Dr. Gray.

The skeleton is that of a young animal, the epiphyses being not united to the bodies of the vertebræ from the axis to the tenth caudal; but the arches have completely coalesced with the bodies throughout the spinal column. The head of the humerus still retains its epiphysial condition. The total length of the living animal, judging from the skull and vertebræ, and allowing for the intervertebral spaces, would be but little more than 5′, the skull being 16·4″. The specimen obtained by d'Orbigny is stated to have measured $2^{m}\cdot4 = 6'\ 8''$ Eng., and its skull is $0^{m}\cdot48$ or 19″. The skulls collected by Mr. Bates indicate animals of still larger size, the one being 19·4″, the other 20·7″ long. The skull at Berlin, as Professor Peters has informed me, is $19\frac{1}{2}''$ Eng. in length. Martius states the length of the animal to be from 7 to 8 feet. Finally, Castelnau gives $2^{m}\cdot80$ or 8′ 4″ as the length of an individual taken at Nauta.

* Mammalogie, p. 512 (1822).

† Catalogue of Seals and Whales in the British Museum, p. 227 (1866).

As *Inia* has always been supposed to have certain affinities with *Platanista*, I have in the following description compared the different bones with those of that singularly modified Cetacean on the one hand, and of several of the ordinary *Delphinidæ* on the other. Fortunately the Museum of the College of Surgeons contains a skeleton of the Gangetic Dolphin of nearly corresponding age with the subject of the present communication, and I have also had frequently to refer to Eschricht's valuable memoir upon the species*.

The leading features of the skull have already been made known by d'Orbigny and Gervais; but I am able to add some further details regarding its structure.

A comparison of the two skulls at the British Museum sent by Mr. Bates, with the present example, shows only such differences as might be expected from the greater age of the former, such as a more marked development of the ridges and prominences in proportion to the size of the brain-case. The postnarial prominence especially is more elevated and angular in the older specimens. The teeth differ somewhat in number, as will be mentioned further on.

The principal dimensions of the three skulls are as follows:—

	Collected by		
	Mr. Bates. *a.*	Mr. Bates. *b.*	Mr. Bartlett.
Extreme length	20·7″	19·4″	16·7″
Length of rostrum (from anterior end of premaxillary to bottom of antorbital notch of maxillary)	13·5	12·7	11·0
From anterior end of premaxillary to lower edge of nasal bones	16·7	15·7	13·6
From anterior end of premaxillary to hinder edge of palate	15·7	†	12·6
Greatest breadth, across zygomatic processes of squamosals	9·4	8·1	7·0
Breadth of foramen magnum	1·4	1·2	1·3
Breadth of the occipital condyles	3·2	3·0	2·9
Breadth across antorbital processes of frontals	6·1	5·3	4·5
Breadth of rostrum at base (bottom of antorbital notches of maxillaries)	4·2	3·5	3·1
Breadth of rostrum at middle	1·4	1·2	1·1
Mandible, length	18·2	17·0	14·2
Length of symphysis	9·8	9·4	7·3
Greatest breadth across the posterior ends of the rami	8·7	7·3	6·5
Height of ramus at coronoid process	3·9	3·4	2·9

The want of symmetry so prevalent in the skulls of Dolphins is but slightly marked. It can, however, be detected in a slight twist to the right of the hinder part of the narrow median space between the premaxillary bones, and in the greater elevation on the same side of the postnarial prominence of the frontal bones. Both maxillary and premaxillary bones extend backwards to an equal extent on the two sides.

In the cranium of the young specimen which forms the subject of the present commu-

* "Om *Gangesdelphinen*," Trans. Roy. Dan. Acad. 1851. Translated in Ann. & Mag. Nat. Hist. for March 1852.

† Broken.

nication (see Plates XXV. & XXVI.), the elements of the occipital bone have completely coalesced with each other and with the basisphenoid, and partially with the parietals. The foramen magnum is subcircular, the greatest vertical and transverse diameters being exactly equal; but it is rather broader above than below. Its plane is nearly vertical when the skull is held horizontally. The condyles are large and prominent; they do not meet below by a space of ·7″. In the middle line on the supraoccipital, just above the margin of the foramen magnum, is a deep triangular depression, continuous with a broad and shallow median groove which ascends nearly to the vertex, and with lateral grooves which pass outwards above the upper edge of the condyles to the concave surface of the exoccipitals. In the lower part of the median groove the surface of the bone is very rough, being channelled out for a plexus of blood-vessels; and there are several rounded perforations, one of them as much as ·1″ in diameter, by which these vessels would apparently communicate with the interior of the cranial cavity. Corresponding to this groove, on the inner side, is a median bony ridge, but there is no transverse tentorial ossification. The lateral boundaries of the supraoccipitals are raised into strong narrow ridges, on the summit of which the occipito-parietal suture is situated. These are nearly parallel until they come opposite to the posterior angle of the maxillaries; then they rapidly converge, enclosing a triangle with a truncated apex which projects forward into the high postnarial eminence of the frontals.

The temporal fossa, as noticed by d'Orbigny, is very much larger in proportion to the size of the cranium than in any other Dolphin, except *Platanista*, not only occupying a larger space on the lateral surface of the skull, but being prolonged forward at the expense of the orbit. Its form is that of a long oval, with the small end turned forwards. Its posterior nearly semicircular boundary is formed by the ridge, before spoken of, at the junction of the occipital with the squamosal and parietal. The superior border, continued forwards from the latter, is a nearly straight, sharp, thin crest, projecting outwards and upwards, 3″ long, and averaging more than half an inch in height, formed by the maxillary uniting with the edge of the frontal, and posteriorly with the parietal. The inferior border is formed by a long and strong zygomatic process of the squamosal, approaching, but not equalling, that of *Platanista* in size, and a triangular pointed postorbital process of the frontal, ·7″ in length, and directed backwards and downwards, but which does not meet the process of the squamosal, by a space equal to its own length. In *Platanista* there is no space or postorbital process, the anterior end of the prodigiously developed zygomatic process of the squamosal reaching so far forward as even to be lodged in a hollow in that part of the orbital plate of the frontal from which such a process is usually developed.

The bones which enter into the formation of the temporal fossa resemble in their number and arrangement those of the true Dolphins rather than of *Platanista*. The parietal appears in the shape of a wide arch, receiving in its concavity the squamosal, and articulating for a space of ·6″ with the well-developed alisphenoid, thus completely

shutting off the squamosal from the frontal; whereas in *Platanista* the last-named bones unite for a considerable distance below the pointed anterior end of the somewhat triangular parietal, and the alisphenoid does not appear in the fossa at all.

The orbit, in its structure, as well as its size, is intermediate between that of *Platanista* and *Delphinus*. Its antero-posterior diameter is 1″. The malar bone is shorter and more thick and tuberous than in the Dolphins generally, and contributes chiefly to the formation of the prominent rounded antorbital eminence. The ends of the styliform processes are unfortunately broken off; but the portions that remain adhere to the form prevalent among the *Delphinidæ*. In the larger skull in the British Museum this process on one side is 1″ long, and appears to have a free, natural, rounded termination, not uniting, by a very considerable interval, with the zygomatic process of the squamosal. If this is constantly the case, *Inia* presents, in this respect, a remarkable exception to all other Dolphins. There is no distinct lachrymal bone.

The upper surface of the facial portion of the skull behind the rostrum is longer and narrower than in the *Delphinidæ* generally. It is distinctly bounded on each side by the sharp, straight, and nearly parallel crest before spoken of as forming the upper margin of the temporal fossa. Within these crests, on each side, the narrow upward prolongations of the maxillaries are deeply hollowed. Their hinder edge extends an inch further back than the anterior apex of the supraoccipital, and they curve inwards round the top of the premaxillaries to articulate with the nasals, and enter for a small space, between these bones and the premaxillaries, into the formation of the lateral boundaries of the narial opening. It is the narrowness and excavation, combined with the straightness and elevation of the outer borders, of the maxillaries, which gives the peculiar character to the upper surface of the skull of *Inia* as compared with that of *Delphinus*. The difference is only one of arrangement of the same parts; there is nothing superadded like the extraordinary outgrowths upon the maxillæ of *Platanista*.

Immediately behind the narial opening is a somewhat square-shaped elevation, rising vertically in front, sloping behind, and hollowed out and overhanging at the sides, formed chiefly of the frontal bones, and suggestive of the peculiar elevation of this part so characteristic of the Ziphioids. The nasal bones are applied to the front wall of this elevation, but do not reach the top of it. In general form they are irregularly quadrilateral, prominent and thick near their longest, straight, inner border, where they meet each other in the middle line, and deeply hollowed and notched in their upper and lower margins. Their shorter, but straight and thick, outer border articulates with the maxillary. Above and below they are bounded by the frontal, on which they rest. The greatest length of each bone is ·9″, the greatest breadth ·7″. They present no marked deviation from bilateral symmetry. Attached to the upper outer angle of each, and lodged in the groove between the frontal and maxillary, is a minute oval bone, ·25″ long, apparently originally distinct, though now partially united with the nasal; and their inferior internal angles rest upon a median single triangular piece, ·3″

broad and ·25″ high, distinctly separated by a suture from the frontals. It will be seen from the above description that the nasals are extremely different from those of most of the *Delphinidæ*, in which they are generally reduced to irregular, oval, unsymmetrical nodules. *Phocæna*, however, differs from its allies in this respect, and closely approximates to *Inia*. In *Platanista* also the nasal bones are well-developed flattened plates; but they partake of the great elongation, narrowness, and lateral distortion which pervades this region of the skull.

The opening formed by the junction of the anterior nares is 1″ long, and the same width posteriorly. It is bounded laterally and in front by two very prominent, rounded, longitudinal elevations, formed by a thickening of the premaxillaries, like that seen in this region in *Phocæna* and *Beluga*, but considerably more marked. No part of the maxillaries comes to the surface in the middle line in front of the narial aperture as in many of the *Delphinidæ* (e. g. *Globiocephalus*).

The rostrum is exceedingly long and narrow, and, except at its base, much compressed. The diminution of its breadth takes place rapidly for the first fourth of its length, but for the remaining portion only very gradually. The bone of which it is composed is of dense texture; and, even in this young subject, the sutures between the premaxillaries and maxillaries are almost obliterated. The width of the premaxillaries scarcely alters through their entire length, their outer boundaries being parallel, and the general diminution in the breadth of the rostrum taking place solely at the expense of the maxillaries. There is a narrow interval throughout in the middle line between the premaxillaries, and the subjacent cavity for the median ethmoid cartilage is not filled up with bone as in many of the *Ziphiinæ*.

On each side of the inferior surface of the rostrum (Plate XXVI. fig. 1) the alveolar tract, marked by the row of deep and distinctly separated tooth-sockets, extends from the apex to 1½″ from the bottom of the antorbital notch. Between these tracts the palatine surface is quite flat, and in the anterior three-fourths slightly raised above their level. At the middle of the rostrum it is only ·4″ wide, but gradually expands posteriorly. Between the two maxillary bones, in the median line is a narrow fissure, in which, 1″ behind the middle of the rostrum, a thin strip of the vomer appears, and continues visible as far as the posterior edge of the palate.

The remarkable conformation of the bones of the hinder part of the palatial region in the Gangetic Dolphin has been well described by Eschricht, who pointed out that the great lamella of bone which continues backwards the palatine portion of the maxillaries, and passes outwards and upwards to articulate with the squamosals and frontals, is really the pterygoid, and not the palatine as Cuvier supposed *. The easily separable condition of the bones of the young *Platanista* skull in the Museum of the Royal College of Surgeons has enabled me to confirm Eschricht's view; for on removing this plate the true palatine is seen, forming as usual the greater part of the anterior and

* Ossemens Fossiles, 4me édit. (1836) tome viii. p. 130.

outer wall of the nasal passage, but not entering in the slightest degree into the composition of the free surface of the bony palate.

In this disposition of the palatine and pterygoid bones *Platanista* stands alone among Cetaceans; even *Inia* presents no approximation to it. There are, however, in the latter genus some peculiarities in this region by which it may be distinguished from the ordinary Dolphins.

Behind the posterior pair of teeth the palate loses its flatness, and begins to rise to a ridge in the middle line and slope away at the sides towards the roof of the orbits. The summit of the ridge is formed by the vomer, which is quite uncovered in the middle line by the palate-bones. The inner edges of these bones, applied to the surface of the vomer, are distinctly marked, and posteriorly are ·4″ distant from each other. The suture between them and the maxillaries is completely obliterated, so that their limits forwards and outwards cannot be definitely stated. As in the ordinary Dolphins, the palatines have each an outstanding, nearly vertical, plate running outwards and backwards, unattached posteriorly, and forming the upper part (in the natural position of the skull) of the outer wall of the chamber which lodges the great postpalatine air-sinus. This plate is slightly developed and very thin, perforated by numerous large lacunæ, and, owing to the non-development of the outer reflected portion of the pterygoids, is completely free along its inferior edge.

The pterygoids are comparatively simple, and also very thin and lacunated. As usual, the upper or attached portion forms a ridge along the side of the cranium, continuous posteriorly with the ridge on the side of the basisphenoid, which forms the inner wall of the cavity for the lodgment of the ear-bones. This portion articulates by nearly the whole of its inner edge with the hinder expanded part of the vomer, and externally with the alisphenoid and orbitosphenoid. From its anterior part springs the recurved descending plate which bounds externally the posterior nares, and, then turning inwards and backwards, forms the anterior wall of these passages below the palatines. This last-named plate of the pterygoid forms the hinder part of the bony palate; anteriorly it lies on the hinder free edge of the inferior surface of the vomer, but does not quite cover it to the middle line; behind the vomer it diverges rather more from its fellow, leaving a gap of from ·1″ to ·2″ in breadth. Posteriorly each terminates by a concave free margin. The third portion of the pterygoid, which exists in all ordinary Dolphins (excluding the *Physeteridæ*), and which when present completely conceals that last described, being reflected from its hinder and inner edge outwards and upwards to meet the edge of the projecting plate of the palatine, and so close in the postpalatine sinus below, is wanting in *Inia*, or only represented in the osseous cranium by some small irregular body-excrescences. The result is that the cavity for the sinus is widely open below. It might be conjectured that this plate, being thin, brittle, and much exposed to injury during the process of cleaning the skull, had been broken away. It is certainly possible that such is the case;

but as the adult and apparently perfect skull from Ega, in the British Museum, shows a precisely similar condition to that above described*, it is probable that, if ossification takes place at all, it is of a very imperfect character.

Both petro-tympanic bones are unfortunately absent from the skull. The fossa at the base of the cranium for their lodgment is shallow, and the aperture left in the cranial wall by their removal large, compared with that in an ordinary Dolphin. It is irregular, circular, and averages 1″ in diameter. In the largest skull in the British Museum these bones are present, and enter considerably into the formation of the cranial wall, the inner and upper surface of the petrosal being seen in the interior of the cerebral cavity, on a level with the internal surface of the other bones†.

One circumstance in which the petro-tympanic bones of *Inia* differ from those of *Platanista* is their loose connexion with the rest of the cranium; for they are only attached by ligament, as in *Delphinus*, and not locked in their place by a process of the mastoid. In general form the tympanic bullæ resemble those of *Delphinus*, though they are larger than in a member of that genus of corresponding size, and have their anterior (Eustachian) extremity rather more prolonged and pointed, though to a far less degree than in *Platanista*. Their antero-posterior length in the adult skull is 1·65″, their greatest breadth 1·1″.

The mandible presents a remarkable miniature resemblance to that of a Cachalot. It differs from the mandible of all the true *Delphinidæ* by the great length, narrowness, and shallowness of the symphysial portion, which includes three-fourths of the tooth-bearing part of the rami. The consequence is that the hinder parts of the rami diverge much more rapidly from each other than in the true Dolphins. The coronoid process is unusually elevated. The lower jaw of *Platanista*, as is well known, presents all these characters, but in a much more exaggerated degree.

The characteristics of the teeth have been well described by d'Orbigny and Gervais. They are distinguished from those of all other Cetaceans by the peculiar and very

* In the smaller skull in the same Collection nearly the whole of the pterygoids have been destroyed.

† After noticing that in certain Delphinoids the aperture left between the hinder edge of the alisphenoid, the exoccipital, basioccipital, and basisphenoid is exceedingly small, so that the tympano-periotic is still more shut out from the cranial cavity than in *Balæna*, Professor Huxley remarks that "in *Platanista* the aperture is large, and the periotic appears in the interior of the cranial cavity in the ordinary way" (Elements of Comparative Anatomy, 1864, p. 276). This is certainly the case in the two small *Platanista* skulls in the Museum of the College of Surgeons, upon which the observation was founded; but it is worthy of note that in a large and apparently aged skull of an individual of the same genus in the British Museum the periotic bones are completely shut out of the cerebral cavity by the excessive development of the proper cranial bones, and communicate with it only by a narrow passage fully an inch in length. Whether this difference depends on age or on species I cannot at present determine; but it shows that the relative position of these bones to the rest of the cranium may vary, even in most closely allied forms.

marked rugosity of the surface of their crowns*, and especially by the broad, rounded lobe, developed on the inner side of the base of the crown of those situated in the posterior part of both upper and lower jaws (see Plate XXVI. figs 1, 2 & 3). In the anterior two-thirds they are simple, conical, and slightly incurved. They gradually increase in size from the front of the jaws until the fourth from the posterior end of the series, after which they diminish again. Unlike those of most Dolphins, the teeth are implanted by large and generally somewhat twisted and flattened fangs (in the hinder teeth very wide transversely), which fit so tightly into deep alveoli that it is almost impossible to extract them, even in the dried skull, without injury to the bone. When the mouth is shut they fit closely into the interspaces of the opposite series; but there is little sign of attrition to be seen anywhere on their surface.

The number of the teeth in the different specimens of *Inia* examined shows a considerable range of variation, presuming that they all belong to one species. In the one now described there are $\frac{\text{R. 26 L. 26}}{\text{R. 25 L. 27}}=104$. The larger specimen in the British Museum from Ega has $\frac{28-28}{26-27}=109$, and also two minute rudimentary teeth in the gum behind the last in the left maxilla. In the smaller skull from the same place there are $\frac{29-26}{28-27}=110$. In the skull in the Paris Museum, brought by d'Orbigny, there are, according to Gervais, $\frac{33-33}{33-33}=132$; but in the type specimen in the same museum, taken from Lisbon, the number is given by de Blainville as $\frac{26-26}{26-26}=104$. In the Berlin skull the teeth are $\frac{34-32}{33-32}=131$†. Von Martius in his diagnosis of the species gives $\frac{28-28}{29-29}=114$.

The bones of the hyoid apparatus scarcely differ from those of the ordinary Dolphins. Their general form is shown in the figures (Pl. XXVI. figs. 4 & 5) at half their natural size. The basihyal and thyrohyals are not yet united by continuous ossification. The stylohyals are thick, subcylindrical, slightly curved, and somewhat flattened towards the ends.

	in.
Antero-posterior diameter of the basihyal	1·0
Transverse diameter	1·3
Length of thyrohyal	2·0
Greatest breadth	0·6
Distance between the outer extremities of the thyrohyals	3·4
Length of stylohyal	2·7
Greatest thickness	0·4

The spinal column (Pl. XXV. figs. 1 & 2) appears complete to the end of the tail, and consists of but 41 vertebræ, the smallest number known in any Cetacean‡. Of these,

* Some Dolphins of the genus *Steno* of Gray present a similar though far less marked rugosity; and indications of it are seen in young specimens of *Orca* and *Pseudorca*.

† Peters, in a letter.

‡ As the bones had been separated from each other adncleaned at the time that they came into my hands for

7 belong to the cervical, 13 to the thoracic, and 21 to the lumbo-caudal region. When the vertebræ are placed in order, with their bodies in contact, the whole column measures 38·8″.

The cervical region, as in *Platanista*, occupies a larger proportional space than in most other Cetaceans, being 3·3″ long, or $\frac{85}{1000}$ of the whole column. In a common Porpoise, measured for the purpose of comparison, it is but $\frac{30}{1000}$. All the vertebræ are distinct, as in *Platanista*, *Beluga*, and *Monodon* alone among toothed Whales.

The atlas (Pl. XXVII. fig. 1), very large for the size of the animal, greatly resembles that of *Platanista*, but is higher in proportion to its breadth. Its neural arch is strong, and has on its upper surface a slight longitudinal ridge representing the spine. The base of the arch is not perforated as in many Cetaceans, and the groove for the sub-occipital nerve is but slightly marked. On each side, between the anterior and posterior articular surfaces, are two rounded eminences, the rudiments of an upper and lower transverse process. In *Platanista* there is only a single intermediate process (which Eschricht considers to represent the lower process), but it is developed to a much greater length. In *Beluga* both processes are present as in *Inia*, and upon corresponding parts of the surface of the bone. As in the other Odontoceti having a free atlas, there is a strong process developed from the hinder edge of the lower arch of the bone, which passes under and articulates with the inferior surface of the axis (see Pl. XXV. fig. 2). This is bifid at the extremity, and much more powerfully developed than in the young *Platanista* which served for comparison.

The axis has a massive body, and a high neural arch. There is no distinct odontoid process, but only a general (though strongly marked) prominence of the anterior surface of the body, especially towards its lower margin. On the under surface of this there is a large rounded articular facet for the inferior process of the atlas. This is continuous at the sides with the anterior articular facets, and would indicate a tolerably free motion between the first two bones of the neck. In *Platanista* this anterior projection of the body of the axis is still more strongly marked, forming a process quite comparable with the "odontoid" of other Mammalia. In *Beluga* it is almost wanting. The other processes of this vertebra differ somewhat in detail from those of *Platanista*. The spinous process is broad and bifid; the posterior zygapophyses are much less prominent, and their surfaces look more backwards. A proper transverse process can scarcely be said to exist. There are, however, instead of the single, conical, backward-directed process of *Platanista*, slight rudiments of an upper and a lower process, with a groove between them, on the hinder surface of the lateral wings of the bone which support the great articular facets for the atlas. The posterior epiphysis of the body was not ankylosed.

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description, I must admit the possibility of some of them being lost; but the circumstances under which the skeleton was prepared render this, at the least, extremely improbable. When it arrived in this country the vertebræ were all united by their natural ligaments. Unfortunately they were not counted when in this state.

The remaining five cervical vertebræ are compressed in the antero-posterior direction, but less so than in most Cetaceans. They do not present the peculiar depression and transverse extension characteristic of the cervical vertebræ of *Platanista*, but their bodies are nearly circular in outline, and the height of the neural canal bears a more considerable proportion to its breadth. The bodies increase but very slightly in thickness from before backwards. The arches are wide and low, their sides meeting above at very obtuse angle, and so narrow in the antero-posterior direction as to leave spaces between them about equal to their own breadth. They increase but very slightly in height from the third to the seventh, and possess but a mere rudiment of a spine, scarcely recognizable in the third, and but ·2″ in height in the seventh. The anterior and posterior articular facets of the arches are well developed in all, and have their usual relations.

The transverse processes are, as usual, two on each side, upper and lower; the upper springs from the arch, the lower from the body of the vertebra. In the third vertebra these two are very near together, and approximate at their ends so as to enclose an oval foramen or canal ·2″ in its greatest diameter. On the left side this canal is completely surrounded by bone; on the right side it is not quite completely inclosed. In *Beluga* similar rings are formed by the transverse processes of this vertebra, also in the *Platanista* described by Eschricht, though in the College specimen there is but a single broad imperforate transverse process. In the fourth vertebra the processes are wider apart, short, and obtuse, and of about equal length; a small elevation rises from the side of the body of the bone, midway between them. In the fifth vertebra they are still wider apart, owing to the upper one, which is short and conical, rising higher on the side of the arch. The lower process is much larger, stouter, rounded at the end, and directed backwards. Although upwards of ½″ long, it was evidently not fully developed in this immature individual, being tipped with cartilage. The prominence of this process, contrasting with the almost rudimentary condition of all the others, is a marked characteristic of the cervical region. In *Platanista* and *Beluga*, as in most other Mammalia, it is the sixth vertebra which has the most largely developed inferior transverse process, in the former very remarkably so. It is worthy of note, however, that the Dugong (*Halicore*) agrees with *Inia* in this respect, as well as in many other of the characters of the neck-vertebræ.

In the sixth vertebra, both upper and lower processes are small and conical. In the seventh vertebra the upper process is more developed; the lower one still exists, but in quite a rudimentary state; behind it is a shallow excavation for the head of the first rib. The laminæ of the arch of this vertebra are wider than in the others; its spine, as before said, is slightly higher; and the posterior surface of its body is transversely extended.

The thirteen thoracic vertebræ measure in length when placed in close contact 12·5″. Their bodies increase at first rapidly, then more gradually in length—the first mea-

suring ·5″, the sixth ·9″, and the last 1·2″. Their arches are surmounted by rather long, erect, and (especially in the hinder part of the region) very broad spines truncated at the top. The antero-posterior breadth of these processes presents a constant relation to the length of the body, being always nearly equal with it, and forms rather a remarkable feature in the general aspect of the vertebral column. The height of the spine of the first thoracic vertebra is scarcely inferior to that of the others, which are almost precisely equal. In the sixth, from the inferior edge of the body to the junction of the laminæ of the arch measures 1·6″; the spine above this point is 2·2″. Distinct articular facets or zygapophyses are developed on both the anterior and posterior edges of the arches as far as the ninth vertebra, and on the anterior edge only of the tenth and eleventh. These, as usual, are broad and wide apart at the commencement of the series, and gradually become narrow and approximated as they shift from the sides to the summit of the progressively diminishing neural arch.

The so-called oblique processes (metapophyses of Owen) begin to separate themselves from the transverse processes at the fifth or sixth vertebra, and gradually pass upwards and inwards on the anterior edge of the arch towards the prozygapophyses, which they supersede on the twelfth vertebra. Owing to the comparatively slight development both of these processes and the zygapophyses, the thoracic vertebræ of *Inia* are not locked together in the manner which distinguishes those of *Platanista*.

It remains only to speak of the processes for the articulation of the ribs, which offer some interesting peculiarities. In all the ordinary *Delphinidæ* the anterior ribs are articulated by their tubercle to a well-developed transverse process standing out from the side of the arch, and by a long neck to the hinder edge of the body or root of the arch of the antecedent vertebra. There is usually no indication of any articular surface for the head of its own rib on the front edge of the body of the vertebra. At about the middle of the series the heads suddenly cease to be developed, and the rib is only attached by its tubercle to the end of the transverse process, still arising from the arch, but gradually lengthening and becoming lower in its point of origin, till at the end of the series it springs rather from the body of the vertebra than from the arch, and is in a line with the transverse processes of the lumbar vertebræ. This arrangement, departing considerably from that found in the ordinary mammal, occurs in *Delphinus*, *Phocæna*, *Orca*, *Globiocephalus*, *Beluga*, *Monodon*, and their immediate allies—in fact, in all the *Delphinidæ* which have ossified costal ribs. In the remarkably aberrant *Hyperoodon* and *Physeter* a totally different arrangement takes place in the hinder part of the dorsal region, which, however, is equally peculiar among the Mammalia. The upper transverse processes springing from the arch (diapophyses, Owen) suddenly cease, and the rib retains its connexion with the body only: the articular surfaces of the latter push out a process (which, on Owen's system, would be called a parapophysis), at the end of which the rib is attached, and which becomes the transverse process, being continuous serially with the transverse processes of the lumber region. In the first case, the transverse process on the

body of the last dorsal vertebra is arrived at by a gradual lowering of the transverse process of the arch of the first; in the second it is a new process, first appearing on the body rather abruptly, as the process on the arch ceases, but for the space of two or three vertebræ coexisting with it, as in the cervical region: or, to explain the case in other words, the anterior ribs in both have an upper and a lower connexion with the vertebræ; in the first instance they lose their lower connexion by the non-development of their neck and head, but the gradual lowering of the transverse process brings the headless rib again in connexion with the body, by the intervention of a long straight process; in the second instance they always retain their lower connexion, but the development of a process out of the articular surface of the body, with concurrent shortening of the neck of the rib, and disappearance of the upper process of the vertebra, produces an exactly similar result.

In *Inia* the mode of attachment of the ribs is, as far as I know, peculiar among Cetaceans, being intermediate between the two distinct forms above described, and far more resembling that which obtains in the Sirenia and the terrestrial mammals. The anterior vertebræ have as usual a tolerably well-developed, thick and rounded transverse process, springing from the arch at the junction of the pedicle with the lamina, and pointing upwards and forwards, with a large articular facet at its extremity; this process gradually becomes shorter, till in the seventh vertebra little more than the articular facet remains on the side of the arch. On each side of the body of the first vertebra are two distinct articular facets, each receiving part of the head of the first and second ribs respectively. The same occurs in the two following vertebræ, though the facets are less distinctly marked, the head of the rib apparently articulating chiefly to the intervertebral substance in front of its own vertebra. In the fourth, and more distinctly in the fifth and succeeding vertebræ, there is a strongly-marked articular facet on the anterior edge of the body, while that on the posterior edge has entirely disappeared (a condition, it will be observed, never found in the true *Delphinidæ*). Hereafter each rib is solely articulated to its own vertebra, and its lower attachment becomes moved by degrees from the anterior edge to the middle of the body. As far as the seventh vertebra the rib has a double attachment; but in the eighth the upper and lower articular surfaces (that on the arch and that on the body) have coalesced, though the part that originally belonged to the transverse process and that on the body are distinctly recognizable. This coalescence, however, becomes more complete; and, by the diminution of its upper part, the articular facet, at first elongated vertically, becomes oval in the opposite direction in the eleventh vertebra, and also begins to rise out from the body as a short thick process. This process is somewhat elongated and flattened in the twelfth, and notably so in the thirteenth vertebra; and at the same time the articular surface becomes gradually reduced in size, corresponding with that of the head of the rib. We have thus among the toothed Whales a third method by which the transformation from the first thoracic vertebra with its doubly attached rib, to the last with its singly attached

rib, is effected, not in this case by the disappearance of either the lower or the upper attachment, but by their gradual coalescence.

In *Platanista* the attachment of the ribs is again different in detail, being something between that found in the true *Delphinidæ* and in *Inia*. Each of the first seven ribs is attached to the transverse process of its own vertebra and to the body chiefly of the preceding vertebra; but the transverse processes differ from those of the *Delphinidæ* in being very short, and in being more rapidly transferred down to the bodies; indeed this takes place as early as the sixth vertebra, and before the disappearance of the articular facet for the head of the rib, leading to a blending of the two articulations in one as in *Inia*.

The remaining vertebræ (lumbo-caudal) are twenty-one in number. In accordance with the usual (and most correct custom) of reckoning the caudal region of the Cetacea as commencing with the first vertebra which bears a chevron bone*, there are but three, or at most four, vertebræ, which can properly be called lumbar. The uncertainty rests upon the difficulty of determining, in a skeleton of which the bones are all separated, and in which, owing to its immaturity, the articular surfaces and processes are not very distinctly marked, to which of the vertebræ the first (always very small) pair of hæmapophyses was attached. I think, however, that there can be little doubt that the fourth of the vertebræ behind the thoracic region did bear such bones, not only from indications on its own surface, but also because the facets on the hinder edge of the under surface of the fifth are too strongly pronounced to be the attachments of the small first pair. Taking, then, the true lumbar vertebræ at only three, *Inia* presents

* As a uniform system of nomenclature in enumerating the vertebræ of Cetacea is very desirable, it is to be regretted that Eschricht and Reinhardt, in their most recent works on Cetology, should have given the weight of their high authority to reckoning as the last of the lumbar vertebræ the one immediately preceding the first chevron bone, and which has commonly been regarded as the first caudal. The only reason given for this change is, that "the anus, which may justly be said to mark externally the limits between the abdomen and the tail, is situated directly beneath the first chevron bone" [1]. This, however, does not prove the case; for if we look at the skeleton of any terrestrial mammal in which the distinction between the different regions of the vertebral column is definitely marked, we may see that the commencement of the caudal region is situated some way *in front* of the position of the anus. We ought rather, according to this criterion, to reckon two or three of the vertebræ in the Cetacea commonly called lumbar to the region of the tail,—a view further strengthened by the fact that, in the ordinary mammals, the chevron bones, when present, begin generally not on the first, but on the second or third caudal vertebra. Such a division would, however, be quite impracticable.

Each chevron bone belongs essentially to the vertebra in front of it. This is most clearly seen when they are small, as in the commencement of the series. In the skeleton of a *Physeter* that I lately examined, the first is even ankylosed to the posterior edge of the body of its proper vertebra, and has no connexion with that behind it. It is quite certain that any vertebra bearing a chevron bone cannot consistently be regarded as one of the lumbar series. We may therefore conveniently reckon the first vertebra which is so distinguished as the commencement of the caudal region.

[1] Recent Memoirs on the *Cetacea*, published by the Ray Society, 1866: Eschricht and Reinhardt on the Greenland Whale; p. 105; and Reinhardt on *Pseudorca crassidens*, p. 204.

an extraordinary deviation from all other Cetaceans, among which the number, though certainly very variable, is usually considerable, ranging from eight in *Platanista* and *Physeter* to twenty-four in some of the *Delphini* and *Lagenorhynchi*. On the other hand, in the Sirenia, the lumbar region of the vertebral column is, as in *Inia*, extremely restricted.

The three lumbar vertebræ are very remarkable for the great antero-posterior breadth of their processes, both spinous and transverse. The bodies are large, being respectively 1·3″, 1·4″, and 1·5″ in length; their extremities are subcircular, and, as usual in the Cetacea, the middle of the side below the origin of the transverse process is much contracted, so that the median line of the under surface forms a sharp ridge, from which a strongly marked arterial groove runs outwards and backwards to the hinder edge of the root of the transverse process. The spinous processes resemble those of the posterior dorsal region; the first two are slightly curved forwards, the last is nearly vertical and somewhat smaller. The oblique processes (metapophyses) are short, flat, rounded projections from the upper part of the laminæ of the arch, very closely approximated to each other. The transverse processes rise from the whole length of the side of the body; they are of nearly equal length, but increase in breadth, especially by the development of a considerable angular process on the middle of their anterior border, most conspicuous in the third vertebra; beyond this process the anterior border is sharply cut off, so that the extremity appears to point backwards. The hinder border is nearly straight, with a notch close to its origin from the body, continuous with the groove before spoken of on the inferior surface of the bone.

The vertebra here reckoned as the first caudal closely resembles the last lumbar. Its body is of the same length, but its transverse process is even broader. The succeeding tail-vertebræ keep up the same general character, having large heavy bodies and broad processes. The projecting surfaces on the hinder edges for the attachment of the chevron bones are very strongly marked as far as the ninth, after which they become obscure; they are not seen on the anterior edge until the fifth. It is difficult to determine exactly how many chevron bones there were, but probably not more than eleven. The spinous processes, broad and rounded at their summits, become gradually lower, until in the tenth the greatly reduced vertebral canal is scarcely closed in by the laminæ of the neural arch, and there is no longer a true spine. In the eleventh, the canal is altogether open above. The metapophyses continue in much the same relative development and situation as far backward as the spinous processes extend. The transverse processes gradually diminish in length, and lose their characteristic form. Already in the second that cutting away of the anterior edge noticed in the lumbar region is lost; and in the third and succeeding vertebræ the anterior edge is straight, and the hinder one sloping, so that they appear to point forwards. In the eighth they form but a slight prominence on the anterior part of the body, and in the ninth they have altogether disappeared. The vertical perforations for the lateral

ascending branches of the caudal artery, so characteristic of a certain region of the tail-vertebræ of the Cetacea, occur first in the fifth vertebra, but only on the left side; in the sixth they are seen on both sides, perforating the body of the bone, not the root of the transverse process.

As in all Cetacea, the caudal vertebræ suddenly change their characters at the point where they enter the laterally expanded part of the tail and where the chevron bones cease to be developed. They now lose their cylindrical form, and become broad, depressed, and angular. There are seven such vertebræ in the present specimen; and the eighth from the end of the series, or the eleventh caudal, reckoning from the beginning, is what may be called the transitional vertebra, being intermediate in form and size between its two exceedingly different neighbours. The last two show a rapid diminution in width. The terminal one is triangular in outline when seen from above.

Nothing can well be more dissimilar than the lumbo-caudal region of the spinal column in *Inia* and *Platanista*. In the latter the short bodies, the long narrow transverse processes, and high spines curving forwards and bearing immense laterally developed oblique processes with (throughout the lumbar region) well-marked anterior and posterior articular surfaces, form most striking distinguishing characters.

The chevron bones sent with the skeleton are ten in number. It is probable that the first is wanting, as there is none corresponding with the form this usually has in the Cetacea. I have therefore indicated its situation with a dotted outline in the figure of the vertebral column (Pl. XXV. fig. 2). These bones agree in general characters with the processes of the vertebræ with which they are connected, being of moderate length, very broad and rounded at their free extremity. The lateral halves of the last three are not united in the middle line.

There are thirteen pairs of ribs (Pl. XXVII. fig. 2), the last being well developed and articulating with the transverse processes of the corresponding vertebræ. They are stout and heavy for their length, more so than in the ordinary Dolphins. In their comparatively cylindrical form they present a marked contrast to the broad flat ribs of *Platanista*. The last two or three are, however, much more compressed than the others. The curve, very strong and angular in the first, gradually diminishes and becomes more regular. The last has a slight turn outwards at the lower end, giving a gentle sigmoid curve to the whole bone.

The anterior ribs have long and broad, somewhat compressed capitular processes, with distinct articular surfaces at the extremity and at the tubercle. In the fifth the length of this process is sensibly diminished. In the sixth, seventh, and eighth it shortens rapidly, the two articular surfaces being already confluent in the seventh. In the ninth a rounded projection of the lower border of the vertebral end indicates the rudimentary process; in the tenth it has disappeared altogether, and henceforward the upper end of the rib ends in a somewhat dilated, oval, convex, articular surface, gradu-

ally diminishing in size. The mode of attachment of the ribs to the vertebral column has been noticed in the description of the thoracic vertebræ.

The extreme length of the ribs of the right side in a straight line is as follows:—

First	3″·7	Eighth	6″·9
Second	5·7	Ninth	6·7
Third	6·9	Tenth	6·5
Fourth	7·3	Eleventh	6·4
Fifth	7·3	Twelfth	5·9
Sixth	7·2	Thirteenth	5·3
Seventh	7·1		

The costal cartilages, as in *Platanista* and all the Physeteridæ, are not ossified. How many may have reached the sternum it is, in the present state of the skeleton, impossible to determine; but indications of the attachment of only two pairs are to be seen on this bone, which, if confirmed, would be most exceptional among Cetacea, and be another feature of resemblance with the Sirenia.

The sternum (Pl. XXVII. figs. 3, 4 & 5) is very peculiar in shape, quite unlike that of any other Cetacean with which I am acquainted, and in its shortness, breadth, and the deep notch on the anterior border somewhat recalling that of the Manatee. It differs from this, however, in its greater solidity, especially towards the anterior part, and in possessing two strong triangular processes (*b*) projecting downwards and outwards from the fore part of the external surface.

It consists of a single bone, which is at present but incompletely developed, all the prominences and the whole hinder margin terminating in cartilage.

The extreme length of the ossified portion of this singular bone is 4″·2; its greatest breadth, near the middle, is 3″. Its general form is irregularly oval. In the anterior border is a notch 1″ in depth, with smooth, rounded edges. On each side of this are two thick conical processes (*a*), projecting directly forwards, ·7″ apart at their ends. As these have dried cartilage both on their tips and inner surfaces, it is possible that in the adult animal their ossification might extend so far as to convert the notch into a foramen. On each side of the hinder half of the notch the bone becomes very thick, running out on the external or inferior surface into the triangular process before noticed (*b*), and backwards and upwards into a thick irregular edge (*c*), apparently for the attachment of the cartilage of the first rib. The hinder half of the bone is flat, and gradually becomes thinner towards its rounded and incomplete posterior edge, which is divided into two lobes by a narrow cleft, situated slightly to the right of the median line. About the middle of the left lateral margin is a small transverse notch, represented on the right side by an oblique perforation, apparently for the passage of a blood-vessel. Immediately behind this the margin is thickened and excavated for the attachment of the cartilage of the second pair of ribs (*d*). There are no other indica-

tions of such attachments, though it is possible that the cartilaginous hinder margin may have been connected with another pair.

In *Platanista*, according to Eschricht, four pairs of ribs are attached directly by their cartilages to the sternum, and the form of this bone has nothing in common with that of *Inia*. The manubrium is flat and triangular, very broad in front, with a straight anterior edge, and without either of the processes so prominent in *Inia*. This is succeeded by a distinct body, ossified from two lateral centres, and a xiphoid process wholly cartilaginous in the young specimen described. Many of the true Dolphins have two conspicuous pairs of processes on the manubrium sterni, evidently for the attachment of muscles—one projecting forwards and outwards, in front of and within the surface for the attachment of the first pair of sternal ribs, the other rising from the lateral border between the surfaces for the articulation of the first and second sternal ribs, and directed somewhat backwards. These are especially developed in *Monodon*. It is to these that the processes of the sternum of *Inia* appear to correspond, though much modified in direction. The sternum of *Phocæna* entirely wants these processes; otherwise it presents some resemblance to that of *Inia* in its breadth, flatness, and in consisting of a single piece.

The pectoral limbs of *Inia* are described by d'Orbigny as "larges, longues, et obtuses;" and the present skeleton fully corroborates this account.

The scapula (Plate XXV. fig. 3) does not present that singularly aberrant character which is one of the most peculiar features of the skeleton of *Platanista*, but conforms more to the ordinary type of the Dolphin-family. Its superior costa is long, and with a tolerably regular arch; the anterior and posterior costæ (of which the former is slightly the longer) are much hollowed out, so that the lower half of the bone is narrower from side to side than in most Dolphins. Both the acromion process and coracoid are very long, flat, and expanding and truncated at their extremities. The glenoid fossa is large.

The principal dimensions are:—

	in.
Extreme height, from glenoid fossa to middle of superior costa	3·7
Extreme breadth	4·8
Breadth of body at root of acromion process	1·2
Length of acromion	1·7
Length of coracoid process	1·3
Length of glenoid fossa	1·2
Breadth of glenoid fossa	0·9

The humerus is unusually long in proportion to the other segments of the limb, and very simple in its character. The tuberosity is very small; but it is probably not completely ossified. The neck is but slightly marked. The distal end of the bone is

flattened, and not much expanded in width. The inner surface is quite smooth and slightly concave longitudinally. The outer surface is rougher, and has a rather deep pit a little way below the neck.

The radius and ulna are considerably shorter than the humerus, contrary to what obtains in most Cetacea. They are very simple, broad and flat bones, but have a considerable space between them, owing to the concavity of the contiguous borders of the ulna and radius. The ulna presents the great peculiarity of possessing no rudiment of an olecranon process.

Length of humerus	3″·2
Width at middle	1·1
Width at lower end	1·6
Length of radius	2·5
Width at middle	1·2
Width at lower end	1·4
Length of ulna	1·9
Width at middle	1·0
Width at lower end	1·6

The carpal region is large, and composed in the present specimen in great measure of cartilage. There are five principal ossifications. Intending to discuss fully the homologies of the carpal bones of the Cetacea with those of the terrestrial mammals in my Osteography of the genus *Physeter*, I will only say here that these appear to represent:—1 the scapho-trapezium, 2 the lunar, 3 the cuneiform, 4 the unciform, and 5 the magno-trapezoid. They have probably been somewhat disturbed from their natural position by unequal shrinking of the surrounding cartilage in drying. In addition to these five, an oval bone (6) projects from the ulnar border of the carpus, which must represent the pisiform bone, although considerably displaced from its normal situation. The bone which appears to belong to the second row of the carpus near the radial border, and which might well be taken for a trapezium, is probably the first metacarpal, as already determined in other Cetaceans by Cuvier, Gegenbaur, and Van Bambeke.

The digital portion of the hand consists of five fingers of moderate length, and spreading somewhat from each other. The second digit is the longest, the third nearly approaches it, the fourth and fifth are much shorter. It is possible that the terminal phalanges of the digits are not present in every case, especially as they do not always ossify before the animal has attained a considerable age; but the following are the numbers of the phalanges present, exclusive of the metacarpals:—I. 1, II. 5, III. 4, IV. 2, V. 2. The individual phalanges are thus not numerous; but they are long in proportion to their breadth.

From the humerus downwards the pectoral limb of *Inia* presents considerable resemblance to that of *Platanista*, both agreeing in the great length of the humerus as

compared with the forearm, and in the absence of the olecranon process. In the carpus, to judge by Eschricht's figure, some differences of detail may be found. They agree in the comparative length and slenderness of the phalanges and spread of the fingers; but *Platanista* differs from *Inia* and all the other Dolphins in the nearly equal development of the four outer digits, giving the remarkable truncated form to the termination of the extremity.

The pelvic bones have unfortunately not been preserved with the skeleton. They are also unknown in *Platanista*.

II. *On the Skull of* Pontoporia blainvillii.

In the Museum at the Jardin des Plantes, Paris, is the skull of a small Dolphin brought by M. de Fréminville, an officer in the French navy, from the neighbourhood of Monte Video, at the mouth of the Rio de la Plata. This was first described by Professor P. Gervais, in the 'Bullet. de la Soc. Philomathique de Paris,' 1844, (27 Avril) p. 38, as *Delphinus Blainvillei*; also in 'l'Institut,' of the same year.

In the part of the 'Zoology of the Voyage of the Erebus and Terror' devoted to the Cetacea, published in 1846, Dr. Gray gave a figure and brief description of this skull, and constituted the genus *Pontoporia* for the reception of the animal to which it belonged.

Professor Gervais, in the description of the "Mammifères" of d'Orbigny's 'Voyage en Amérique Méridionale,' published in 1847, but the introduction to which bears the date of December 1846, redescribed and figured the skull (plate 23), pointing out that its peculiarities were sufficient to entitle it to rank as a subgenus, for which the name of *Stenodelphis* was proposed. In the same plate a figure is given of a long-beaked Dolphin, observed by d'Orbigny off the coast of Patagonia, but of which no portion was brought home; and a conjecture is thrown out that this Dolphin belonged to the same species as the skull presented to the Museum by M. de Fréminville. Although this is a mere assumption, and not a very well founded one, as even the colour does not correspond with the brief description given by M. de Fréminville*, it has unfortunately been treated as a certainty in most systematic works†, and thus *Pontoporia*, the skull of which shows such near affinities with those of the river-Dolphins *Inia* and *Platanista*, and which from its only known habitat may be wholly or partially fluviatile, and of which the external form is entirely unknown, is now regularly installed in zoological literature as an oceanic Dolphin with a high falcate dorsal fin!

A few weeks ago, and after the whole of the foregoing description of the skeleton of

* "D'après un renseignement favori par M. de Fréminville, le Dauphin dont provient ce crâne, est long de quatre pieds, et il est blanc, avec une bande dorsale noire."

† See Gervais, Hist. Nat. des Mammifères (1855), vol. ii. p. 322; Gray, Cat. Seals and Whales, Brit. Mus. (1866) p. 231.

Inia was written, a second skull of *Pontoporia*, also from the mouth of the Rio de la Plata, was received at the British Museum, as a present from Dr. Hermann Burmeister, of Buenos Ayres. With his wonted liberality, Dr. Gray immediately informed me of its arrival, and has permitted me to add to the description of the skull of *Inia* a comparison with this nearly allied form.

The skull (Pl. XXVIII.) is that of a perfectly adult animal. The sutures are partially obliterated, and the bones are compact and heavy. Many of the teeth are broken, some having been lost during life and the alveoli filled up; the remainder are considerably worn at the points. The rostrum is curved downwards towards the extremity, much more so than in the Paris specimen; this is probably the effect of age, as a similar change takes place in *Inia* and some other Dolphins. The mandible partakes also of this curve. The small, rounded and depressed cranium, and very long, narrow and compressed beak, give a remarkable appearance to this skull, reminding one, as Gervais remarks, of the head of a scolopacine bird.

The principal dimensions are:—

Extreme length	15″·8
Length of rostrum (from anterior end of premaxillary to bottom of antorbital notch of maxillary)	11·2
From anterior end of premaxillary to lower edge of nasal bones	13·5
Greatest breadth (across zygomatic process of squamosals)	4·8
Breadth of foramen magnum	1·1
Breadth of occipital condyles	2·4
Breadth across antorbital processes of frontals	2·6
Breadth of rostrum at base	1·8
Breadth of rostrum at middle	0·6
Mandible, length	13·7
Mandible, length of symphysis	8·0
Greatest breadth posteriorly	4·5
Height at the coronoid process	2·3

The supraoccipital is broader and shorter than in *Inia*, terminating in front by a much more open angle, and on each side in a low ridge, coming in close contact with the broad posterior extremities of the suprafrontal plates of the maxillaries. In the ankylosed condition of the bones it is impossible to say whether any of the frontal intervenes between them. The temporal fossa resembles that of *Inia* in its extent and form. The zygomatic process of the squamosal is proportionally longer, and meets the postorbital process of the frontal. The relative forms of the parietal, squamosal, and frontal bones, as they appear in the temporal fossa, more resemble those of *Platanista* than of *Inia*; but a narrow piece of the parietal prevents the union of the frontal and squamosal

below. The alisphenoid is concealed by a plate of the pterygoid, which articulates with all three bones just mentioned.

The orbit is slightly larger in proportion to the length of the cranium than in *Inia*, and therefore considerably more so than in *Platanista*. The upper margin forms a wider arch than in the former; the postorbital process is broader and shorter; the antorbital tuberosity much smaller, but still chiefly formed by the malar bone. The styliform processes are unfortunately broken off.

The upper surface of the skull is remarkably flat, showing scarcely a trace of the postnarial elevation. On this surface the frontal bones appear in a narrow, slightly raised median piece behind the nasal bones, ·7″ long, and ·5″ wide, bounded laterally by the posterior extensions of the maxillaries—and on each side in the supraorbital plates, of which a much broader piece is left uncovered by the maxillaries than in *Inia*. The nasals are flattened, irregularly quadrate plates, as in *Inia*, but, in consequence of the direction of the frontals, lying nearly horizontally instead of vertically.

The narial aperture is broader, but shorter, than in *Inia*, being encroached upon by the largely developed antenarial tuberosities of the premaxillaries, which are broader and flatter on the surface than in *Inia*. The upper obtusely pointed ends of the premaxillaries extend to a level with the inferior border of the nasals, but do not articulate with them, as a strip of the maxillary comes between. The hinder ends of the maxillaries are broader and flatter than in *Inia*; but in front of the nostrils they are much more contracted, and above the orbits have a small but distinct longitudinal crest, ·3″ high at the middle and gradually subsiding at the ends. This is not a mere elevation of the edge of the bone, as in *Inia*, but a distinct ridge placed some way within the suture between the maxillary and the orbital plate of the frontal, and of which there is no trace in *Inia*. Between this crest and the elevated portion of the premaxillary there is a very deep and narrow fossa, continuous in front with an extremely narrow but deep groove, which lies between the maxillary and premaxillary along the entire length of the rostrum, and which is only faintly indicated in *Inia*. The rostrum is considerably longer and narrower in proportion to the size of the cranium than in *Inia*.

The palate-bones resemble those of *Inia* in not covering the vomer in the middle line. They have a small free external plate. Unfortunately the greater part of the pterygoids is broken away; but enough remains to show that these bones do not conform to the type of the ordinary Dolphins, but are arranged in a peculiar manner, apparently intermediate between those of *Inia* and *Platanista*. A broad outer lamella, resembling that so characteristic of *Platanista*, remains on each side, and, though not covering the palatine anteriorly as in that genus, passes upwards and outwards to the temporal fossa, overlying the alisphenoid and articulating with the squamosal, parietal, and frontal

The petrotympanic bones are wanting on both sides, showing that their mode of attachment resembles that of *Inia* rather than that of *Platanista*.

The mandible resembles that of both *Inia* and *Platanista*, and is intermediate between the two in narrowness and comparative length of the symphysis. Its osseous substance is very dense, and the two rami are completely ankylosed at the symphysis. Running along each side of the symphysial portion is a deep and narrow groove, corresponding to that on the rostrum between the maxillary and premaxillary.

The teeth are implanted in distinct alveoli. As many have been lost from the anterior part of the lower jaw during life, and the sockets completely filled up, their number cannot be estimated with perfect accuracy, but it may be estimated as follows: $\frac{57-56}{54?-54?}=221?$. All have broad fangs, much compressed laterally, surmounted by a crown, the base of which, when seen from above, is of a quadrilateral form, with the angles rounded off, longer from before backwards than from side to side; this suddenly contracts into a slender subconical apical portion, much compressed in the opposite direction, and slightly incurved at the apex, which is worn off in nearly all the teeth of this old specimen. The enlarged base of the crown, which forms a sort of cingulum, is slightly granulated on the surface, and in the natural state is entirely concealed within the gum. The projecting contracted portion has a smooth glossy surface. The teeth vary but little in size or form throughout the whole series of both jaws. The dimensions of one taken from the middle of the lower jaw are:—

Length of fang	·15
Length of crown	·24
Antero-posterior breadth of cingulum	·17
Transverse breadth of cingulum	·11
Antero-posterior breadth of apical part at middle	·05
Transverse breadth	·10

This peculiar form of the teeth, which distinguishes *Pontoporia* from all the ordinary Dolphins, and affords another evidence of its affinity with *Inia*, has not been observed in the Paris specimen. Gervais's description is as follows:—"Les dents * * * * sont petites, longues de 5 ou 6 millimètres au plus, toutes plus ou moins aiguës, et au nombre de 53 ou 54 supérieurement, ainsi qu'inférieurement. Les postérieures sont un peu moins aiguës que les autres, et leur partie terminale est un peu recourbée."

The Paris skull, moreover, according to the figures, has a less elongated and slender rostrum than the present specimen—a difference which may certainly depend on age, presuming that the two animals belong to the same species.

III. *On the Systematic Position of* Inia *and* Pontoporia *in the order* Cetacea.

The foregoing sketch of the principal osteological features of *Inia* shows that this Cetacean presents peculiarities sufficient to constitute it a well-marked genus among the Dolphins. Its natural position in the order, and its affinities, however, can only be

determined when a complete and satisfactory classification of the entire group can be arrived at. The requisite materials for accomplishing this are at present wanting. The anatomy of many distinct forms is still but imperfectly known; and moreover it is probable that there are many others existing as yet undiscovered. We know enough, however, to arrive at certain general conclusions. The larger natural divisions may be indicated with tolerable certainty; and when the extent and limits of these become generally recognized, much will have been done towards clearing the ground for future observation. We shall at least be spared from the irrelevant comparisons, between objects essentially dissimilar, with which anatomical treatises on the Cetacea are too often encumbered.

Before proceeding further with this part of the subject, I would remark, in passing, that several resemblances pointed out above between the skeleton of this Cetacean and that of the Sirenia, according singularly with d'Orbigny's observations upon its external form and habits, can scarcely be regarded as evidences of affinity; they only add somewhat to the numerous morphological analogies between the members of these essentially distinct orders.

The interval which separates the Whalebone-Whales from all the Whales with teeth, in almost every point of their structure, is far greater than can be found between the most widely divergent forms of the latter. Hence the division of the Cetacea into several primary groups or families, of which the Whalebone-Whales constitute one, and are therefore treated as equivalent to some of the minor groups of the Toothed Whales, is quite inadmissible. The recognition of two great and distinct groups (suborders) is the first requisite to a right appreciation of the classification of the Cetacea.

The principal distinctive characters of these two groups were defined in a former paper *. Increased knowledge of their structure, especially of the *Odontoceti*, has rendered some slight modifications of these characters necessary. They may at present stand thus:—

1. Mystacoceti or Balænoidea. Teeth never functionally developed, but always disappearing before the close of intra-uterine life. Upper jaw provided with plates of baleen. Olfactory organ distinctly developed. External respiratory aperture double. Skull symmetrical. Maxilla produced in front of, but not over, the orbital process of the frontal. Lachrymal bones small and distinct from the jugal. Rami of mandible arched outwards, their anterior ends meeting at an angle, and connected by fibrous tissue, without any true symphysis. Sternum composed of a single piece, generally broader than long, and connected only with the first pair of ribs. No costo-sternal bones. All the ribs at their upper extremity articulating only with the transverse processes of the vertebræ; their capitular processes, when present, not articulating immediately with the bodies of the vertebræ.

* Proc. Zool. Soc. 1864, p. 388.

2. Odontoceti or Delphinoidea. Teeth always developed after birth, and generally numerous, sometimes few and early deciduous. No baleen. Olfactory organ rudimentary or absent. External respiratory aperture single. Upper surface of the skull generally, if not always, unsymmetrical. Hinder end of the maxilla expanded, and covering the greater part of the orbital plate of the frontal bone. Lachrymal bone either inseparable from the jugal or, when distinct, very large and forming part of the roof of the orbit. Rami of mandible nearly straight, much expanded in height posteriorly, and coming into contact in front by a surface of variable length, but always constituting a true symphysis. Sternum almost always composed of several pieces placed one behind the other, and always connected with several pairs of ribs, either by cartilage or by distinct costo-sternal bones. Many of the ribs with capitular processes developed, and articulating with the bodies of the vertebræ.

It is not necessary to pursue further the arrangement of the *Mystacoceti*, as it has no direct bearing upon the subject of this memoir, and as moreover I have no reason to make any alteration in the divisions into families and genera sketched out in the paper above referred to.

The subdivision of the *Odontoceti*, according to their structural affinities, presents at first sight considerable difficulty. To relate all the various attempts, more or less successful, that have been made to unravel this problem would be out of place here. I will only add one more to the number, founded chiefly on an examination of the osteological characters of the principal members of the group*.

In seeking for some starting-point from which to commence the formation of a natural division of the Toothed Whales, one has occurred to me which I have not found hitherto noticed. The strong and well-defined bones which connect the ribs with the sternum, ossified even at birth, common to the Porpoise, true Dolphins, and their nearest allies, are represented even in the adult *Hyperoodon* by an entirely unossified cartilage. In the four skeletons of *Physeter macrocephalus* that I have had the opportunity of examining, I have looked in vain for sterno-costal bones, some of which would certainly have been preserved if they approached in relative magnitude and density those of the true Dolphins. In answer to my inquiries on the subject, Dr. George Bennett has kindly informed me that, in both the skeletons of the genus *Kogia*, now mounted in the Sydney Museum, the cartilages are unossified; and I am indebted to Professor Van Beneden for similar information respecting the skeleton of the ziphioid *Micropteron* preserved in the Zoological Museum at Brussels. From these facts, I think that we may safely infer that the absence of ossified sternal ribs is a character common to the large natural group which includes *Physeter*, *Hyperoodon*, and the Ziphioids. To

* The arrangement here proposed nearly coincides with that arrived at by Professor Huxley and myself, when discussing this subject together before the delivery of the course of Hunterian Lectures at the Royal College of Surgeons for the present year (see 'Lancet,' 1866, vol. i. p. 381).

these may also be added *Platanista* and *Inia*. Here, then, is a character derived from a part of the organization apparently less liable to adaptive modification than the teeth or fins, which may be taken as the basis of a primary division. It must now be seen whether the remaining essential structural modifications are in accordance with it. Still confining our attention to the axial skeleton, there are certain tolerably obvious peculiarities about the vertebral column, more especially in the thoracic region, that will afford considerable assistance. As before indicated (p. 98), a peculiar mode of attachment of the ribs to the vertebræ is constantly found associated with the sterno-costal bones. The genera thus characterized may therefore be separated at once as a distinct natural group. They have also several minor characters in common, which will be pointed out presently.

Should the whole of the genera with cartilaginous sternal ribs be united into a single group, equivalent to that just marked off? I am inclined to think that they should not. To revert to the same point of structure just mentioned, it was shown before that *Physeter* and *Hyperoodon* agree in a very peculiar condition of thoracic vertebræ and rib-attachments. Whether *Kogia* and the Ziphioids conform with their nearest allies in this respect I am not at present able to say; but we may assume with tolerable certainty that they do. But here, as well as in many more trivial characters, including the teeth and pectoral limbs, *Inia* and *Platanista* differ—and differ, as it appears to me, more than any of the true Dolphins do, *inter se*. I would therefore raise the Cachalots and Ziphioids on the one hand, and *Platanista* and *Inia* on the other, to the rank of primary divisions of the Toothed Whales. With the latter it is in the highest degree probable that the genus *Pontoporia* should be associated. This group is not so compact and easily defined by positive characters as the other two, between which it naturally stands. The two genera whose structure is most completely known vary widely from each other, one diverging towards the Physeteridæ, the other towards the Delphinidæ, yet distinctly marked off from either. The validity of the group as a natural one will be greatly strengthened if the skeleton of *Pontoporia* should be found to possess the characters common to *Platanista* and *Inia**. It would be interesting, moreover, if it should be discovered that this Dolphin is, like the members of the other two genera, habitually fluviatile†.

* Dr. Gray in the "Zoology of the Voyage of the Erebus and Terror" placed *Inia* and *Pontoporia* in one section at the end of the family Delphinidæ, following immediately upon *Platanista*. In his recently published Catalogue, *Platanista* constitutes the fourth family (Platanistidæ) of the Cetacea, following the Catodontidæ; *Inia* forms a separate (the fifth) family, Iniidæ; and *Pontoporia* commences the sixth family (Delphinidæ), comprising all the remaining Dolphins except the Globiocephalidæ and the Ziphiidæ.

Gervais (Hist. Nat. des Mammifères, 1855) unites *Platanista*, *Inia*, and *Stenodelphis* (*Pontoporia*) to form one of the five tribes (*Platanistins*, *Delphinins*, *Orcins*, *Monodontins*, and *Phocénins*) into which the family *Delphinidés* is divided. The primary divisions of the order or families are:—*Physeteridés*, *Ziphiidés*, *Delphinidés*, and *Balénidés*.

† It is to be hoped that Dr. Burmeister may be able to obtain information on this point. I should mention

I will now endeavour to formularize the distinctive characters of these three primary groups of the ODONTOCETI, giving them the rank of families.

1. PHYSETERIDÆ. Costal cartilages not ossified. The hinder ribs losing their tubercular and retaining their capitular articulation with the vertebræ. The greater number of the cervical vertebræ ankylosed together. Pterygoid bones thick, produced backwards, meeting in the middle line, and not involuted to form the outer wall of the postpalatine air-sinus. Symphysis of mandible of moderate or excessive length. No functional teeth in upper jaw. Mandibular teeth various, often much reduced in number. Lachrymal bones usually large and distinct. Bones of the skull raised so as to form an elevated prominence or crest behind the anterior nares. Orbit of small or moderate size. Pectoral limbs small. Dorsal fin usually present.

II. PLATANISTIDÆ. Costal cartilages not ossified. The tubercular and capitular articulations of the ribs blending together posteriorly. Cervical vertebræ all free. Pterygoid bones thin, not conforming in their mode of arrangement with either of the other sections. Jaws very long and narrow; both with numerous teeth having compressed fangs. Symphysis of mandible very long, exceeding half the length of the entire ramus. Orbit very small. Lachrymal bones not distinct from the jugal. Pectoral limbs large. Dorsal fin rudimentary*.

III. DELPHINIDÆ. Costal cartilages firmly ossified. Posterior ribs losing their capitular articulation, and only uniting with the transverse processes of the vertebræ by the tubercle. Anterior (2–6) cervical, in most, ankylosed together. Pterygoid bones short, thin, involuted to form, with a process of the palatine bone, the outer wall of the postpalatine air-sinus. Numerous teeth in both jaws (*Monodon* excepted), sometimes deciduous. Symphysis of mandible short or moderate, never exceeding one-third the length of the ramus. Bones of the skull not raised into a distinct crest behind the anterior nares. Orbit of moderate size. Lachrymal bone not distinct from the jugal. Pectoral limbs varying much in form and size. Dorsal fin usually present.

I. The *Physeteridæ* appear to constitute a very natural group†. This may, however, be divided into two well-marked subfamilies:—

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that Mr. Darwin has informed me that he met with no evidence of the existence of a freshwater Dolphin in the La Plata system of rivers, and that no mention is made by Azara of any such animal.

* These characters are subject to modification when more is known of the structure of *Pontoporia*.

† Van Beneden insists strongly upon the close affinity of *Physeter* with the Ziphioids: he says, "Comme on le voit, les Cachalots sont pour nous des Ziphioïdes véritables, portant une rangée de dents fortes et espacées sur chaque branche de maxillaire" (Mém. sur une Nouv. Espèce de *Ziphius*, Mém. de l'Acad. Royale de Belgique, t. xvi. 1863).

1. *Physeterinæ*, characterized by the numerous teeth in the lower jaw, and having no distinct lachrymal bone, including the genera *Physeter* and *Kogia* (Gray)*.

2. *Ziphiinæ*, with only one or two pairs of teeth in the lower jaw (besides the rudimentary concealed teeth), and a distinct lachrymal bone. This includes *Hyperoodon*, *Berardius*, *Ziphius*, *Micropteron*, *Dioplodon*, and several extinct forms.

II. The two best-known genera of the *Platanistidæ* must each be placed in a distinct subfamily, characterized thus:—

1. *Platanistinæ*. Maxillary bones supporting large bony incurved crests. No cingulum or tubercle at the base of the crown of the teeth. Pectoral fins truncated. Visual organs rudimentary. External respiratory aperture longitudinal, linear.

2. *Iniinæ*. Maxillary crests absent, or very slightly developed. Many of the teeth with a complete cingulum or a distinct tubercle at the base of the crown. Pectoral fin ovate, obtusely pointed.

The position of *Pontoporia* cannot be definitely determined until more is known of its general structure; but as its cranial and dental characters accord most nearly with those of *Inia*, it may be placed provisionally in the same subfamily.

III. Although the *Delphinidæ* present considerable diversity in the characters of their dentition, in the relative length of the rostral part of the skull, in the form and structure of the pectoral limb, and in the form and size of the dorsal fin, it is by no means easy to subdivide them into natural groups. It is even difficult to define neatly the distinguishing characters of the genera, so much do they blend one into the other.

The Narwhal and the *Beluga* appear to separate themselves from all the rest, by certain well-marked structural conditions, especially the characters of the cervical vertebræ. As these two animals are in almost every part of their skeleton nearly identical, even to the number of the vertebræ and phalanges, I am disposed to look upon the exceptional dentition of the former as an aberration of secondary importance, and to unite the two genera into a distinct subfamily, placing it next to the *Platanistidæ*. Among the remaining genera, none stand out in equal prominence. We must either group them together in one subfamily or make almost as many subfamilies as there are genera. For the present I prefer adopting the former course. *Phocæna* and *Neomeris* stand by themselves in the form of their teeth and certain cranial characters. *Orca* is distinguished from all the others by its excessively broad manus, and *Globiocephalus* by the extreme length and narrowness of the same member. *Delphinus* and its allies are characterized by the long narrow rostrum and numerous teeth. Each of these genera might

* A genus quite distinct from *Physeter*. It has also been called *Euphysetes* (Wall. Descr. New Sperm Whale, &c., 1851); but Gray's name (Zool. Erebus and Terror, 1846) clearly has the priority.

easily be made the type of a distinct subfamily, were it not for the difficulty of placing the numerous osculant forms, *Pseudorca*, *Grampus*, *Lagenorhynchus*, &c.

In the following tabular view of the arrangement of the Cetacea, many of the genera lately formed, chiefly by subdivision of the old genus *Delphinus*, are not introduced. It must not be be inferred from this that I question their validity, though such as are founded on skulls alone may require revision when the entire skeleton is known. But as the present object is to determine the position of *Inia* and *Pontoporia* in the order, it is only necessary to mention the well-established and generally recognized generic divisions.

Order CETACEA.

Suborders.	*Families.*	*Subfamilies.*	*Genera.*
I. Mystacoceti* or Balænoidea.	Balænidæ	Balæninæ	Balæna.
			Eubalæna.
	Balænopteridæ	Megapterinæ	Megaptera.
		Balænopterinæ	Physalus.
			Sibbaldius.
			Balænoptera.
II. Odontoceti† or Delphinoidea.	Physeteridæ	Physeterinæ	Physeter.
			Kogia.
		Ziphiinæ	Hyperoodon.
			Berardius.
			Ziphius.
			Dioplodon.
			Micropteron.
	Platanistidæ	Platanistinæ	Platanista.
		Iniinæ	Pontoporia ?
			Inia.
	Delphinidæ	Beluginæ	Monodon.
			Beluga.
		Delphininæ ?	Phocæna.
			Neomeris.
			Grampus.
			Orca.
			Pseudorca.
			Lagenorhynchus.
			Delphinus.
			Delphinapterus.
			Globiocephalus.

* μύσταξ, κῆτος; equivalent to the German "Barten-Walle." † ὀδούς, κῆτος.

DESCRIPTION OF THE PLATES.

The figures in Plates XXV., XXVI., and XXVII. are drawn from the skeleton of the young *Inia geoffrensis* described above.

PLATE XXV.

Fig. 1. Upper surface of the cranium and vertebral column of *Inia geoffrensis*. One-fourth the natural size.

Fig. 2. Side view of the skull and vertebral column. One-fourth the natural size.

Fig. 3. Bones of the right pectoral limb. Half the natural size.

PLATE XXVI.

Fig. 1. Inferior surface of the cranium of *Inia geoffrensis*. Half the natural size.

Fig. 2. Superior surface of the mandible. Half the natural size.

Fig. 3. A maxillary tooth from the left side, the fourth from the posterior end of the series. Natural size.

Fig. 4. The basi- and thyro-hyals. Half the natural size.

Fig. 5. One of the stylo-hyals. Half the natural size.

PLATE XXVII.

Details of the osteology of *Inia geoffrensis*. All the figures half the natural size.

Fig. 1. Anterior surfaces of the seven cervical vertebræ.

Fig. 2. The thirteen ribs of the right side.

Fig. 3. Side view of the sternum.

- *a*. Anterior process.
- *b*. Lateral process.
- *c*. Surface for attachment of cartilage of first rib.
- *d*. Surface for attachment of cartilage of second rib.

Fig. 4. Internal surface of sternum.

Fig. 5. External surface of sternum.

PLATE XXVIII.

Skull of adult *Pontoporia blainvillii*. All the figures (except fig. 5) half the natural size.

Fig. 1. Side view of cranium.

Fig. 2. Side view of mandible.

Fig. 3. Upper surface of cranium.

Fig. 4. Inferior surface of mandible.

Fig. 5. A maxillary tooth from the left side, the fourth from the posterior end of the series. Twice the natural size.

Trans. Zool. Soc. Vol. 6. Pl. 25.

Fig. 1.

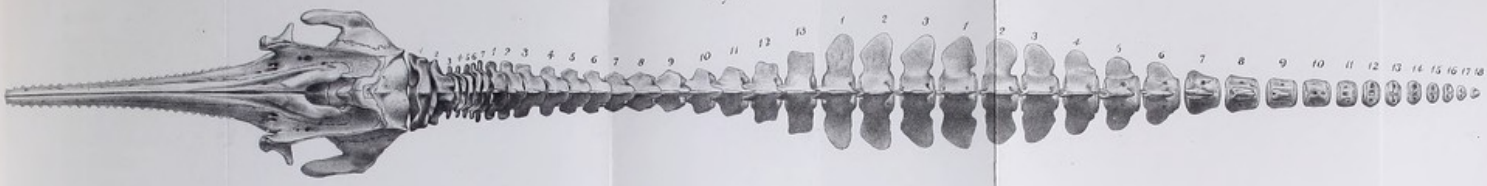


Fig. 3

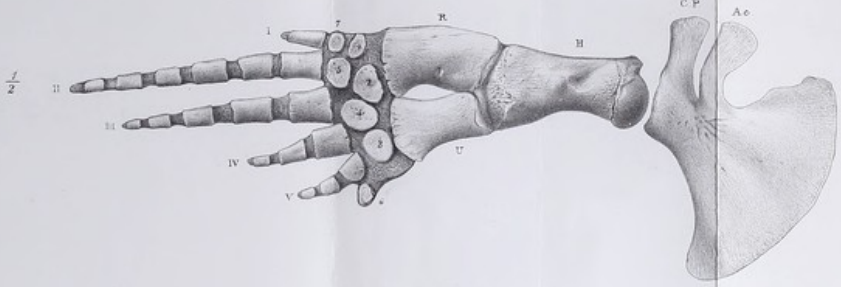
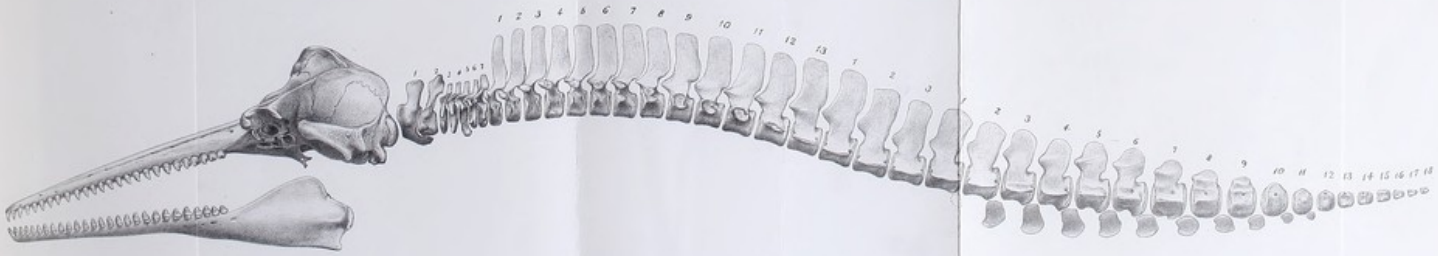


Fig. 2



INIA GEOFFRENSIS

Fig. 1.

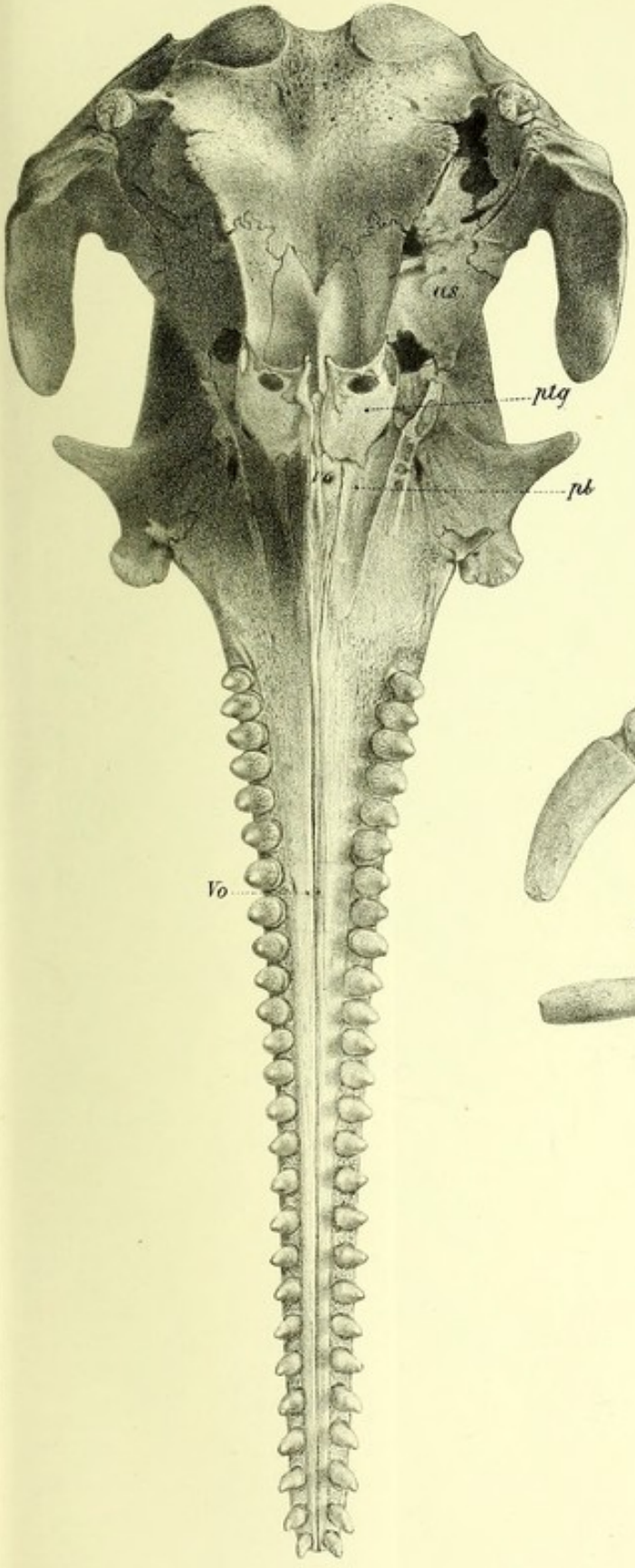


Fig. 3

Fig 4

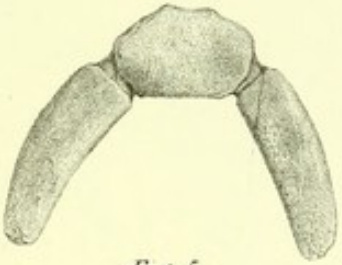


Fig. 5.

Fig. 2.

Smit. lith.

M & N Hanhart imp.

INIA GEOFFRENSIS. ½

Fig. 2.

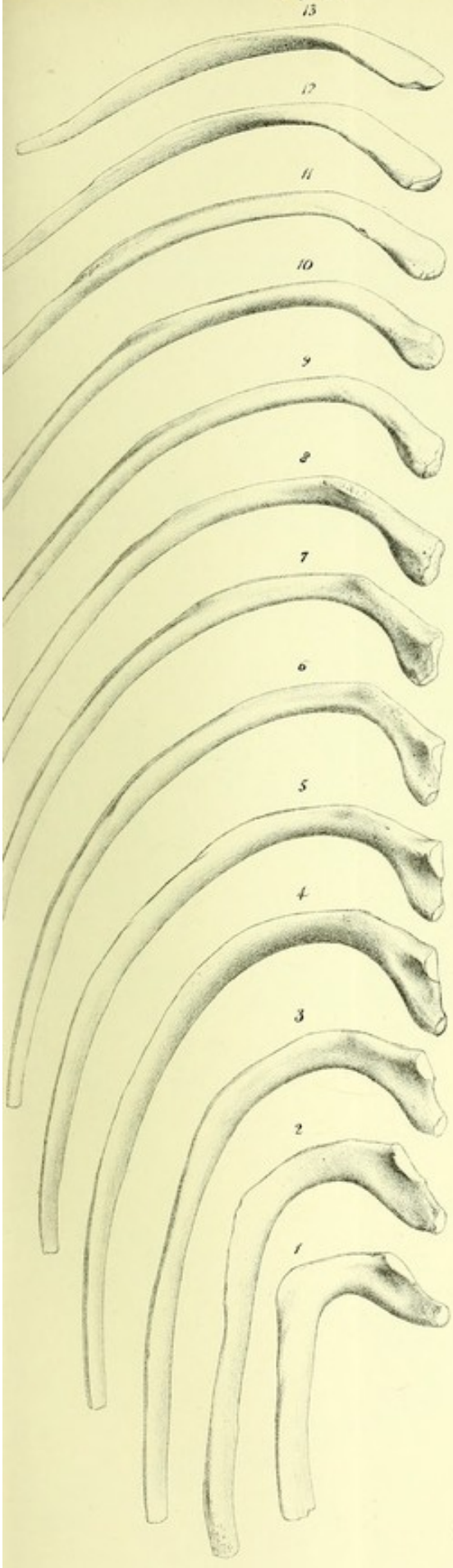


Fig. 3.

Fig. 1.

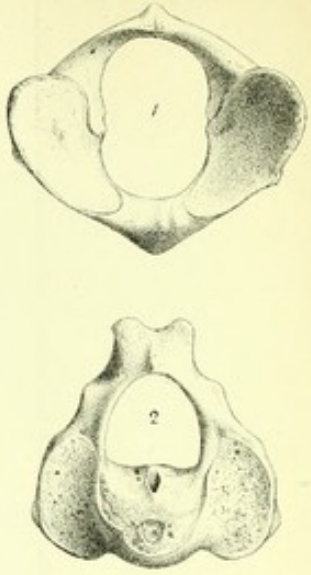


Fig 4

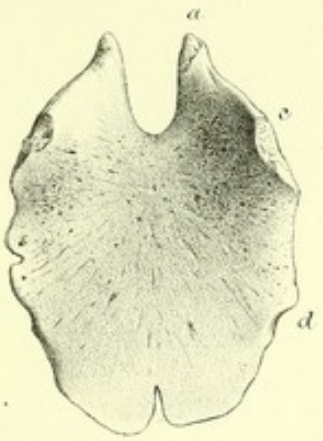
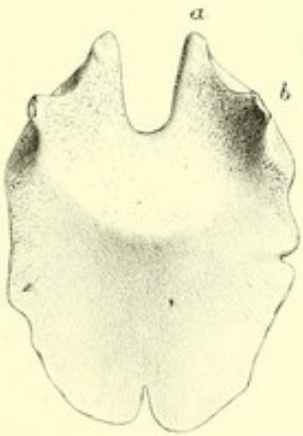


Fig. 5.



INIA GEOFFRENSIS. $\frac{1}{2}$

Trans. Zool. Soc. Vol 6 Pl 27.

Fig. 2.

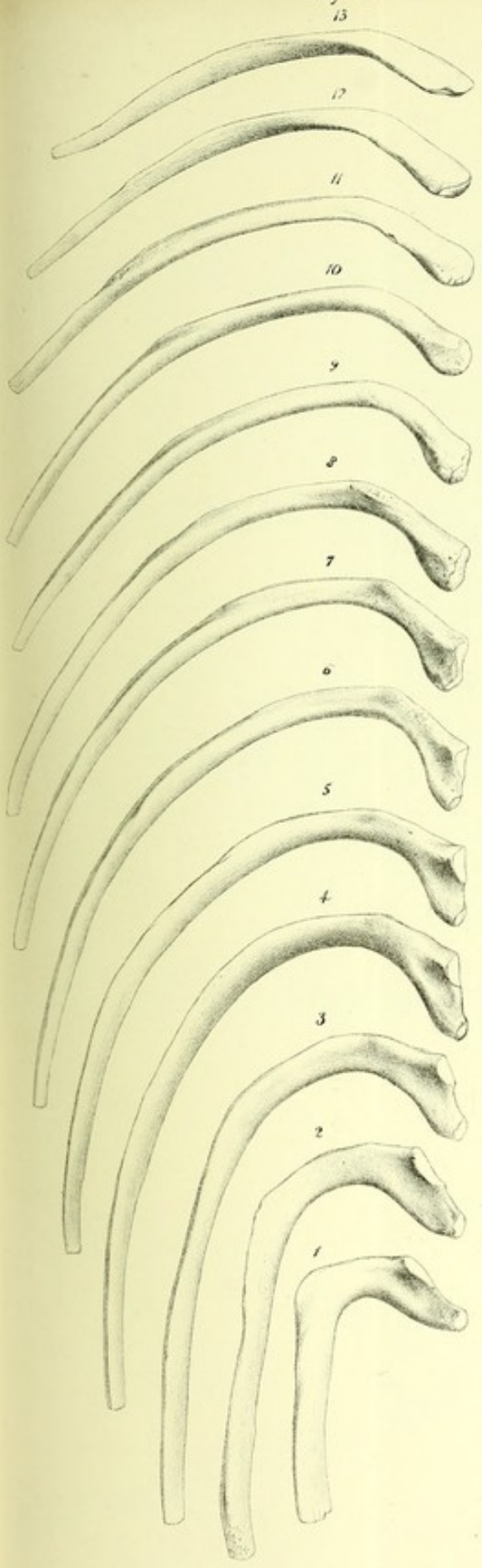


Fig. 3.

Fig. 1.

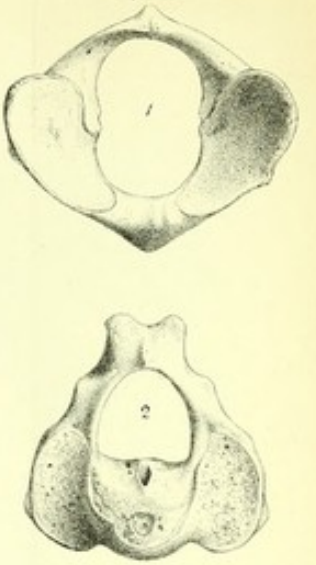


Fig 4

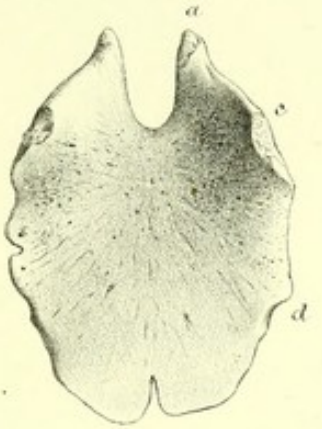
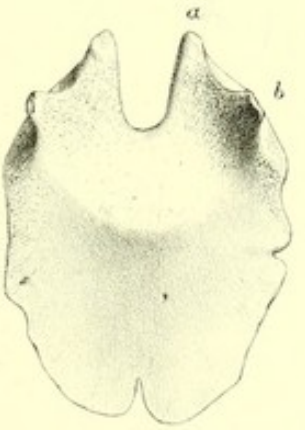


Fig. 5.



J. Smit. lith.

M & N Hanhart. imp

INIA GEOFFRENSIS. $\frac{1}{2}$

Fig. 1.

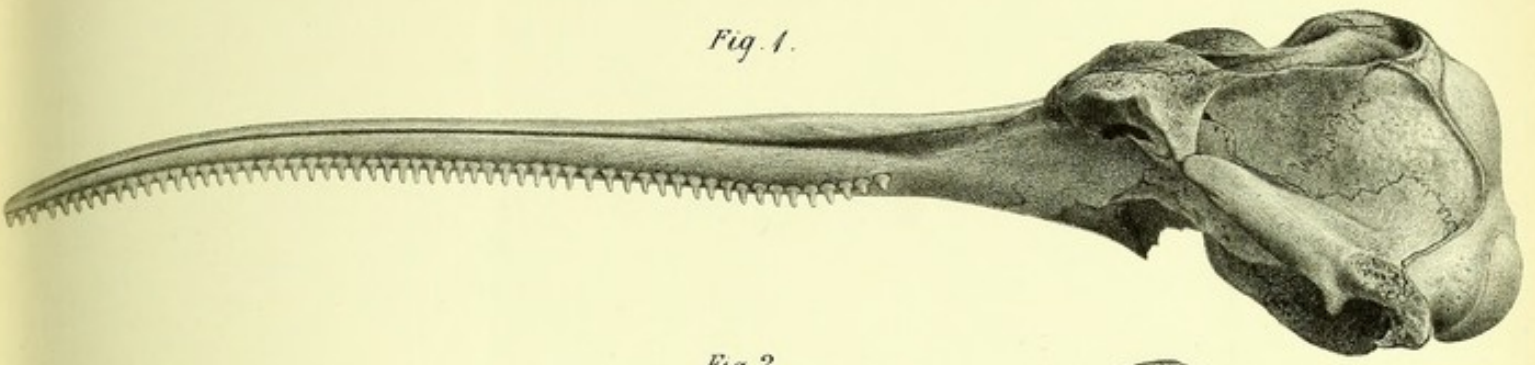


Fig. 2.

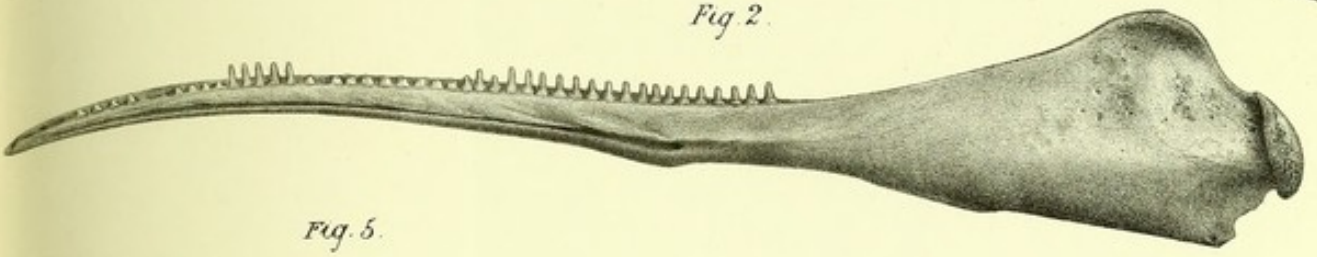


Fig. 5.

Fig. 3.

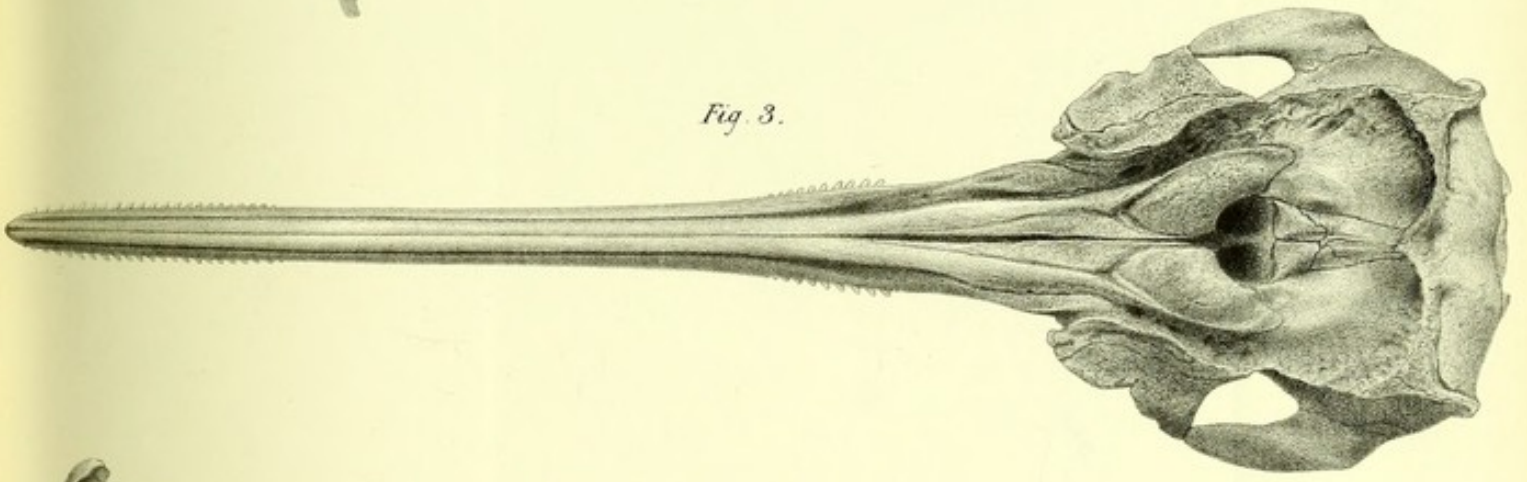
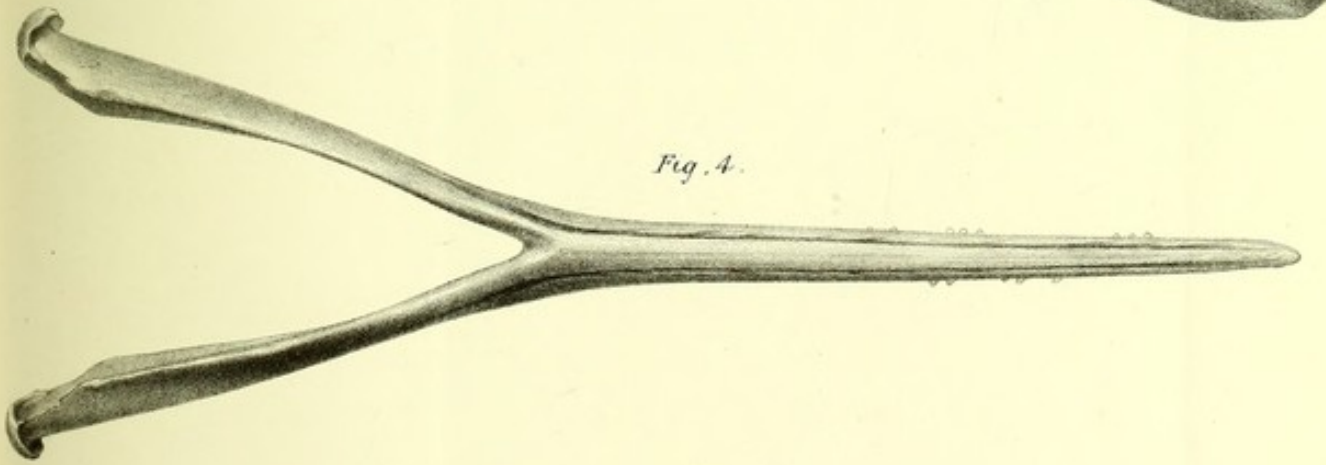


Fig. 4.



J. Smit lith.

M. & N. Hanhart imp

PONTOPORIA BLAINVILLII. $\frac{1}{2}$