IX. *On the milk tusks, and organ of hearing of the Dugong.*

By *Sir* EVERARD HOME, *Bart. V. P. R. S.*

Read April 13th, 1820.

I HAVE found nothing that so much promotes the enquiry respecting those animals with which we are little acquainted, as laying before the public the materials, however scanty they may be, that have been already procured.

By making those materials generally known, naturalists have their minds awakened to the enquiry, and are not only more disposed, but better able to take advantage of such opportunities as come within their reach, to advance our knowledge of that subject.

This at least has happened in so great a degree with respect to the fossil bones of the Proteosaurus, of which very little was known at the time I laid my first observations upon them before the Royal Society, that I am induced to make a similar trial respecting the Dugong, which, I believe, has never been seen of its full size, by any one conversant in comparative anatomy.

On the present, as well as on former occasions, it is not the whole structure of the animal that has attracted my notice, but such parts of it as differed in form from similar parts in other animals most nearly allied to it; as I consider that all peculiarities of this kind are deserving of the notice of this Society, since they bring to our knowledge a new construction of parts, and therefore make us acquainted with animals

that form intermediate links in the chain of gradation between those that are already known. The truth of this observation is very strongly illustrated in the proteosaurus.

Our knowledge of comparative anatomy has been so much encreased in extent within the last few years, that we can now better, than at any former period, attempt the arrangement of animals into a regular order, according to their internal mechanism; showing that they form so many parts of one great system of structures; and if the pursuit is followed with the same ardor, and attended with the like success, we may soon expect to have all the material links of this great chain made out.

To assist our progress towards this end, the great purpose for which comparative anatomy is cultivated as a science, I have in all my researches into the structures of animals, or their fossil remains, kept it in view.

The observations I now bring forward respecting the milk tusks, and organ of hearing of the dugong, have been made upon a skull of that extraordinary animal, in a very perfect state of preservation, sent to me, by my friend Sir THOMAS STAMFORD RAFFLES, from Sumatra.

There are three skulls which I may say have come under my observation, of animals nearly of the same age, but not entirely so, for although the milk tusks at their points in all of them, put on the same appearance, that is not the case with their other extremities. One of these skulls is in the possession of M. CUVIER, and a figure of it is engraved in the thirteenth volume of the *Annales du Museè d'Histoire Naturelle*; and also in the fourth volume of his work, entitled *Recherches sur les Ossimens Fossiles des Quadrupedes.* In this figure the

bones of the ear are not represented; and as in that stage of the animal's growth they have no bony connection with the skull, there is sufficient evidence of their having belonged to a young animal. Another skull is in the collection of comparative anatomy belonging to Mr. BROOKES, in London. In that also the organs of hearing are wanting. The third is in my possession, and is the subject of the present observations; in this the bones of the ear on both sides of the skull are preserved, although they have acquired no bony connection with the skull.

The first examination which it occurred to me to make, was respecting the length of the tusks, the points of which were the only parts exposed. For this purpose, one of the bony canals, composed of the bones of the face in which the tusk is contained, was laid open, and one of the tusks was removed from its socket, and a longitudinal section afterwards made of it. The whole of its substance was found to be solid, showing that it had arrived at its full growth, and was therefore only a milk tusk: at the posterior extremity there was a small shallow cup composed of the same materials, which appeared to be no part of the tusk itself, but, as it were, fixed to the end of it. This was contained in a corresponding cavity adapted to it, in the skull; but upon the upper surface, the bony table of the skull was entirely removed to some extent by absorption, so that the shallow cup at the root of the tusk was exposed externally, giving the skull at that part a very extraordinary appearance. In Mr. BROOKES's specimen, the aperture through the external table of the skull is to a less extent, than in my specimen, but exactly of the same kind. In M. CUVIER's skull, there is no appearance of any breach in

the upper table whatever, so that the process of absorption of the outer table of the skull, to make room for the formation of the permanent tusk, had not begun to take place.

When the section of this tusk was compared with a similar section of the milk tusk of the narwhal, and of the elephant, I found that in its internal structure it closely resembled them; and I noticed that the external surface in all of them was deficient in smoothness, when compared with the permanent tusks of those animals.

In the narwhal, the root of the milk tusk terminates in a rounded blunt end, behind which there is no appearance of any preparation for the formation of the permanent tusk; so that there is no evidence of that tusk having its origin in a cell similar to those of the dugong; but by comparing the place where the root of the milk tusk has its origin, with that of the permanent tusk in the same animal, for the two tusks in the narwhal come forward at such different periods of time, that this comparison may be made even when one permanent tusk appears to have arrived at its full growth, or nearly so; at which time the rudiments of the corresponding permanent tusk have not begun to be formed, and the depth in the skull of the milk and permanent tusk exactly correspond.

As the permanent tusk in the narwhal begins to form in a direct line immediately behind the origin of the milk tusk, the great purpose of the milk tusk is evidently to open the road for, and to direct the course of the permanent tusk, till it is completely pushed out by it. In the elephant, both of whose tusks appear at the same time, and whose skull encreases in size much more rapidly than that of the narwhal, the permanent tusk has its origin even farther forward than

the milk tusk; but then it afterwards has an increase backwards in the space between the tables of the skull, which the tusks of the narwhal have not; and in this growth backwards, which is very slow, corresponding to that of the skull, absorption of the upper table previously formed, is produced, to make room for it. In this way the sockets of the elephant's tusks, which are shallow when the animal is young, acquire an increase of depth as the elephant grows up, to give it sufficient firmness in the skull to support them in the exertions that are made with them.

A similar absorption to what takes place in the upper table of the skull in the elephant, is shown to occur in the dugong; it is however probably at a different period of the animal's growth, as the milk tusk in the elephant is shed between the first and second year, and the absorption of the upper table many years after; but in the dugong, the absorption of the skull takes place just as the milk tusks begin to extend themselves beyond the gums, but the age at which the animal has at this time arrived is not known.

The use of the shallow cup, which appears to be an appendage peculiar to the milk tusk of the dugong, forming no part of the tusk itself, would appear to be for the purpose of receiving the point of the permanent tusk as soon as it is formed; so that as the milk tusk advances in the act of its being shed, the other may be directed forwards in the same course, which is different from that in which it set out.

The facts that were brought forward in a former paper upon the milk tusks of the narwhal, explained many circumstances in the natural history of that animal which were involved in obscurity; and the observations that are now made upon the

tusks of the dugong, show that the milk tusks have been mistaken for the permanent ones, and that the real appearance of the permanent tusks of this animal is at present unknown. Having corrected so great an error in the natural history of this animal, we must wait till we are so fortunate as to procure the skull of a full grown dugong, before we attempt to form any analogies between its tusks and those of other tribes of animals.

The grinding teeth, as will be seen in the annexed plate, are not exactly similar to those of any known animal, but form an approach to the hippopotamus. They consist of two cones united together; but when a transverse section is made, there is no line of separation, the whole being uniform; the external crust is not enamel, nor is it the hardest part; a little within it, there is a narrow rim of a yellow colour, that describes an oval figure, much more dense than the rest of the tooth, although to the eye there is no apparent difference in its texture; all that is within this rim is soft ivory; so that these teeth in wearing down will always have the crown rendered concave.

On the organ of hearing.

In examining the organ of hearing of the dugong, which was done with more facility, as the skull had not been completely formed, I met with a peculiarity, that does not belong, as far as I am aware, to any other tribe of animals. The malleus and incus, which have nearly the same shape as in other animals, are fastened to the sides of the tympanum by a bony substance extending across the intervening space. The malleus is in this way connected to one side of the tympanum,

the incus to the other, so as to render these ossicula in a great measure immoveable. The stapes is unconnected with the foramen ovale, to which it is opposed; nor is it anchylosed with the ramus of the incus. The handle of the malleus projects in the centre of the circle over which the membrana tympani had been spread, so as to leave no doubt that, in the living animal, it is attached to the centre of that membrane.

The nearest approach to this mechanism, is an attachment by bony union of the malleus to one side of the tympanum, which Mr. HUNTER, in his paper on the Anatomy of Whales, states he had met with in some of that tribe; but does not, (which is unfortunate) mention in what species. He says not in the porpoise; and the author knows it is not the case in the balæna mysticetus; so that this structure does not belong to those genera that live principally upon the surface, nor to those that penetrate the unfathomable depths; and as HUNTER describes the organ at length in the pike-whale, without mentioning this peculiarity as part of the description, it could not have occurred in that species. This renders it probable that he met with it in the grampus, or the bottle-nose, and it is very likely in both, as he insinuates that it is not confined to one genus.

The dugong feeds on the plants that grow at the bottom of the sea, and comes in great numbers to the harbours of uninhabited islands, and remains for many hours in the shoal water, where it finds food: at least this account is given of its habits by Mr. LEGUAT, who, with several companions, spent nearly three years in an island previously uninhabited, about fifty leagues from the Mauritius, and the dugong was a

principal part of their food. It is from him we learn that their usual length is twenty feet; but that catching them full grown was a service of danger; nor were they so delicate as food for the table. This gentleman's account was published in 1720, and is written with so much apparent candour, that there is no reason for doubting the veracity of his narrative.

As these habits are allied to those of the hippopotamus, I inquired whether this peculiarity of structure exists in the ear of that animal, but find there is nothing of the kind; all the ossicula are separate, and very readily drop out of the cavity of the tympanum when the skull is deprived of the soft parts. There are peculiarities in the mechanism of this organ in the hippopotamus which deserve being mentioned. The projecting ear and meatus auditorius externus, have a higher situation upon the head than in most other animals; and the tube that passes down to the membrana tympani, is one straight line. The bony portion of it is four inches long, its direction from the external surface of the head down to the membrane, is at an angle of 45°, and its termination is upon a ledge which forms a slight projection beyond the bony ring to which the membrana tympani is attached; the space on the outer surface of the membrane, between it and the opposite side of the tube, is so small, that it cannot exceed the thickness of the membrane itself. The ossicula are small, when the size of the animal is considered; but the cochlea makes two turns and a half, which is by no means common; the semicircular canals have the usual appearance.

This animal I understand, from every enquiry I have been able to make, when it goes down into the water to feed at the

bottom, allows itself to sink by its own weight, descending in a standing posture, so that as soon as the head is covered, the water would pass into the tube of the ears, were there not something like a valve at the orifice of the meatus externus to prevent it. In other animals that live in the sea, or are much under water, there are contrivances, very different from this, to prevent the water getting into the tube of the ear. In the whale tribe, the external orifice is so extremely small, as to exclude it. In the seal, the meatus externus makes a turn nearly circular, to answer the same purpose. In the ornithorhyncus paradoxus, the external opening is at a great distance from the organ; and the meatus, which is the size of a crow quill, and cartilaginous, winds round upon the temporal bone. The external meatus in the walrus, I have not had an opportunity of examining; the orifice in the bony tube corresponds in size with that of the hippopotamus, its termination at the membrana tympani is less oblique, and its direction horizontal. The ossicula in the hippopotamus are small, the stapes is imperforate, and the bones have no bony union.

The external orifice of the meatus externus in the dugong is extremely small, so as readily to exclude the water. The cochlea is very small, making only one turn and nearly one half. The semicircular canals are also exceedingly small. The peculiar bony connections to the tympanum, connecting the malleus and incus with the bones of the skull already described, lead to the idea that this animal is more indebted for its hearing, than any other that lives in water, to the vibrations received by the bones of the skull, being commu-

nicated, through the bony connections that have been mentioned, to the ossicula, and from thence to the cochlea, and semicircular canals.

This animal, although the tail is horizontal, possesses the sense of smell, since there are orifices in the cerebriform plate of the skull for the olfactory nerves.

While this paper was in the press, I have been so fortunate as to receive from Sir THOMAS STAMFORD RAFFLES, another skull belonging to a dugong, 8 feet long, in which the milk tusks had been shed, and the permanent ones had acquired sufficient length to show the degree they project beyond the bony sockets, and the manner in which they are worn down, by rooting up the plants while feeding. They are considerably broader than the milk tusks, even at their points, explaining the use of the cup at the end of the milk tusk being wider than the tusk itself, to admit of the point of the permanent one having this encreased breadth.

These tusks bear a near resemblance to those of the hog, the points being turned a little outwards, and they wear down in the same manner.

It is not a little remarkable, that in writing this paper upon the milk tusks, I should have an opportunity, during an accidental delay in the press, of being furnished with materials to show the appearance of the permanent tusks, which forms so essential a character of the animal, and also to prove that while young, there are incisors in the lower jaw; two of them in the jaw of this skull having been accidentally entangled (while shedding,) in the new bone that was closing

up the socket, and consequently retained there. This is a curious additional fact, and is so far an approach to ruminating animals, whose incisors are only in the lower jaw. These incisors enable the young dugong to crop the tender plants, but are no longer wanted when the animal grows up.

EXPLANATION OF THE PLATES.

PLATE XII.

This plate consists of three figures.

Fig. 1. A side view of the first skull of the dugong, sent by Sir T. S. RAFFLES, in which the organ of hearing is in its place, and one of the tusks exposed through its whole length.

Fig. 2. The longitudinal section of the tusk.

These two figures are in the proportion of half an inch to one inch.

Fig. 3. An exact copy taken from Mr. CUVIER's representation of the dugong's skull, the proportions of which are not mentioned

PLATE XIII.

This plate consists of three figures, in the proportion of half an inch to one inch. The first represents the basis of the skull of the dugong with milk tusks; the second, the appearance of the permanent tusks in situ; the third, the section of the permanent tusk.

PLATE XIV.

This plate consists of four figures.

Fig. 1. The lower jaw of the skull represented in Pl. XIII.


Fig. 3.
Fig. 2.
Fig. 1.

Fig. 1.

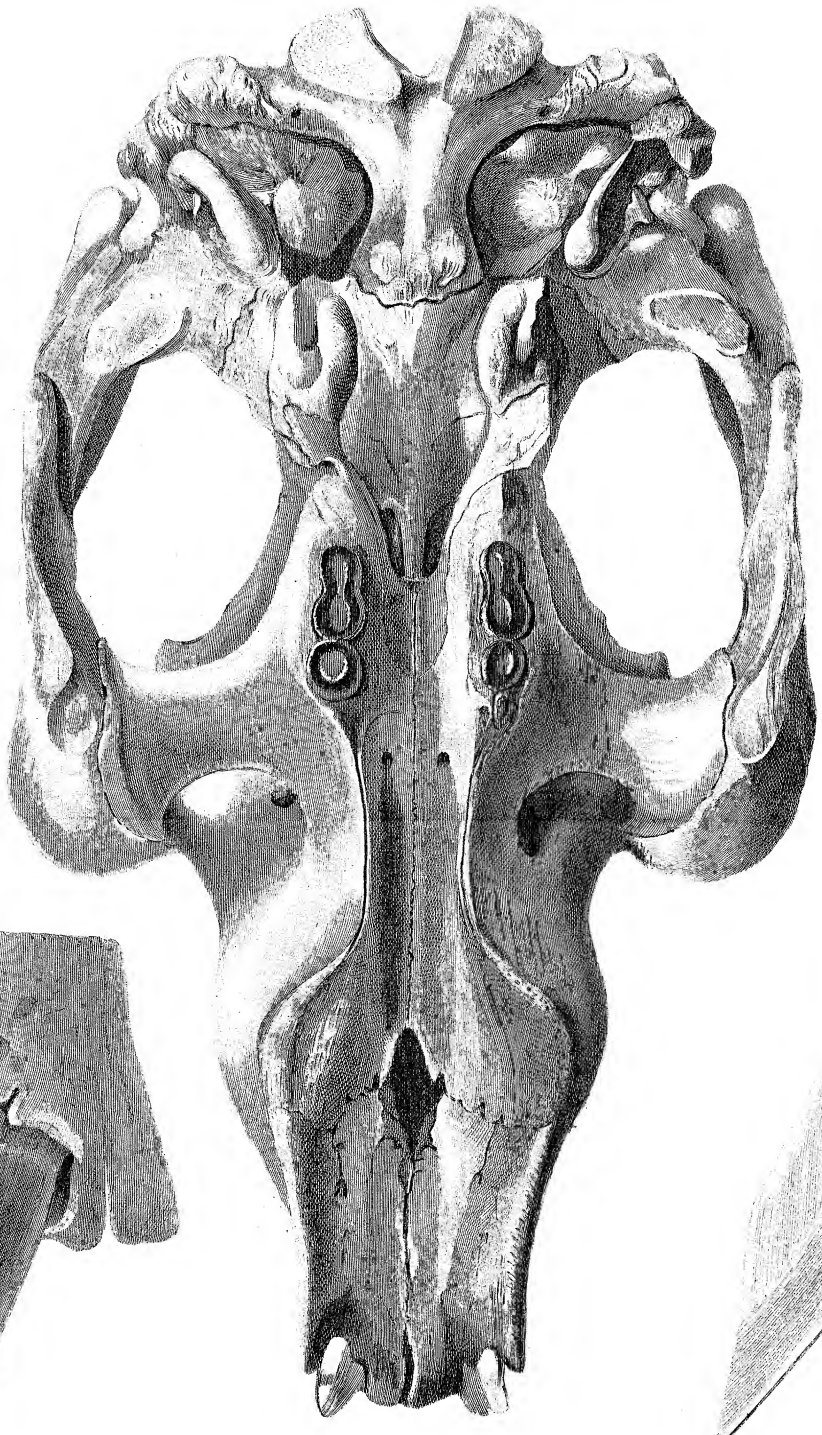

Fig. 3.

Fig. 2.

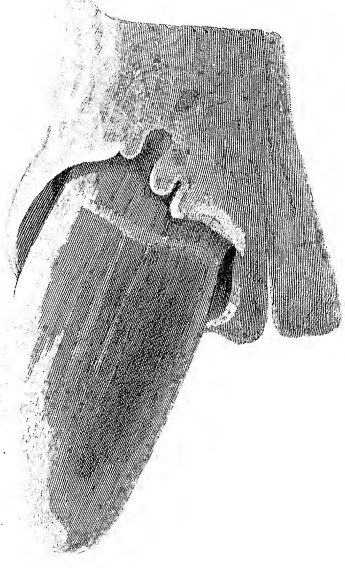

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Fig. 4.

Fig. 1.

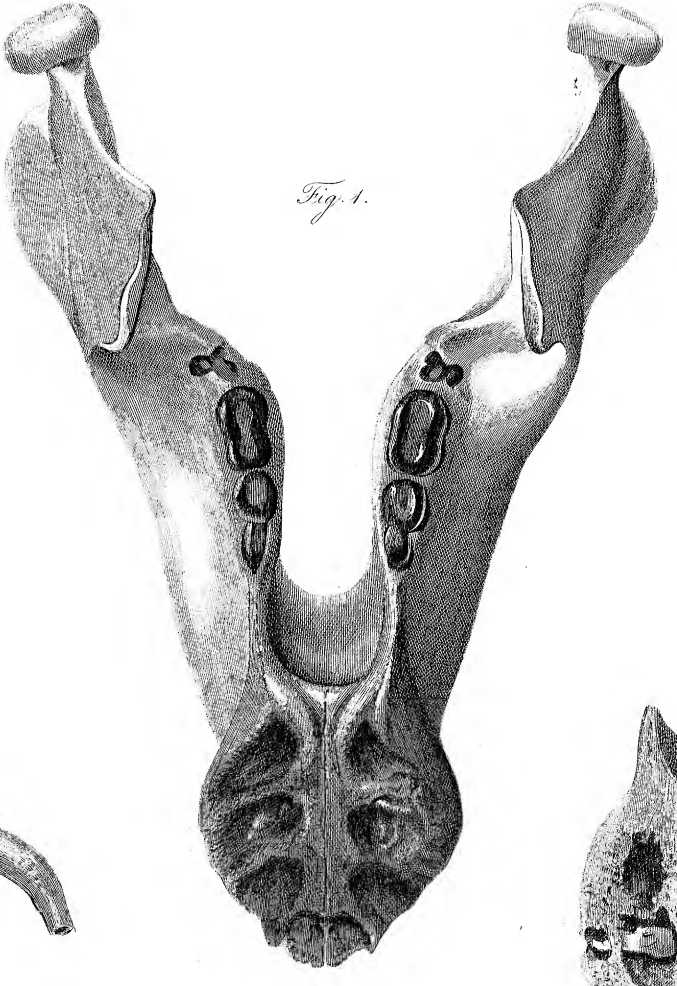

Fig. 2.

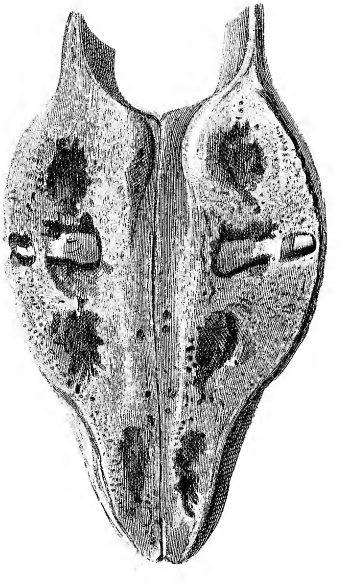

Fig. 3.

Fig. 2. The remains of two incisors in situ; both these figures are in the same proportion.

Fig. 3. The two incisors in a shedding state, removed from the jaw, of the natural size.

Fig. 4. A transverse section of one of the dentes molares, represented also of the natural size.