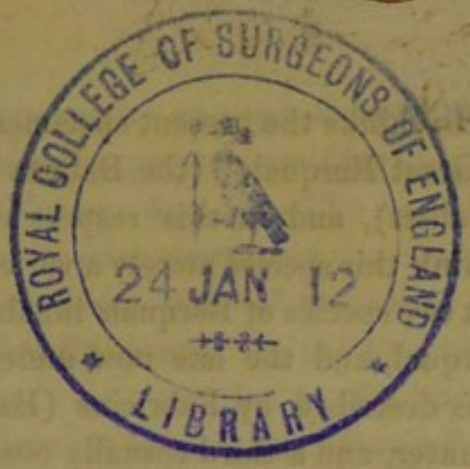
Account of the dissection of a young rorqual, or short whalebone whale, (the Balaena rostrata of Fabricius) : with a few observations on the anatomy of the foetal Mysticetus / by Dr. Knox.



ACCOUNT

OF THE

DISSECTION OF A YOUNG RORQUAL,

OR SHORT WHALEBONE WHALE,

(THE BALÆNA ROSTRATA OF FABRICIUS);

WITH A FEW OBSERVATIONS ON THE ANATOMY OF THE FŒTAL MYSTICETUS.

BY DR KNOX.

In February 1834, a young Whalebone Whale was taken near the Queensferry, in the Frith of Forth. After being exhibited for a short time by the proprietors, it was purchased by the author of this memoir, and dissected as carefully as time and circumstances would permit. He requests naturalists to observe, that the term Rorqual is employed throughout this and the preceding memoir on the great Balænoptera, dissected by him about two years ago, (an account of which was also read to the Society), in the sense employed by M. Cuvier, as designating " Whalebone Whales, with longitudinal folds under

the throat and chest." He thinks the present specimen quite distinct, specifically from the "Great Rorqual," (the Balæna boops, jubarte, musculus, &c. of naturalists), and in this respect differs from M. Cuvier, who seems to think this species merely a variety of the larger one. There are at least two species of Rorquals inhabiting the North Seas, viz. the Great Rorqual, and the one now under consideration, a specimen of which was described by Fabricius (Balæna rostrata); another dissected by Hunter, and a third casually observed by James Watson, Esq., who sent a drawing of the same to Dr Traill, by whom it was communicated to Mr Scoresby.

The author has not as yet had leisure to examine the osteology with sufficient care; the following results have, in the mean time, been attained.

Internal and External Character.—Eight distinct bristles, arranged in perpendicular rows, were found in the extremity of the snout, in both jaws. To give a correct drawing of the external appearance of this Balænoptera, it was suspended by the back at three points horizontally, and in a swimming posture; by this means the proper character of the head and mouth were given, and this altered so much the appearance of the animal, that the author thinks all previous views extremely incorrect; besides tending to mislead the naturalist as to the real capacity of the mouth of the Balænopteræ generally, which is very great. The lower part of the mouth is an enormous pouch or bag, which, in the great northern Rorqual, must at times contain an incredible volume of water. The tongue was free towards the apex, almost as much as in man. The pale rose or vermilion colour of the inside of the mouth, observed originally by Mrs Traill, was very remarkable in this specimen, owing perhaps to its freshness.

The whalebone (about $2\frac{1}{2}$ inches in length), presented various shades, from a pale-rose colour to a dull-white; no vestiges of teeth were found in either jaw, although it is by no means improbable that they exist in the fœtus of this species, as well as in that of the Mysticetus, in the lower jaw of which, lying imbedded below the gum, a series of teeth were discovered by M. Geoffroy St Hilaire several years ago; the author of this paper has since observed them in the *upper jaw* of the Mysticetus, an observation which proves in an extraordinary and mysterious manner the "unity of organization" in all animals, and must force the anatomist to view the whalebone, (which after a time comes to occupy the upper jaw), as being a substitute functionally

for teeth, and in reality an appendage of the general integuments of the body, in many respects resembling the gills of fishes.

Brain and Nervous System.—The remarkable fact that the cavity of the cranium, besides containing the brain and its membranes, incloses also a very large mass of a vascular substance, closely resembling the "erectile tissue," is at once unexpected and important. First, as it forms an exception to the hitherto uniformly observed law of coincidence, at least in the Mammalia, between the configuration of the inner table of the skull and the contained brain; in this respect, a cast of the interior of the skull of the "Whalebone Whales," the Mysticetus and Rorqual groups, enables us to determine neither the actual bulk of the brain, nor its shape. The "erectile tissue" observed in the dissection of this Balænoptera, filled a very large proportion of the interior of the cranium, extended from thence into the interior of the spinal column, three-fourths of whose cavity it also occupied, surrounding the spinal marrow and the spinal nerves, and seemingly everywhere in close connexion with the outside of the dura mater; in some places it was nearly a couple of inches in thickness, and its abundance around the spinal nerves at their passage through the intervertebral foramina, was very remarkable. It accompanied also five or six of the superior dorsal nerves, lying between the ribs, and consequently outside the pleuræ. Originally observed in connexion with the chest by Mr Hunter, some writers on natural history since his time have supposed the vascular tissue in question, to have a relation to the system of breathing of aquatic animals; but this is a mere conjecture, and is not even a plausible one.

From these positive data, the author does not now believe in the assigned weight of the brain in any animal, recent or fossil, derived from a measurement of the cranium. The weight of the brain of the Great Rorqual of the North, as determined by the mode devised by Sir William Hamilton, applied so ingeniously and with such important results to the human cranium and its contained organ, he now believes to be incorrect, and that the method, so valuable in respect to *specific* appearances, is inapplicable to the animal kingdom *generally*. Correct data, then, for determining the actual weight of the brain of any of the Cetacea, must be derived from actually weighing the *organ* itself, *and in no other way;* the weight, then, of the brain of the Mysticetus and of the Great Rorqual is still unknown, so far as the author of these observations knows. That of the Rostrata of Fabricius, a Rorqual also, that is, a "Short Whalebone Whale, with

thoracic and guttural plicæ," was found to be $3\frac{1}{2}$ pounds, but this included all the cerebral mass found within the cavity of the cranium, and likewise about 2 inches of the spinal marrow. The cerebellum, pons, and 2 inches of the spinal marrow, weighed together only $\frac{3}{4}$ths of a pound. The Whalebone or Baleen occupied the usual situation in the upper jaw, and $\frac{3}{5}\frac{0}{0}\frac{7}{7}$=614 external large plates were counted distinctly.

Respiratory Organs.—The mode of breathing, and the structure of the nostrils, was precisely as in the Great Rorqual, making allowance for the difference in magnitude. Two bolster-like substances filled the nostrils, which are withdrawn from them at the moment of breathing by muscles provided for that purpose; the mechanism is admirable, and would sustain any pressure from above, although the animal was to descend thousands of fathoms.

There are turbinated bones in the nose, and olfactory nerves (nerves of smell), as large at least as the human. The author thinks it physically impossible for water to be habitually spouted through the nostrils, as naturalists have supposed, a supposition which was sanctioned by some imperfect views of M. Cuvier, in which the structure of the genus Delphinus was erroneously transferred to the Balænæ and Balænopteræ. The Whalebone Whales have complex nostrils, and smell and breathe precisely as the higher orders of the Mammalia.

The *Stomach,* composed of four compartments, contained no food. The middle tunic of the *ureter* was composed of distinct longitudinal muscular fasciculi.

A question has arisen regarding the structure and functions of the abdominal glands of the Cetacea of an interesting kind, and has already been brought before the Institute six or seven times in the course of a single season; the question resolves itself into this.

1. Have the abdominal glands of the Cetacea a mammary structure, and do they secrete milk? In other words, are they mammiferous?*

* The question as stated above, in the language used before the Institute, may be further narrowed, and limited to "Whalebone Whales." The great group of the "Delphinus" was proved to be mammiferous long ago by Mr Watson. See extract of Observations by Mr Watson, quoted in "Scoresby's Greenland." The author deems it sufficiently curious, that this work, which contains the intuitive evidence as applied to the "Delphinus," should be unknown to English naturalists, who have met M. Geoffrey St Hilaire's doubts by statements drawn from M. Baer's assertions regarding anatomical structures, which it is (with deference) submitted M. Baer *could never have seen.*

2. Are the glands similarly situated in the ornithorynchus paradoxus and echidna mammary glands, and do they also secrete milk? This position M. St Hilaire doubts. He thinks the glands of the ornithorynchus sexual, specific, and odoriferous, and that the abdominal glands of the Cetacea may be similar to those of the ornithorynchus. As he has thought fit to question M. Baer's objections to his views at great length, the author thinks it will abbreviate the discussion much, if these distinguished naturalists will take the following observations into consideration.

The term Mammary may still be applied to two glands lying on each side of the organs of generation, until it be proved that they are not the Mammæ; in which case the Cetacea will be removed, so far as regards the name, from the great class of animals with which they have been hitherto arranged. Whatever be the functions of these, the structure in the young Rorqual dissected by the author was as follows:—

On each side the fissure of the vulva,* but perfectly distinct from it, being 1½ inches from its edge, and running parallel with it, are two fissures, 3 inches long, leading into cavities about an inch in depth. In the bottom of this cavity, and about the middle, there projects a small nipple-like process, about the size of the end of the little finger, the projection of this, however, being but little elevated. In the centre of these nipple-like processes, there is an aperture, sufficiently large to admit a middling-sized boujie; these apertures lead each to a canal, extending upwards under the integuments of the abdomen for several inches. Unfortunately, their full extent upwards could not be determined, but they were traced for 6 inches, during which extent they had not diminished greatly in calibre, so that conjecturally, one-third at least of their total length had been removed in cutting out the parts. The membrane lining the interior of these tubes may be called mucous, just as all internal reduplications of the skin leading towards the interior of the body are

* From the edge of the vulva to the opening of the vagina, *i. e.* the opening of the fissure, was exactly 3½ inches; the depth of the fissure in which the nipple was placed being 1½ inches.

Length of the fissure in which the vagina and meatus urinarius were placed, 7 inches; its greatest depth 3½ inches. The length here meant is to that part where the fissure for the anus commences, and that of the vulva splits as it were into two lateral fissures, about an inch in length.

Length of the fissure in which the anus is placed, 3 inches.

so named; but in other respects it bore little resemblance to a mucous membrane, being neither villous nor covered with mucosities. Long striæ lay outside the membrane in the axis of the tube, like what we observe at the bifurcation of the trachea into the bronchial tubes. These striæ may be, and in all probability are, longitudinal muscular fasciculi. Besides this, the tube presented a considerable number of orifices, which were found, on passing a silver probe into them, to be lateral tubes, communicating, of course, with the main one. The number altogether of these tubes and openings might be about a dozen. They were of different sizes, and three were observed close together, and a very short way within the entrance of the nipple. Into some of these lateral tubes a pretty large silver probe could be passed. In structure, these lateral tubes differed from the principal trunk; none of the longitudinal striæ were observed in them, and their tunics became suddenly extremely fine, so that it was found impossible to follow them by dissection; but their mode of termination was easily enough traced by blowing air in, which shewed us distinctly that the principal large tube at first gradually, and latterly suddenly, branched out into a number of smaller ones. All this took place in a mass which was evidently glandular, and surrounding the main tube throughout its whole length, and into which glandular mass the lateral tubes penetrated in a direction always upwards, and communicating with the large tube in such a way as always to look downwards, and in the course of the secreted fluids towards the nipple.

On looking attentively at this glandular mass (of which the apparatus of tubes or canals we have just described constitutes evidently the excretory ducts), it bore, upon the whole, a considerable resemblance to the glandular masses in which the mammary ducts commence in the female breast; observing, at the same time, that there was nothing *in* the structure to prove their identity of function, and that, upon the whole, the glandular structure and its system of ducts in the Rorqual more resembled the pancreas than the human mammæ.

The glands thus described lay outside the tendons of the abdominal muscles. There was no special investing capsule, but interposed between them and the integuments a layer of transverse muscular fibres, which fibres lay immediately outside the gland.

As M. Geoffroy St Hilaire refers to a dissection of these organs in the fœtus of a Mysticetus, the author has added the following remarks, made during the dissection of one now in his Museum.

The glands appeared to have a special investing tunic in the *fetal* Mysticetus ; but nothing of this kind could be made out in the dissection of the larger Balænoptera.

The supposed muscular layer inclosing the bag in the Mysticetus may be a deception, caused by the difficulty in investigating parts so minute.

M. St Hilaire has supposed that " the gland may be drawn towards the external orifice in the whale by its muscular tunic, and that the gland may thus be pushed from within outwards at the extremity of the excretory duct, and that the pretended nipples may be merely something of the nature of a prepuce."

These conclusions on the part of M. St Hilaire are drawn from the inspection of parts exceedingly minute, and which, though this is not stated, must have been preserved for a considerable time in spirits. Now, the author examined the same structure in a fœtus cut from the uterus of the mother, and preserved in a similar way, without arriving at any conclusion at all worthy of notice, as illustrative of M. St Hilaire's view, by the inspection of structures so extremely minute, altered in colour, and in consistence, by their mode of preservation, and from the youth of the animal, avowedly rudimentary ; whereas, parts similarly situated in the female Rorqual, examined within eight days after death, and in an animal having at least 100 times the bulk of the fetal Mysticet so described, enabled the author to conclude that the gland is of a perfectly fixed nature, and cannot be moved towards the termination of the excretory duct. It has no resemblance whatever to such structures as are found in the Beaver, to which kind of organs M. St Hilaire seems anxious to refer the ones now under consideration.

After examining this system of glands, presumed to be mammary, the author looked cursorily into the same system of organs in the Mysticetus ; and, in so far as such minute structures could be made out satisfactorily, they seemed to agree very nearly with those of the Balænoptera under examination. The fœtus now alluded to was nearly two feet long. Already the organs were perfectly well marked, and having not the slightest disposition to the monotremic structure ; the anus was far removed from the vulva, and opened directly upon the surface, and so also with the two lateral fissures, in the bottom of which we find the nipples. From these *four* orifices opening so directly upon the surface, and having no connection with each other ; and this happening as well in the fœtus of the Mysticetus as in the larger specimen of the Balœnoptera now more immediately under

escription; and the dissections coinciding entirely with those by Mr Hunter, the author deems it impossible to class these with preputial glands; and feels assured that no anatomist of reputation, and accustomed to examine structures for himself, would, after a careful observation, venture to overlook the distance between the lateral fissures for the nipples and the vulva, or ever think of viewing these glands as *preputial* or anal.

To assist the distinguished disputant M. St Hilaire to come to a right conclusion in this matter, the following observations are made by the author:—

"In the Cetacea, these glands are found only in the female. They differ from the human mammæ by terminating in a single large tube, into which many lateral branches pour their contents: but this may be caused by their aquatic habits. There is positively a nipple, though small, and there is nothing in the form of the young whale to prevent it getting at the nipples of the mother."

"In the absence of positive facts as to the nature of the fluid secreted by these glands, it is observed, that there is nothing in their structure opposed to their being mammary. In what respect they resemble the glands discovered by Meckel, and similarly situated in the Ornithorynchus, the author does not venture to say, not having had an opportunity of seeing these glands; but he is sure that they do not exist in the male Ornithorynchus, having examined that animal with very considerable care. See *Mem. Wern. Soc.*"

"There is no properly authenticated fact proving the Ornithorynchus to be oviparous, neither can a single positive stâtement be made in respect to its suckling its young, either after the mode of the Mammalia, properly so called, or in the more anomalous arrangement of the Marsupialia. Thus, in the absence of any thing like positive facts, it seems idle to conjecture as to what may be. The inhabitants of colonies generally are otherwise occupied than determining the habits of the singular animals which remote countries often produce."

Dispute as to the intimate structure of these glands.—The question, then, which has arisen between M. Baer and M. St Hilaire seems to the author to have assumed a form likely to terminate in a dispute about words.* M. St Hilaire objected to Mr Meckel's view, 1*st*, in respect to the abdominal gland of the Ornithorynchus being viewed as mammæ, on the ground that their structure was not conglomerated, like the true lactiferous glands, but simply lobated, and developed in numerous cœca,—a structure much resembling what he himself had

* See Report of Institute.

described in the Sorex, and more lately in the Water-Rat, which glands he knew were odoriferous simply, and not lactiferous, and consequently that he had a right to conclude that the glands described by Mr Meckel in the Ornithorynchus performed similar functions; and, 2*dly*, that very probably the abdominal glands of the Cetaceæ were of a similar character, since, although common observation made these animals hot-blooded or mammiferous, it does not follow that they really are so, and more especially since the secreted fluid had never been seen by any one.

To this M. Von Baer made the following objections: "1*st*, He had proved that it was not exact or correct to say that lactiferous glands are necessarily conglomerated, since, in the Cetacea, these organs are also merely simply cœca, of a structure still more simple than that observed in the Ornithorynchus."

The author presumes that the foregoing description of these glands in the Cetaceæ will prove M. Baer, and those who follow him,* to be entirely in error as to the anatomical structure; and will satisfy any one, that the naturalist who describes these glands as he has done, could never have seen them.

M. V. Baer has used the word conglobate as synonymous with conglomerate, the former being a term which M. St. Hilaire has never used, being, in fact, an expression, as all anatomists know full well, applied to lymphatic glands which have no excretory ducts. *Secondly*, With regard to the dubious glands in the Cetacea being composed internally of simple cœca, the description given of those as found in the Rorqual must prove a refutation. Not to mention the *third* objection, viz. M. V. Baer taking for granted the very fact which requires proof,—their secreting milk. Now this is very far from having been proved. It seems doubtful if the disputants, in this case, attach any precise meaning to the words conglobate and conglomerate. The want of resemblance between the glands in the Ornythorynchus and the Cetacea is striking, in respect to the mode of termination of the excretory duct being in the one case by a single orifice, and in the other, as is said, by 150. As M. V. Baer overlooked this remarkable difference, British zoologists overlooked it also, the structures not being before them. The author does not say that any of these remarks prove the Porpoise to be one of the Mammalia; he merely infers, that the organs, excepting in position, do not resemble the glands of the Ornithorynchus, or of the Sorex or water-rat.

* Transactions of the Zoological Society of London, as quoted in the "Institute," a French periodical.

In addition to their anatomical structures, which go far to prove certain, at least, of the Cetacea, lactiferous, the author addressed a question to a former pupil Mr Auld, whose opportunities for observing the whale tribe had been ample. His reply goes far to set this difficult question at rest.

"EDINBURGH, *April* 3. 1834.

"SIR,—I feel much pleasure in communicating the following facts to you, and which will be borne out by every individual who has had an opportunity of witnessing the same. While standing on the abdomen of the whale, I have been enabled, by the pressure of my foot, to force out a considerable quantity of milk from the parts, even to the extent of some pounds. It resembles cream in colour and consistence, but is of an oily taste and odour. I have seen the young of the Mysticetus harpooned, and from their mouths, after death, milk, or a fluid resembling it, flowed in great profusion, of the same colour and appearance as that forced from the nipples of the parent whale. I have the honour to be, &c. R. AULD.

"To Dr KNOX."

The conclusions arrived at by the author from these dissections, are,

1*st*, That the abdominal glands of the Balœnopteræ and Mysticetus are lactiferous, but very differently formed from any other mammæ he has examined.

2*d*, That they do not resemble the abdominal glands of the Ornithorynchus, either in position or in structure.

3*d*, That M. Von Baer, and the English naturalists following him, could not have examined the mammary glands of the Cetacea, since he states them to be "simple cœca," to which structure they have no resemblance.

4*th*, The author is further inclined to believe the Ornithorynchus a mammiferous animal.

The following measurements and details may be useful to naturalists.

	Feet.	Inches.
Total length of the specimen dissected,	9	11
From snout to ear,	3	0
From nostrils to snout,	1	4
Length of jaw,	2	3
Pectoral extremity, inner side,	1	3
Angle of mouth to pectoral extremity or fin,	1	3

	Feet.	Inches.
From snout to fin,	2	9
From fin to tail,	6	3
Tail in depth,	0	11
Dorsel fin at base,	0	8
Length of ditto,	0	8½
Breadth of tail from tip to tip,	2	8½
From back fin to fissure of the tail,	2	10
Thickness of tail at its origin		17½
Circumference of the trunk at the termination of the plicæ and folds,	4	8

SKELETON.

Length of cranium,	2	11
Greatest breadth between the orbits,	1	3
Length of lower jaw,	2	4
Length of vertebral column,	7	8

Specific differences in the skeletons of the greater Rorqual, and the smaller, or Rostrata of Fabricius.

GREAT RORQUAL.

VERTEBRÆ.

Cervical.	Dorsal.	Lumbar, Sacral, and Caudal.	
7	13	43	= 63

SMALL RORQUAL.

VERTEBRÆ.

Cervical.	Dorsal.	Lumbar.	Sacral and Caudal.	
7	11	13	17	= 48

P. S.—Since the above remarks were sent to press, the author finds, by a late number of the "Institute," just put into his hands, that at the request of M. St Hilaire, His Excellency the Minister of the Interior of France had directed information to be sent to Paris of the stranding of any of the Whale tribe on the coasts. Accordingly, in a short time, two distinct notices reached Paris of the stranding of a great number of the "Dolphin group" or genus, and the question as to their suckling their young was set at rest immediately, by its being proved that such was the case. In respect to the trouble taken by the French naturalists, and so kindly by the Government, to set at rest this question in natural history, the author is of opinion that the whole is a work of supererogation as to the Dolphin group of the Octaceæ, since the fact of their being mammiferous had been proved long ago; not so, however, with regard to true or Whalebone Whales; but the author hopes that the preceding remarks prove them also to be mammiferous.

A new question has been started by M. St Hilaire, as to the mode of lactation or sucking of the young Dolphin and Whale. That distinguished naturalist conjectures that the young does not suck, the milk being merely projected into the mouth of the young whale by a voluntary and muscular action exercised upon the mammary glands of the parent; it seems very questionable to the author, if this question merits much consideration.