

Dissection of a spermaceti whale and three other cetaceans / by J.B.S. Jackson.

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B O S T O N

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ART. I.—DISSECTION OF A SPERMACETI WHALE AND THREE OTHER CETACEANS. By J. B. S. JACKSON, M. D. Read April 6 and September 7, 1842.

THESE dissections were made in the spring of 1842, and, following each other in quick succession, afforded a very favorable opportunity for comparison. The first specimen examined was that of the spermaceti whale, the internal structure of which, so far as I can ascertain, has never yet been fully described. Mr. Hunter,¹ whose paper contains about all that is known on the subject at the present day, states that his

¹ The following authorities have been carefully examined with reference to these dissections.

- Hunter on the Structure and Economy of Whales, with Notes by Mr. Owen.
Fred. Cuvier, (*Hist. Nat. des Cétacés*, 1836.)
Lesson, (*Histoire Naturelle des Cétacés*.)
G. Cuvier, (*Anat. Comp.*, and *Oss. Fossiles*.)
Beale, (*Natural History of the Sperm Whale*, 2d ed. 1839.)
Dr. Alderson's description of a Sperm Whale, (*Cambridge Philos. Trans.* vol. ii. p. 250.)
Sir Wm. Jardine, (*Naturalist's Library*, vol. vi. on Whales.)
Todd's *Cyclopedia of Anatomy*, (Art. *Cetacea*.)

observations were founded upon the dissection of seven different species, and that one of the number was a spermaceti whale, though he says that some of them were only superficially examined; it does not appear whether this was the case with regard to the whale, but it may be suspected, as he mentions only two of the internal organs, the heart and the tongue. Dr. Alderson describes the heart particularly, and notices the form of the thyroid cartilage, and G. Cuvier figures the body of the hyoid bone. The osteology, and some of the external organs, as they may be called, have been fully described; but, as I have found nothing more concerning the internal structure than what is above mentioned, I shall give my notes of this dissection in detail. The second specimen examined was probably the *Delphinus delphis*, and the third the *Phocæna globiceps*. The fourth consisted of the organs merely of the common porpoise. These three last dissections, of which full notes were taken, will not be given in detail, but chiefly those points in the description of particular parts which I have not found noticed by authors, or which differed from their descriptions; entire organs will also be described, which are not mentioned by the authors above quoted, or whose existence has been denied.

OF THE SPERMACETI WHALE.

This was a very young specimen, and was taken in Vineyard Sound, about fifteen miles from New Bedford, on the 29th of March, 1842. On the 31st it was brought on the Providence Railroad to this city for exhibition, and on the night of April 1st, with the assistance of Dr. William Henry Thayer, I removed the organs; these were carried to the Medical College on the following day, and were there examined.

On its arrival at the railroad depot, it was found to weigh 3,053 pounds. After the removal of the organs, the body having been stuffed to about its natural size, and carefully

sewed up, the measurements were as follows:—From a line with the anterior extremity of the head to the tip of the tail 16 feet, to the rudimentary dorsal fin 9 feet, to the anterior fin about 4 feet, to the vent 10 feet 2 inches, to the eye 3 feet 2 inches, to the external orifice of the ear 3 feet 8 inches, to the angle of the mouth 2 feet 10 inches. According to Mr. Owen, “When brought forth, the young cachalot is usually twenty feet in length;” but the present individual could not have been recently born, as the foramen ovale was completely closed. Vertical diameter of the head just in front of the opening of the mouth 34 inches, and of the largest part of the body 3 feet, the abdomen having, perhaps, fallen in somewhat since the removal of the organs; anterior fin 18 inches long and 9 inches wide. The dorsal fin, or hump, forms a very obtuse angle, and is ill defined, being about 10 inches in length, and 2 or 3 inches in height, there being also between it and the caudal two or three quite small finlets. Span of tail 19 inches, and 4 inches wide midway. Lower jaw to the angle of the mouth 20 inches; right eye $1\frac{1}{2}$ inches long; the left not examined, as the animal laid upon that side, and I was not aware, at the time, of the difference that had been observed, the left being, according to F. Cuvier, always imperfect, and almost useless. Orifice of the external ear about the size of a goose quill. The circumference of the body before the removal of the organs was, according to the owners, 9 feet.

As to the general outline, it resembled the figure in the Naturalist's Library, (vol. vi. pl. 8,) about as nearly as one individual would be likely to resemble another of a different age and sex. The small finlets, however, are not shown in the figure, and the under part of the body near the caudal fin is much less prominent than it was in the present specimen; the external surface also was everywhere quite black, remarkably smooth, and elastic like India rubber.

Epidermis as in the other cetaceans. The skin, known generally as the blubber, was about 3 inches thick where cut

through, and the muscles resembled those of other large mammalia as to color and texture.

The *teeth* in the lower jaw had not yet come through. Some have described teeth as having been found concealed beneath the gum in the upper jaw of adults ; this fact, however, is questioned by some of the highest authorities. I will, therefore, give the testimony of a very intelligent observer, Capt. Benjamin Chase, of Nantucket, who, having been for many years engaged in the sperm whale fishery, is well acquainted with the subject, and has allowed me to use his name, and to give the result of some of his observations. He states that he has more than once seen teeth of a considerable size in the upper jaw of the adult females, though always covered by the gum ; the males, he says, being much larger, are cut up differently, and in such a way as not to expose the teeth. The roof of the mouth was smooth, light colored, and hollowed as if to receive the lower jaw, which is quite narrow in front.

The *tongue* was 33 inches in length, the free extremity being 7 inches long, and 6 inches wide. Mr. Hunter describes it in the sperm whale as "almost like a feather-bed ;" but in the present specimen, which was quite fresh, it was not remarkably soft. The surface was not so flat as it often is in the cetaceans ; towards the edges anteriorly were numerous small fissures and granulations, and, posteriorly, there were several quite prominent glands, but generally it was sufficiently smooth. In structure it seemed wholly muscular, whereas in the Greenland whale, it furnishes a large quantity of oil.

The body of the os hyoides resembled the figure in Cuvier's *Oss. Fossiles*, and was 12 inches transversely across the base, and 6 inches on the median line ; this was connected by two intermediate cartilages, 3 inches in length, with the styloid bones, which were 9 inches long and $1\frac{1}{2}$ inch in diameter. Dr. Todd remarks, with regard to this bone in the cetaceans, (p. 572,) on its "slight degree, or total absence of connection with the larynx," but nothing of the kind was observed in any one of these dissections.

The *œsophagus* was 20 inches in length from the cricoid cartilage, and not remarkably capacious; muscular coat thick, and lined by a smooth cutis and cuticle.

The *stomach* in this order of animals, as in the ruminants, is composed of several cavities, the number being generally four or five. In the present case there were but three, and the appearances have been most perfectly represented in a figure drawn by Dr. J. Wyman, Plate XIV.

The first cavity (marked *b* in the figure,) is commonly described as a mere ovoid dilatation of the *œsophagus*, but here it is nearly of a globular form, projects so far towards the left side as to form a *cul de sac*, as in the human stomach, and is altogether about the size of a man's head; the size and form of it, however, probably depend somewhat upon the age of the animal, as in case of the ruminants. The cutis and cuticle are continued throughout from the *œsophagus* (*a*), and, where they abruptly terminate, the second cavity is supposed to commence. The inner surface was sufficiently smooth, but the cuticle being partially detached, there were seen upon its under surface, numerous rounded papillæ, corresponding undoubtedly with follicles in the cutis. The muscular coat in this, as in all of the other cavities, was tolerably thick. Mr. Hunter supposed the first cavity of the stomach in the cetaceans to be a mere reservoir, as in the ruminants; but this idea is now fully disproved, and the object of the cuticular structure remains unexplained. In the case of the sperm whale this structure is particularly remarkable, considering the nature of its food, which, according to Mr. Beale, is the soft squid, this being, as he remarks, the only animal which it ejects when wounded; the same observation has been repeatedly made by Captain Chase, and the confirmation is important, as being so directly opposed to the statement of F. Cuvier. (p. 298.) In the present case nothing was found in any one of the cavities but a little water, and some fine greenish sand, the animal not having taken any food, probably, since it was separated from its mother.

The second cavity of the stomach (*c*) differed entirely from that of the cetaceans generally. In the first place, the œsophagus opened about as freely into it as into the first cavity. Secondly, the communication between it and the second was very large, measuring 15 inches across when cut open, and it was not surrounded by projections of any sort. Thirdly, instead of being spherical, it was much elongated, and terminated at the further extremity in a blunt point, measuring 20 inches in length. Fourthly, the characteristic rugæ on the inner surface were nowhere strongly marked, and towards the first cavity were even wanting. The mucous coat was about half a line in thickness, quite dense, and showed upon the cut edge a slight appearance of fine, whitish, perpendicular and parallel lines, this structure being often described as highly glandular in the cetaceans.

The third cavity (*e*) which evidently corresponds to the fourth, as generally described in the cetaceans, arose from the second about midway (*d*), was of an elongated form, quite narrow at its commencement, but becoming dilated and curved upon itself towards its further extremity. Externally it measured 30 inches in length, $3\frac{1}{2}$ inches in diameter for the first four inches, and 18 inches at the largest part. The mucous coat, as compared with the second cavity, was less rugous, thinner, less dense, and without any of the linear appearance. There is generally a very small, intermediate cavity between this and the second, of a spherical form and marked by distinct orifices, but nothing of the kind was found in the present case.

Beyond these three is still a fourth cavity (*g*), about which, in the cetaceans generally, there has been much question whether it should be regarded as an additional cavity of the stomach, or as a dilatation of the intestine. In this case it appeared rather larger than the first cavity, the largest diameter being about 13 inches, and the transverse about 6 inches. It was extensively and intimately connected with the third cavity, but the opening between them was exceedingly small (*f*), measuring only $\frac{1}{4}$ inch in diameter, the two appearing not un-

like one cavity divided by a septum, through the centre of which a small circular hole had been punched. This cavity, which was largest at its commencement, rapidly diminished in size, and soon made an abrupt turn upon itself, almost immediately after which the intestine (*h*) was well marked. The mucous membrane was thinner and softer than in the other cavities, and quite free from rugæ, the whole thickness of the parietes in these two last cavities being less than in that of the first. On the most careful examination nothing like pylorus was found, neither was there any sudden change in the thickness or structure of the mucous coat, as described by G. Cuvier, so that if the question had not existed, I should not have thought of this cavity as otherwise than a dilatation of the intestine; a similar dilatation I have twice seen in the dromedary. (Journal B. S. N. H., IV. 7.)

The *intestine*, being cut away from the mesentery, was found to measure 260 feet, or just $16\frac{1}{4}$ times the length of the animal. Before being opened, it measured, on an average, about one inch in diameter, near the upper extremity $1\frac{3}{4}$ inches, midway or rather below, less than an inch, and for the last 12 feet, it dilated from about $2\frac{1}{4}$ to $8\frac{1}{2}$ inches; cæcum wanting, as it was in all of the other specimens. The contents were for the most part pasty, and colored by bile; throughout the last 30 or 40 feet, they were of an intensely deep brown color, thin at first, but towards the last having a thick, glutinous consistence. Mucous coat thin, but very firm; muscular rather thick. The valvulæ conniventes were most remarkably developed from near the commencement of the intestine to within about 40 feet of its termination; instead of being transverse and interrupted, as in man, they were more or less oblique, and apparently continuous; this being quite obvious in some parts before the intestine was opened, so that it appeared as if there were a spiral valve within; the effect of this would be to add to the already great length of the intestine, and balance in some measure its small size. The valves were $1\frac{1}{2}$ or 2 lines in width, very regular, and so close together as nearly to

overlap, the intervening mucous membrane being traversed longitudinally by very numerous fine lines. Along the first few feet of the intestine the surface was generally smooth, but there were a number of folds of mucous membrane which might properly be called *valvulae conniventes*, not being continued entirely across the intestine; these were about one inch apart, and $\frac{1}{2}$ inch in width midway. About 40 feet from the termination of the intestine, the valves became smaller and more irregular, and soon the mucous surface assumed a very peculiar appearance, the change, however, being gradual; the portion opposite the mesentery continued thin and nearly or quite smooth, whilst the remainder, consisting of one half or two-thirds of the whole intestine, was extremely thick and rugous, the *rugae* being very broad and mostly transverse, though many were longitudinal; no mucous follicles were seen here, nor indeed in any part of the intestine, except a few very small ones in the rectum, and yet it was impossible not to regard this as a glandular structure, analogous, perhaps, to the Peyerian; the mucous membrane throughout the last 20 or 25 feet was smooth. Finally the rectum opened in the sulcus which gave outlet to the vagina.

The *liver* was a broad, flat, very regular organ, divided into two lobes, of which the left was decidedly the largest, differing therein from each of the other specimens, and from what has been generally observed in the cetaceans; the right measured 24 inches in length, the left 25, and the whole organ transversely 34 inches; thickness 2 inches; no trace of a third lobe. Color and structure not remarkable. Gall-bladder wanting, as usual, in the cetaceans; duct, near the liver, reticulated upon the inner surface, and measured $1\frac{1}{2}$ inches transversely.

The *spleen* was a soft, dark red organ, somewhat lobulated, of a flattened, oval form, and about 10 inches in length; also a second, about an inch in diameter, and connected with the first by cellular membrane; several of these are sometimes found in the cetacea, and I am not sure that there were not others in the present case.

The *kidneys*, of a flattened, lozenge-like shape, were formed, as usual, of an aggregation of small glands about the size of a filbert. One of them measured 19 inches in length, 14 inches at the broadest part, and 2 inches thick. There was no marked pelvis at the commencement of the ureter. The bladder was small and flaccid, containing scarcely any fluid; before being opened it measured 10 inches in length and $4\frac{1}{2}$ inches across the fundus. Mucous and muscular coats not remarkable. The urethra, which opened close to the clitoris was 11 inches in length, and one inch transversely when cut open; muscular coat quite thick.

Of the *genital organs*. The external fissure, 8 inches in length and $2\frac{1}{2}$ inches deep, received the opening of the vagina about midway, and posteriorly the rectum; anteriorly was the clitoris, a dense, greyish organ, having somewhat the form of a parrot's beak, and measuring $1\frac{1}{2}$ inches in its two principal diameters. Outlet of vagina transverse and contracted, the posterior lip being a very thick, rounded mass; outlet of rectum also surrounded by numerous, rounded masses of the size of filberts. The whole canal, from the outlet to the division into the cornua uteri, which was quite abrupt, measured 32 inches; the first 12 inches were smooth, and measured $7\frac{1}{2}$ inches transversely when cut open, gradually diminishing afterwards to 3 inches at the bifurcation. Where it began to contract, transverse rugæ were seen, and soon became as strongly developed as in the ruminants, or even more so, being $\frac{1}{2}$ inch in width and almost overlapping; these are also crossed by an infinity of longitudinal rugæ. The muscular coat was 2 or $2\frac{1}{2}$ lines thick, and extended up into the rugæ, becoming thinner in the upper part of the uterus and in the cornua. Superiorly, the transverse rugæ became less marked, and just below the bifurcation they nearly or quite disappeared. As in the ruminants, the limit between the vagina and the uterus was not marked. One of the cornua only was examined; this was 12 inches in length, and 3 inches transversely when cut open; longitudinal rugæ on the inner surface very

close and well marked. The Fallopian tube, cut open, was extremely thin and delicate, its mucous coat being thrown into fine longitudinal folds; $2\frac{1}{2}$ lines transversely where it leaves the uterus, and about 8 lines at the further extremity, though at this last part it cannot be said exactly where it terminates, since it finally expands into a delicate membrane, as it does in some other animals. The ovaries were of a flattened, oval form, and $3\frac{1}{2}$ by $1\frac{3}{4}$ inches; surface somewhat fissured; a single incision being made through one of them, no vesicles were seen. On each side of the genital fissure, and very near to it, was another, about 5 inches in length, at the bottom of which was felt the nipple.

F. Cuvier says, (Op. cit. p. xxiv.) "On ignore le mode d'accouplement des cétacés souffleurs. Personne jusqu'à présent n'en a été témoin. L'opinion la plus probable, c'est qu'ils s'unissent couchés tous deux sur le côté. Steller dit que son *manatus* (le Stellère) s'accouple avec la femelle couchée sur le dos." Hunter's opinion appears to be very absurd, though Mr. Beale quotes it without remark. Now, on this point, Capt. Chase's observations were exceedingly interesting, and were stated by him with full confidence. He informed me that he had more than once had the most favorable opportunity of witnessing the act in the spermaceti whale, in the right whale, and in the "porpoise;" in the two first, it continues for a few minutes, but, in the last, it is almost momentary; the position is horizontal, and not upon the side, nor does the female remain supine, but, being close to the surface of the water, they occasionally turn so as alternately to bring the top of the head above the water, evidently for the purpose of respiration. The right whale, he thinks, breeds at particular seasons, but the spermaceti at any season of the year; and he agrees with most observers in never having seen more than a single young one at a time about an old female; in cutting up one of these last, he has seen "a bucket-full of thick, rich milk" discharged from the mammary gland; the act of suckling he has never witnessed.

Of the *heart*, the ventricular portion was formed very much as in the tortoises, measuring $16\frac{1}{2}$ inches transversely, whilst, from above downwards, the right side measured but 7, and the left 8 inches. In the place of an apex, there was a broad surface, and rather a depression on the median line, as if it were the first step towards a separation of the ventricles, as seen in the dugong. Vrolik (*Ann. des Sc.* 1838) speaks of the semilunar form of the heart in some of the cetaceans, but this was the only instance in which it was found, in the four specimens here described. The right auricle was about twice as large as the double fist; form not remarkable, neither was its thickness; appendix well marked, and its cavity traversed by a mesh of strong, muscular fibres. Foramen ovale quite closed, and the fossa very little marked. No Eustachian valve, neither was there in either of the three other specimens. Coronary vein one inch in diameter, and opened at the usual place; no valve found in any one of the specimens. One superior cava, which soon divided; one inferior cava, measuring, transversely, 8 inches, when cut open in its passage behind the liver, and entering the heart as soon as it had passed through the diaphragm.

Right ventricle from about $\frac{1}{2}$ to $\frac{3}{4}$ of an inch thick; the inner surface being very irregular from strong, muscular bands. Tricuspid valve $14\frac{1}{2}$ inches along its adherent edge. Pulmonary artery $3\frac{1}{2}$ inches from upper edge of valves to bifurcation, 9 inches in circumference on inner surface, and about 2 lines thick.

Left auricle rather smaller than the right. Parietes generally thin, but having numerous very strong and prominent muscular columns on the inner surface. Appendix well marked. Fossa ovalis less distinct than on the right side. In the left ventricle the muscular columns were so numerous, large, and prominent, that it was difficult to measure the parietes, but the average thickness was not far from $1\frac{1}{3}$ inches, that of the apex being 5 lines. Circumference of mitral valve at adherent edge 11 inches; cordæ tendiniæ very numerous.

The ascending aorta measured 4 inches to the first branch at the arch; no marked dilatation, the circumference on the inner surface being $8\frac{1}{4}$ inches; parietes 3 lines thick. The ductus arteriosus formed a cord $2\frac{1}{3}$ inches long, and $\frac{3}{4}$ of an inch in diameter, externally, but the canal remained open so as to allow the passage of an instrument about $\frac{1}{4}$ of an inch in diameter. The persistence of this opening is quite remarkable, even in a cetacean, not having been found in either of the three other specimens, except in the dolphin, which was foetal. The arch of the aorta gave off three vessels. The first, 6 inches in circumference externally, divided at once into two branches, one of which was traced in situ, and was found to be the right carotid, the other taking the direction of the subclavian; these vessels were of about equal size, and it is remarkable that they were so, considering the great bulk of the head as compared with the anterior extremities. The second vessel arose only half an inch from the first, was 5 inches in circumference, and consisted almost wholly of carotid. The third vessel arose from the aorta 5 inches beyond the second, was $3\frac{1}{4}$ inches in circumference, and may have been a superior intercostal, such as was afterwards found in the dolphin.

I regret exceedingly not to have seen the intercostal plexuses, one of the most interesting structures in the cetaceans, and one of the discoveries of Mr. Hunter which the French have endeavored to appropriate; they were not overlooked, but the first examination was made under too unfavorable circumstances for observation.

The vena porta, the vena cava where it passes behind the liver, and the hepatic veins, are said to be dilated into reservoirs in some of the cetaceans, to be used, like the plexuses, during the time of submersion; but nothing of the kind was found in the present case. One singular fact, however, which I have not seen noticed, was observed in all of the four specimens; and that was, a persistence of the umbilical vein, or, at least, a vessel of considerable size in the suspensory liga-

ment, and which opened into the vena porta; of course, it would be found in the dolphin, which was fœtal; in the whale, it was nearly or quite as large as the thumb.

The *lungs* consisted, each, of a single lobe, as in the three other specimens, and were of a regular, flattened, oval form, the left measuring 25 by 14 inches. The air-cells were not visible to the naked eye, being much smaller than in man; moreover, they did not communicate through the lung, but through one bronchus a definite portion of the lung only could be inflated, as in the other mammalia, the surrounding structure remaining quite collapsed. Neither did they so communicate in any one of the other subjects, except in the dolphin, the experiment being fairly tried in each of them. The fact of this communication was first noticed by Mr. Hunter; but he seems to apply the observation to the cetacea in general. G. Cuvier, (*An. Comp.* vol. vii. p. 108,) or rather Duvernoy, makes the same general statement with regard to the carnivorous cetacea, and mentions particularly the dolphin and the porpoise.

The *trachea* was 8 inches in length, 4 inches wide, and much flattened antero-posteriorly. Rings about seven in number, but very irregular, as in all of the other specimens; some quite broad, some narrow and running into each other. No membranous portion, neither was there in either of the other subjects. The left primary bronchus was 6 inches long, the right 5 inches; and, from this last, just at its origin rather than from the trachea, as generally observed in the cetacea, arose a third smaller bronchus, which went to the upper part of the right lung. In the division of the bronchi there was nothing very remarkable; some very small glands were seen in the mucous membrane, and beneath it were well-developed transverse fibres.

The *larynx* is one of the most interesting organs in the cetacea, being elongated upwards so as to project into the posterior nares, or internal orifice of the blow-hole, thus establishing, for the purpose of respiration, a direct commu-

nication between the external air and the interior of the lungs; the soft palate extends very far backwards, and the strong muscles in that region, contracting about the larynx, cut off all communication between it and the cavity of the mouth. In the collapsed state in which the organs were after their removal from the body, the glottis stood erect three inches above the posterior edge of the soft palate, and it was $2\frac{3}{4}$ inches in width, the anterior lip being the largest. It appeared to consist of an anterior and a posterior cartilage, covered by a thin membrane and by cuticle, the whole bearing some gross resemblance in form to a turtle's back; down the back of the anterior cartilage there extended a ridge, and along the opposite one a corresponding groove, allowing the two to close very perfectly together, and superseding the necessity of a proper epiglottis, which organ seemed to be wanting, though it really existed in the form of the anterior cartilage. The thyroid cartilage is 3 inches in length anteriorly, 6 inches posteriorly, and the same for the width on one side; form very regular. Cricoid not remarkable.

The blow-hole, situated on the top of the head, at the very extremity, and rather towards the left side, was $6\frac{1}{2}$ inches long, and in the form of an *f*, as observed by Alderson and also by Beale. F. Cuvier says, in one part of his work, (p. 288) that the form is semicircular, though in a supplement, (p. 384) he quotes largely from Beale's work, which was then recent, and so far corrects himself as to say that it has the form of an *s*. The direction was longitudinal, though Hunter makes it transverse. Captain Chase states, that when the whale blows out, the orifice becomes circular, and that in an old one he has seen it as large as a bucket; as to the formation of the spout, about which there has been and is still so much question amongst authors, he regards it unequivocally as the vapor of the expired air with the addition of a very small quantity of water that gets into the blow-hole from without, the water that is taken in with the food being discharged, he thinks, as it was received, and not through the blow-hole; his observations, then, agree

with those of Mr. Beale, who, on this point, is the best of all authorities. Captain Chase has seen the blow-hole cut open, and describes it as a single, continuous tube, about as large as a man's arm, and without any lateral cavities such as are found in the dolphin; inner surface smooth, and black; it extends backwards near the top of the head as far as the eye, and then turns down to the throat; this last descending portion he has never examined.

The following parts have been preserved for the Society's Collection: — 1st, the stomach, with the œsophagus, and commencement of the intestine; 2d, portions of intestine, showing the structure at different parts; 3d, the heart, and large vessels; 4th, the tongue, palate, pharynx, larynx, trachea and large bronchi; 5th, the genital organs; 6th, a cast has been made of one of the kidneys.

Since this dissection was made, I have had an opportunity to examine the entire lower jaw from six different subjects, and I would here give the result of these observations, as there seem to be some erroneous views with regard to the teeth; also, recently, Dr. Henry Wheatland, of Salem, has examined three others, and sent me his observations, which will be added to the above.

The first specimen was from a sperm whale that was said to have made 110 barrels of oil, and that was taken only a week before, by a vessel bound into New Bedford. The length on the median line was $16\frac{1}{4}$ feet, and from the back tooth to the articulating surface $5\frac{1}{2}$ feet. The teeth were generally more or less movable, the gum being still quite fresh; posteriorly they were small, and appeared but little above the gum; on the right side there were 25, regularly arranged, but on the left only 24, the number often varying, not merely in different individuals of the same species, as a general rule in the cetaceans, but in the same individual on the two sides; the ninth and tenth from the front, on the left side, though of full size, were so close together as fairly to touch, several of the teeth about them not being opposite to those upon the other side, as they generally were.

The second specimen was from a whale taken the year before between Cape Hatteras and the Bermudas, and said to have made 100 bbls. of oil. Length on the median line 15 feet 7 inches; between the articulating surfaces $5\frac{3}{4}$ feet, and to the back tooth $5\frac{1}{2}$ feet; on the right side there were 25 teeth, and on the left 27, opposite to each other towards the front, but soon became irregular, and were more so than in the other specimens; towards the front also they were quite pointed, but further back rounded or ovoid; the back teeth were much the smallest, the surface being worn so as to show the structure. F. Cuvier says, that fifty-four is the greatest number of teeth that has been met with, and that the number increases with the size of the animal; but, if this last is in proportion to the length of the lower jaw, the rule does not apply to the present specimens. He says, moreover, that they are conical in the young and ovoid in the old; they were conical in the small and undoubtedly young specimens presently to be mentioned, but so were the anterior teeth in this second specimen, which belonged to a full grown adult. The same author thinks that the sperm whale sheds its teeth, and that, too, more than once; and T. R. Jones (*Comp. Anat.* p. 666,) has an idea, with regard to the cetaceans, that, as they advance in age, new teeth are formed in the back of the jaw, whilst those in front drop out, the alveoli becoming absorbed; but, in the present specimens, I found nothing to favor either of these suppositions; the front teeth in the largest individuals were perfectly preserved, there were nowhere any deficiencies, and there were in one of the smallest specimens about as many teeth as are generally found in the adult.

The third specimen was 8 feet 5 inches in length, 3 feet 9 inches between the articulating surfaces, and the same to the back tooth. There were 20 teeth on each side, arranged regularly opposite to each other, and very little if at all worn; anteriorly they were comparatively large and strong, midway more slender, and posteriorly small.

The fourth specimen was 7 feet 10 inches in length; 4 feet between the articulating surfaces, and 3 feet 2 inches to the back tooth; on the right side 26 teeth, and on the left 23.

The fourth specimen was from a young animal, said to have been 18 feet long, and to have made 14 bbls. of oil; taken within three days' sail of Nantucket. It was about 5 feet 8 inches in length, and had 23 teeth on each side, but, as these were cemented in, the number cannot be so fully depended upon; all of them were pointed.

The sixth specimen, which is in the Society's Cabinet, is $5\frac{1}{4}$ feet in length, 2 feet 9 inches between the articulating surfaces, and the same to the back tooth. The teeth, which are connected by a strip of dried gum, and are perfectly loose in the sockets, are 25 in number on the right side, and 24 on the left, besides an anterior one on the left side, which has evidently been lost; all of them pointed, and some hardly piercing the gum. With the jaw, is the entire cranium, $6\frac{1}{4}$ feet long, and corresponding generally with G. Cuvier's description and figures (*Oss. Foss.* vol. v. pl. xxiv.); the petrous portion of the temporal bone, however, remains on one side, and, instead of being free, as usual in the cetaceans, is as closely connected with the base of the skull as any other bone.

The seventh specimen (these three last were examined by Dr. Wyman) was $15\frac{1}{3}$ feet in length on the median line, 5 feet 1 inch between the articulating surfaces, and 4 feet 9 inches to the back tooth. On the right side 26 teeth; on the left 25, besides a back one, which seems to have been removed.

The eighth specimen is $7\frac{1}{3}$ feet in length, between the articulating surfaces 3 feet 8 inches, and to the back tooth 3 feet 2 inches; 24 teeth on each side.

The ninth specimen is 8 feet 2 inches in length, between the articulating surfaces 4 feet 2 inches, and to the back tooth 3 feet 8 inches; 23 teeth on each side.

DISSECTION OF A FETAL DOLPHIN.

About a fortnight after the dissection of the whale, I received from Dr. Storer a specimen of the above, which was sent to him by Dr. William Prescott, of Lynn, with the following description of the mother, from whom it had just been removed.

The length was $7\frac{1}{4}$ feet; color dusky black on the back, white on the belly, and lead-colored on the sides; a dusky line, from one to two inches in width, commenced a little above the eyes, and, passing along the sides, was lost in the lead color within 18 or 20 inches of the tail, and another, much less distinct, ran parallel to this. Very exact measurements were also given of the position and dimensions of the external parts. The animal had just been harpooned, and seemed to be quite new to the fishermen.

The fœtus must have been mature, or very nearly so, being 38 inches, or nearly half the length of the mother. According to Mr. Owen, the cetacea, in general, are remarkable for the large size of the fœtus at birth. It had Sir William Jardine's characteristics of a true dolphin, the "convex forehead and the snout in form of a beak, distinguished from the forehead by a marked furrow;" in form, moreover, it pretty nearly resembled the *Delph. delphis*, L., as figured in the Naturalist's Library, though it will be shown to differ in structure from that species, if, indeed, it is always the same species that is described under that name. The back was of a dark bluish gray, and the belly nearly a salmon color, but this last may originally have been white, as the same change of color was observed in the *D. globiceps*; no longitudinal stripes, as in the mother, but some very indistinct, broad, transverse stripes were seen towards the back. The teeth had not yet appeared. Since the dissection the animal has been stuffed, and the specimen is now in the Boston Museum.

As to the number of vertebræ, there were 7 cervical, 14 dorsal, and 55 posterior to these. In the *Dauphin ordinaire* (by which is understood the *D. delphis*, L.) there are said by G. Cuvier to be 14 dorsal, and 52 posterior to these, (Anat. Comp. i. 103,) though in the *Oss. Fossiles* (v. 303) he says the dorsal are 13, and the whole number, without the cervical, 60, leaving 47 only posterior to the dorsal; F. Cuvier (Cet. p. 140) quotes this last. Lesson (Cet. p. 226) says there are 13 dorsal and 53 lumbar in the common dol-

phin, and in Griffith's Cuvier the same numbers are given; Sir William Jardine says 12 dorsal and 52 lumbar. Of the cervical vertebræ, the first and second were large and scarcely movable upon each other; the other five were much smaller and rather more movable, the second being more, and the seventh less developed than in the *D. delphis*, according to Cuvier (Oss. Foss. v. 303); these vertebræ, he says, are fused into a single piece, and yet, he elsewhere says, (Anat. Comp. i. 105,) that in the dolphins the atlas and axis only are united, the other cervical vertebræ remaining separate, though extremely thin. Lesson (Cet. p. 226) describes the six first as quite thin in the *D. delphis*, and the last as somewhat thick. These discrepancies, upon so important a point as the number and form of the vertebræ, can only be explained by the confounding of species, and, with regard to the present individual, its specific appellation must be left undetermined.

The stomach, with the œsophagus, and part of the intestine, having been inflated, dried and varnished, showed the form, and, to a certain extent, the structure of the different cavities, better than if they had been laid open, and from this specimen a very correct drawing was taken by Dr. Parker. (Pl. XIV. fig. 2.) The œsophagus is $5\frac{1}{2}$ inches in length, and about 7 lines in diameter; the first cavity of the stomach (*a*), which is perfectly identical with it in structure, dilates gradually, and is $1\frac{1}{2}$ by 1 inch. The second cavity (*b*), continued in a line with the œsophagus, is about $1\frac{1}{2}$ inches in length, and terminates in a blunt cone, so far corresponding with the general description by Mr. Hunter and others of the first; it differs, however, entirely in structure from what is here described as the first, being more red, thicker, and much more muscular; the two are also separated by a deep groove externally, and a corresponding fold of membrane within, though they still communicate freely, (portions of the cavities have been cut away so as to show their internal relations); it is equally remarkable, then, whether considered as an additional cavity, or as a modification of the first, which is so generally uniform in shape and

structure ; and it is the more interesting as something of the kind was found in the *globiceps*. Sir E. Home has described and figured (Phil. Trans. 1807) the stomach of the very species (*D. delphis*, L.) which the present individual most nearly resembles externally, and the first cavity is continuous and uniform, as usual in the cetaceans. The third cavity (*c*), generally described as the second, is 2 inches by 1 inch, curved upon itself, and communicates freely with the first ; in the recent state it felt very thick and fleshy, and now strongly marked rugæ are seen upon the inner surface, giving it somewhat of a coarse honeycomb structure. The fourth, not seen in the figure, is a small, rounded cavity, about $\frac{1}{2}$ inch in diameter, and resembles the intestine in structure now that it is dried ; its communication with the third is not two lines distant from that between the first and third cavities ; in some of the cetacea this small cavity is said not to appear externally. The fifth cavity (*d*) is about $3\frac{1}{2}$ inches in length, somewhat dilated at first, but towards the further extremity about four lines in diameter ; it is very strongly bent upon itself, and in structure resembles the fourth. Between the third and fourth cavities, the fourth and fifth, the fifth and the sixth, as many would have it, there is stretched a thin transverse septum, perforated by a very small opening.

The intestine was 20 feet 8 inches in length, or about six and a half times that of the animal, whereas it should be eleven or twelve times, according to Fred. Cuvier (Cet. p. 86.) G. Cuvier does not give the length in the dolphin or porpoise, but merely remarks upon it as "passablement long." Just at its commencement it is considerably dilated, and measures in the dried specimen (*e*) $\frac{1}{2}$ inch in diameter ; this is generally described as an additional cavity of the stomach (as above stated,) but, in the present case, from the gradual diminution of size and the absence of anything like an abrupt curve, such as was noticed in the whale, it is impossible to regard it otherwise than as part of the intestine ; the communication with the last cavity of the stomach is very small. The folds in the

mucous membrane were wholly longitudinal and not abundant. One narrow Peyer's patch, 8 inches in length, was found below the middle of the intestine, and two smaller ones higher up; they were not strongly marked, though the follicles were distinct; no other appearances of glands, except in the rectum, where they were very numerous though minute. The difference in length and structure of the intestine in this specimen and the last, was very remarkable.

The hepatic duct opened, as usual in the cetacea, into the dilated portion of the duodenum, two lines only from its commencement, and not near its termination, as stated by G. Cuvier; neither was there any dilatation of the duct in its passage through the parietes of the intestine, as described by him, or rather by Duvernoy, in the common dolphin. (*Anat. Comp.* vol. iv. part 2d, p. 531.) The hepatic veins were large. The umbilical vein opened largely into the vena portæ, but the opening into the general venous system was not found. No dilatation of the vena portæ near to the liver was observed, as has been described in the dolphin.

The heart, which is generally described as semilunar, had the apex quite marked, contrasting strongly with the whale's, as it did also with regard to the muscular columns, which were not strongly developed in any of the cavities. The fossa ovalis was quite marked, at the bottom of which was an exceedingly delicate membrane, and at the upper part of this, was the foramen ovale, which seemed quite small; the ductus arteriosus, also, was small.

The aorta, which was not dilated, as some have described it in the dolphin, sent off two vessels from the arch close together. The right gave, first, a large branch, which was distributed as the superior intercostal, and yet the recurrent branch of the par vagum passed around it, as if it had been the subclavian; secondly, a large branch which entered the base of the skull, and may be called the internal carotid; thirdly, a rather smaller branch, which also passed up the neck, and may be called the external carotid; fourthly, a large trunk,

which subdivided into, first, the subclavian; and, secondly, a large branch which followed the phrenic nerve, and was distributed like it upon the diaphragm, sending off a very small internal mammary artery near its origin. The left innominata divided mainly like the right, but the subclavian was accidentally cut off. The left superior intercostal arose separately from the aorta, one inch beyond the second great trunk, a vessel corresponding in situation being also found in the whale.

The *plexus* on each side of the spine was well marked, and, on cutting away extensively the wings from the bodies of the vertebræ, it was seen to pass freely into the spinal cavity, and completely to surround the theca, being there very strongly marked. In the lower part of the abdomen the plexuses were not so distinct.

The air-cells communicated, so that through one of the secondary bronchi the whole lung could be inflated; in size they about equalled those of man, being considerably larger than in the whale. The muscular fibres, which have been described as surrounding the lungs, I did not find. The trachea was much flattened antero-posteriorly, and fifteen rings were counted on one side. Just above the bifurcation a large bronchus was given off to the upper part of the right lung, and in the substance of the lungs the rings were continued nearly or quite down into the smallest tubes, as has been often observed.

The spiracle, or blow-hole, being exposed on one side by a longitudinal section through the skull, was found to be a regular and continuous passage for about one half its extent upwards from the fauces. The upper half was very irregular, being dilated mainly into two large sacs, each of which would probably hold 3 jss. or more, and which seemed to burrow beneath the skin as the finger was passed into them through the external semilunar orifice; the expulsor muscles about these sacs were very large.

Mr. Hunter says of the cetacea generally, "I could not observe anything like a thyroid gland." It existed, however,

in the present case, as a soft mass, of a dark red color, situated just below the larynx, and in form and size resembling the same organ in man; it was also found in the globiceps, and I think it must have existed in the porpoise. I was not aware, when these observations were made, that this body had been met with in any of the cetaceans, but I have recently seen Mr. Owen's statement that it is found in the porpoise and bottle-nose dolphin.¹

The *thymus gland* was quite large, and, in structure appeared to resemble the same in man, though, on a single transverse incision, I found no cavity. Whole length $3\frac{1}{4}$ inches; body 14 by 15 lines, and crura half an inch in width.

The *renal capsules* were very prominent, and of a regular, oval form, though, according to Mr. Hunter, they are flat in the cetacea. *Urachus* very large where cut across at the umbilicus. The *epididymis* was more developed than it is represented in the Cyclopaedia of Anatomy and Physiology. The *vasa deferentia* were large and quite distinct, and opened separately on each side of the verumontanum, which was also quite large. The *vesiculæ seminales* are wanting in the cetacea, according to the best authorities, and as shown in this and the two next dissections; Pallas has described them in the Beluga, as quoted by F. Cuvier, (p. 211) but this is the only case, so far as I can learn, in which they have been observed. In the present case there is a marked dilatation of the last half inch of the vasa, this portion being firm, white, smooth on the inner surface, and measuring $\frac{1}{4}$ inch transversely when cut open. A similar dilatation was found in the globiceps and porpoise, and yet I have not seen the fact noticed by any anatomist.

The *brain* was from various causes unfit for a full examination. The weight of the cerebrum was $5\frac{7}{8}$ ounces, (avoirdupois,) and of the cerebellum $1\frac{1}{2}$ ounces. The two upper tubercula quadrigemina were of medium size, but the two others were

¹ Since this paper was read before the Society, some additions and alterations have been made, which it is unnecessary further to notice.

very large and directed obliquely outwards. In place of the corpora pyramidalia and olivaria was a defined, circular, raised mass, about $\frac{1}{4}$ inch in diameter and very unlike Tiedemann's figure of the *D. delphis*. The *spinal marrow* was rather small and uniformly so, closely invested by the dura mater, as remarked by Mr. Hunter, and formed the cauda equina at about the tenth vertebra from the dorsal. The cerebral *nerves* generally were large, except the first pair, of which no trace could be found; externally, the portio dura, the par vagum and some others appeared immensely large.

The pupil of the *eye* was of an elongated, rather oval form, and not heart-shaped, as in the *D. delphis*, according to F. Cuvier, Lesson, and Sir William Jardine; lens spherical; pigmentum not continued over the choroid coat, which has rather a greenish hue; numerous and distinct orifices of glands were found in the conjunctiva where it is reflected over the globe, the mucous secretion from which Mr. Hunter supposed to answer the purpose of the lachrymal gland, which is small in the cetacea. The external opening of the *ear* was just large enough to admit a small pin, and communicated with the internal organ apparently by means of a single cartilage.

OF THE PHOCÆNA GLOBICEPS. (Cuv.)

This animal was harpooned near the bath-house at Craigie's bridge, June 16th, 1842, and I saw it on the same day. It looked quite thin, and on the right side the surface was uneven to a considerable extent, as if cicatrized; this appearance is interesting, as something of the kind seems to have been observed in another individual of the same species by Mr. Couch, (Mag. of Nat. Hist. July, 1842.) It was of an uniform, dark slate color, except on the belly, where was an ill-defined, narrow, clouded, white streak, extending from beneath the jaw to about the anus, being much broader and whiter in some parts than others, and most so beneath the jaw. Weight estimated at 255 lbs.

The figure at the end of the volume, by Dr. William T.

Parker, represents the animal as it appeared after the removal of the organs; and, from the rounded form of the head, the slight projection of the upper jaw, the narrow, elongated, pointed anterior fins, and the color as above described, I think there can be no doubt of its being the globiceps.

Measurements, taken on the first day, were as follows: from the anterior extremity of the head to the centre of the tail, 7 feet 2 inches; to the pectoral fin, 20 inches; to the dorsal, 38 inches; to the blow-hole, $9\frac{3}{4}$ inches; to the eye, $9\frac{1}{2}$ inches; to the penis, 4 feet 1 inch, and to the anus, 4 feet 8 inches. Span of tail 21 inches, with a notch 1 inch deep in the centre; pectoral fin $5\frac{1}{2}$ inches across the base; 21 inches along the anterior edge, and $15\frac{1}{2}$ inches along the posterior. Dorsal fin about 15 inches across the base, 18 inches along the anterior edge, and 6 inches along the posterior. Circumference in front of dorsal fin, 3 feet 10 inches; blow-hole concave anteriorly, and $1\frac{3}{4}$ inches across, from tip to tip; eye $\frac{7}{8}$ of an inch. The external opening of the ear was so small as only to admit a pin, and was not found till after the cartilage had been cut through; according to Cuvier, and the statement is repeated by Sir William Jardine and by Mr. Beale, this opening was not discovered in any one of the seventy globiceps stranded in Brittany in 1812; one of these specimens was sent to G. Cuvier, besides many of the heads and other parts, (*Oss. Foss.* v. 285); but I do not find that he alludes to the external ear, nor scarcely to any other point of anatomy, except the stomach, which he describes in the *Anatomie Comparée*.

Of the teeth, there were counted, on the left side, nine in the upper jaw and three in the lower, several of them being quite loose. On dissection, there were found to be nine on each side in the upper jaw; in the lower, eight on each side, and behind these two others on the right side which were considerably smaller than the rest.

The stomach inflated and dried, is represented in Plate XV. drawn by Dr. J. Wyman, and portions of the parietes having been cut away as in case of the dolphin, the communication

between the cavities was distinctly shown. The 1st (*b*) was $11\frac{1}{2}$ inches in length, and $4\frac{3}{4}$ inches in width superiorly. The 2d (*c* and *c'*) was of a somewhat globular form, and smaller than the first, with which it communicated largely; when recent, it felt about as thick as the first, though evidently quite different in structure; and, on being dried, the characteristic rugæ are distinctly seen. Between these two, is a small supplementary cavity, partially seen in the figure (*d*), of a crescentic form, extending about half round the organ, and opening largely throughout its whole extent into the first cavity, with which it seems to be connected; the parietes, however, are thinner than those of the first; it is separated from both the cavities by broad septa, and the limits externally are well marked, so that it should perhaps be rather regarded as a distinct cavity. The third cavity (*e*) is quite small, but perfectly distinct, and equal to between one and two inches in diameter. The fourth (*f*) is about three times as large as the last, and equally distinct, of a rounded form, and quite prominent. The fifth (*g*) is elongated, curved upon itself, and thin like the two last; it is $13\frac{1}{2}$ inches in length, following the curve, and about $6\frac{1}{2}$ inches in circumference midway, though larger at the two extremities. Connected with these is what has been described as an additional cavity of the stomach, but which, as above stated, I should certainly regard as a dilatation of the intestine. This cavity (*h*) is $3\frac{3}{4}$ inches long, $7\frac{1}{4}$ inches in circumference at its commencement, and $3\frac{1}{3}$ inches at its termination, at which last part there is a marked contraction (*i*), but without the feel of anything like pylorus. Immediately below this, the intestine becomes suddenly much thicker, as if from the commencement of valvulæ conniventes. As in the dolphin, the second and third cavities of the stomach, the third and fourth, the fourth and fifth, the fifth and sixth, as many would call the last, are divided by a thin, transverse septum, perforated by a small opening.

The intestine was 57 feet, or eight times the length of the

animal. Being cut open, it measured transversely $1\frac{1}{2}$ inches on an average, $2\frac{1}{3}$ inches at the upper or largest part, and 2 inches at the largest part of the rectum. Valvulæ conniv. strongly developed, except in the last 10 or 12 feet, and most so in the upper part; the valves were transverse, instead of being oblique as in the whale; and it is remarkable that G. Cuvier should not have mentioned these in the globiceps, when he is speaking (Anat. Comp.) of the longitudinal folds in the intestine of the porpoise and the dolphin; neither is anything said by Mr. Hunter of marked transverse rugæ, nor by F. Cuvier, nor Lesson, so far as I have seen. In the last 10 or 12 feet, the mucous membrane was in irregular folds, more longitudinal than transverse. No Peyer's nor other glands seen. Muscular coat thick, the longitudinal fibres being quite marked at the upper part. The intestine terminates at last, not directly upon the surface of the body, but in a fissure eight or ten inches in length.

The right lobe of the *liver* was from two to three times as large as the left. The vena cava passed in a groove behind the organ; umbilical vein pervious, opening freely into the vena portæ, but seemed to be gradually obliterated towards the umbilicus. The hepatic duct ran directly to the intestine, then turned abruptly, and ran along the dilated portion of intestine, forming a part of its parietes, and opened just at the contraction between this portion and the proper intestine. The duct was considerably larger where it turned than at first, measuring about half an inch across when cut open; continued large and thick in the parietes of the intestine, but without any dilatation.

The *pancreas* was a well-defined organ, 2 by 4 inches in extent, white, quite soft, but glandular as in man. The duct opened into the hepatic, where it turned, and was 7 lines across when cut open in the substance of the gland.

Spleen connected with first cavity of stomach; a dark red, very firm organ, of a flattened spherical form, about 4 inches in diameter, and $1\frac{1}{2}$ inches thick; also two smaller, supplementary organs.

The *heart* was a strongly developed, muscular organ, not flattened, nor unusually broad, the apex being sufficiently marked, though between the ventricles there is a considerable groove. Ventricular portion 7 inches across the base, and about 5 inches long. Some muscular interlacement in appendices of auricles. Foramen ovale closed, with very little of a fossa on the right, and none on the left side. Tricuspid valve $7\frac{1}{4}$ inches along the adherent edge, and well developed. Right ventricle $\frac{1}{3}$ to $\frac{1}{2}$ of an inch thick, and the muscular columns rather coarse. Pulmonary artery $4\frac{3}{4}$ inches in circumference just above the valves, and aorta $3\frac{2}{3}$ inches. Left ventricle one inch at thickest part. The aorta dilated considerably, though gradually, towards the arch, where it gave off two large branches of about equal size, and afterwards a smaller one, all of which seemed to be distributed very much as in the dolphin. Intercostal plexus well marked. A large vein, entering the right side of the thorax between the upper dorsal vertebræ, was undoubtedly the azygos, as described by Breschet (*Annales des Sc. Nat.* 1834) in the phocæna. The lower cava received a large vessel from the lower part of the thorax, just before entering the auricle.

The *lungs* were very tough or leathery to the feel, coarse in structure, and invested by a thick membrane. These organs were pretty extensively diseased, being infiltrated with a light yellowish substance, something between pus and lymph, though nowhere hepatized, and without any well-marked tuberculous deposit. At the anterior inferior part of each lung was a large gland, similarly diseased, great numbers of enlarged lymphatics being seen on the outer surface of the lungs going to these; several glands were also found in the neck and about the lungs, enlarged and diseased. Mr. J. Couch, above quoted, remarks, that "most of the cetaceous animals taken in England have run themselves on shore; a circumstance which has been ascribed, with much appearance of probability, to the influence of sickness." Trachea, $4\frac{1}{2}$ inches long, and $1\frac{1}{2}$ inches wide;

rings very irregular. Bronchus, $\frac{3}{4}$ of an inch in diameter, sent off from about the middle of the trachea to the upper part of the right lung; the primary bronchi were about $1\frac{1}{4}$ inches long, and the rings were continued into the smallest tubes that were opened.

Thyroid gland in the usual place, dark red, and soft; $3\frac{1}{2}$ inches transversely, and about $1\frac{1}{4}$ inches longitudinally. This body, as already stated, Mr. Hunter did not find in the cetaceans.

The thyroid cartilage was quite irregular, the limit between this and the epiglottis not being felt. The cricoid was well developed posteriorly, but anteriorly it terminated in two rather blunt points, which, though they approximated, did not unite; the same is found in the beluga, according to Dr. Barclay, (Wernerian Trans. 3d vol.) and he is the only writer, so far as I have seen, who has mentioned the fact; I believe it existed also in the porpoise. Epiglottis about $3\frac{1}{2}$ inches long, and $\frac{2}{3}$ of an inch wide, though wider at the top. Arytenoid cartilages about 3 inches long, not rising quite so high as the epiglottis, nearly united at the top, but more separated below, and seeming to run into the cricoid. Glottis quite distensible.

Pharynx contracted about glottis, but, above this, capacious. Mucous follicles in the posterior nares, and the muscular structure strongly developed, as described by Hunter, and as they were in the dolphin.

The renal capsules, situated above the kidneys, were about $1\frac{1}{2}$ to 2 inches in diameter, and 3 or 4 lines thick. Bladder small; portion towards the urethra long and narrow, as it was in the porpoise.

Testes and epididymis very much as in the dolphin; the first $2\frac{3}{4}$ inches by $\frac{3}{4}$ of an inch. The vasa deferentia were tortuous nearly to the bladder, then straight, and, for the last 2 inches, so near as to appear like one tube. Behind the bladder, they were $1\frac{1}{2}$ lines in diameter; and, on being cut open, the parietes were found quite thick, and the canal

$1\frac{1}{2}$ lines across. For about 2 inches before their termination, they became quite thin, and the canal increased to 5 lines; dilatation not sudden; opened at last separately on the verumontanum by a small orifice or slit.

Connected with the vasa deferentia, and forming undoubtedly a part of the genital system, was a single canal, $2\frac{1}{2}$ inches long, opening on the verumontanum, just in front of the vasa, and so closely connected with them as not distinctly to appear, except for about $\frac{1}{3}$ of an inch just before the vasa came together. At this last part, where it terminated in a cul de sac, it appeared as large as the vasa, but was thinner, and the cavity larger, the inner surface being white and rugous. It afterwards became smaller, but, before termination, the cavity enlarged to 5 or 6 lines. No glands seen on the inner surface. A similar canal was found in the porpoise.

Prostate large; ducts large and numerous, and opened on each side of the verumontanum.

Penis 11 inches in length, and $1\frac{1}{2}$ inches in diameter midway; no septum; fibrous parietes thick and dense. The last $4\frac{1}{4}$ inches tapers to a point, and is free, though concealed beneath the surface of the body. Erector muscles strongly developed, but the acceleratores less so. A strong retractor pair, also, appearing like one muscle, arose near the perineum, and was inserted about the commencement of the free portion of the organ.

The animal having been purchased for the Society, the bones were macerated with a view to the skeleton; but they were found to be too imperfectly ossified, some of the epiphyses being not merely separate but scarcely formed. The vertebræ were 58 in number; bodies of 6 of the cervical co-ossified; 11 dorsal, as stated by Cuvier in the *globiceps* (*Oss. Foss.* vol. v.); but posterior to these were 40, whereas he makes but 37. The cranium corresponded sufficiently well with his description and figures of the *globiceps* (pl. xxi.), with which it was very carefully compared, though not so well as an old cranium in the Society's Cabinet; the

under surface of the superior maxillary bones in both our specimens, however, are less broad and flat than he represents them. In the young one, there is considerable space between the occipital ridge and the nasal bones, formed, I suppose, by the interparietal bones fused to the occiput; the foramen opticum is not formed, but, in the place of it, a deep notch in the ant. sphenoid; in the post. sphenoid is a large foramen, which I supposed to be the carotid, but no rotundum nor ovale, neither was there in the old specimen, though the optic was well formed. The condyloid foramina, in both specimens, were found in the lateral portion of the occiput. No bony tentorium, though, in the old specimen, it was well marked. The sternum was composed of four pieces, the third being in two lateral portions, and the fourth quite cartilaginous; deep notch in the first, as stated by Cuvier. Eleven pairs of ribs, the last five being connected only with the transverse processes of the vertebræ, as stated by Cuvier; cartilages ossified. Pelvic bones about $2\frac{3}{4}$ inches long, and half an inch in diameter. As to the phalanges, from the very imperfect degree of ossification, the exact number was not ascertained, but they did not seem to correspond with Cuvier's description.

ANATOMY OF THE PORPOISE (*PHOCÆNA COMMUNIS*, L.)

July 13th, 1842, Dr. Storer saw and examined a specimen that had just been taken at Nahant. Length 4 feet 5 inches. Externally it resembled the figure of the common porpoise in the Naturalist's Library, though the form of the head was more like that of the Cape porpoise in the same plate. Pectoral fins lead-colored above, like the upper part of the body generally, but white below; in the work just quoted they are said to be brownish. Dorsal emarginated just back of the tip, and at the upper part, anteriorly, it exhibited quite a number of small tubercles or dentations. At the suggestion of Dr. Storer, the organs were then carefully removed by Mr. Johnson, of Nahant, and on the following day, were sent to me in a perfectly fresh state.

The first cavity of the *stomach* was somewhat heart-shaped, and had a marked mamillary process at the apex, though no corresponding depression internally. Length 8 inches, and transversely, at the upper part, 6 inches. Cuticular coat thick, dense, dead white, and much more rugous than in the œsophagus. Cavity nearly full of half-digested fish and bones, showing that it is not a mere reservoir, as Hunter supposed. Second cavity, of a regular, elongated form, somewhat curved upon itself, 7 by 3 inches before being cut open, and very thick to the feel. The orifice was not far from the œsophagus, and admitted the fore-finger, but the outlet was considerably smaller; no projections about the orifice, as stated in the *Cyclop. of Anat. & Phys.* Contained only a little thick liquid. Mucous membrane everywhere thrown into dark red, very thick and prominent, longitudinal, close-set rugæ, and, in cutting it across, the linear appearance was seen, which has been described by Sir David Brewster in the porpoise as tubular (*Cyclop. of Anat. & Phys.*); the limit between this and the cuticular coat of the first stomach was strongly defined, but there were not the strongly marked rugæ about the orifice, described by G. Cuvier. Muscular coat thin, allowing the rugæ of the mucous membrane to be seen through from the external surface, like the convolutions through the membranes of the brain. The third cavity was exceedingly small, though as distinct as any of the rest; limits externally well marked, and measured $1\frac{1}{2}$ by $\frac{3}{4}$ inches. The orifice is amongst the rugæ of the second cavity, a short distance from its extremity, and admits the last joint of the little finger, so that it can be passed about within its cavity; the outlet is from 4 to 5 lines in diameter. Structure and feel of this and the next, thin and membranous. Fourth cavity, quite serpentine in form; 11 inches following the curve; transversely, about $1\frac{1}{4}$ inch midway, and $1\frac{3}{4}$ inch at each extremity, before being opened; outlet $2\frac{1}{2}$ lines in diameter. Contained little or nothing. Mucous membrane firm and moderately thick.

Intestine, $61\frac{1}{4}$ feet, or nearly 14 times the length of the

animal, varying considerably from the last two specimens, as they all three do from F. Cuvier's statement. (Cétacés, p. 86.) Lower half, generally about the size of the fore-finger, increasing somewhat downwards, though, for the last foot or more, it becomes much smaller; upper half, to a considerable extent, smaller than the little finger, though longer at the very upper part; according to F. Cuvier, the diameter of the intestine, in the "dauphins et marsouins," is regular, diminishing but very little from the pylorus to the anus; these would include the present specimen and the globiceps, as well as the dolphin, and yet his remark is not confirmed in either case. The dilatation at the commencement of the intestine was strongly marked: $4\frac{1}{4}$ inches long, and $2\frac{3}{4}$ inches transversely at commencement; parietes about as thick as the intestine below, but the mucous membrane of the two differed greatly in structure, and the change was rather abrupt, though there was no contraction nor anything like a valve. The mucous membrane of the dilated part was quite smooth, polished, somewhat transparent, and, after being in spirit for one night, showed several opaque points which were evidently glands, whereas that of the intestine immediately below was just the reverse, opaque with marked longitudinal rugæ. These rugæ extended more or less throughout the intestine, but were not very numerous, being much less than in the dolphin; none transverse. Several patches of Peyer's glands were seen, $\frac{1}{2}$ to $\frac{3}{4}$ inch wide; generally several inches, and one of them 15 inches in length; the follicles, which were small, and very close set, were not situated directly upon the inner surface of the intestine, but upon a distinct fold, which was attached to the mucous membrane by its centre only. Cuticle continued about 3 inches within the rectum. Some inflammation and enlargement of the solitary glands was observed, and some of them were ulcerated.

Right lobe of the *liver* two or three times larger than the left. Umbilical vein pervious, as above stated. Some disease in this organ also, being such as I have occasionally seen

in man ; apparently a partial obliteration of the ducts, and a collection of the secretion beyond. The hepatic duct opened directly into the dilated portion of the intestine, upon a little protuberance, half an inch before the rugous portion of the intestine began ; no dilatation. The pancreatic duct opened into the hepatic, not far from its termination.

Spleen about $\frac{2}{3}$ of an inch in diameter, and closely attached to the first cavity of the stomach, with three or four others of the size of peas scattered in the omentum at some distance.

The *lungs* were fleshy to the feel, but much less so than in the globiceps ; air-cells quite as large as in man. The cricoid cartilage had been cut through in the removal of the organs, but from what remained, it appeared, as in the globiceps, not to close anteriorly. A dark red, firm body was found in the place of the thyroid gland, but this, too, had been cut across. In the bronchi were great numbers of thread-like worms, probably filariæ, and quite a collection were seen hanging from an open ulcer upon the inner surface of the stomach ; several ascarides were also found free in the cavity of this last organ.

Of the *heart*. The apex was well marked, and the structure not remarkable. Fossa ovalis rather deep, but foramen closed. Two vessels given off at the arch of the aorta close together, and a third a little way beyond.

The *testes*, $3\frac{1}{2}$ inches long, and $1\frac{1}{2}$ inch wide, appeared much enlarged, or swollen, which probably was the case, as the animal was killed during what is supposed to be the rutting season. Epididymis not separated from the gland, as in the globiceps and dolphin. Vasa deferentia tortuous at first, but straight for some distance before termination, whereas, according to G. Cuvier, they are tortuous, in the porpoise, as far as the opening in the urethra ; opening separately upon the verumontanum, which is moderately developed. Before terminating they dilate, as above stated, measuring from four to five lines transversely, when cut open. Here again was an organ, similar to that above described in the globiceps, and which may perhaps have existed in a rudimentary state in the dolphin,

being so small as to be overlooked. A single canal, opening on the verumontanum, just in front of the vasa deferentia, and closely connected with these last, so that it did not appear except for about $1\frac{1}{4}$ inch before the vasa came together. At this last part, it was much smaller and thinner than the vasa, and, as it extended upwards, it became so small, thin and transparent, that, when first seen, I took it for an enlarged lymphatic; it tapered off to a point, and was gradually lost. After it joined the vasa, the cavity enlarged considerably, so that a probe moved freely within it, and it contained some transparent, viscid fluid, whereas that in the vasa was more opaque. This organ is not mentioned by G. Cuvier in his description of the genital organs of the porpoise, as quoted by F. Cuvier, (*Cétacés*, p. 172,) neither has it before been observed in any of the cetaceans, so far as I can learn.

The *prostate* was tolerably large, and seemed to be a tissue of ducts filled with a transparent, viscid fluid; the under surface covered by a strong muscle.

The *penis* seemed very large for the size of the animal: 18 inches from the tip to the membranous portion, and $4\frac{3}{4}$ inches in circumference at the largest part. Free portion concealed beneath the surface of the body, 6 inches in length, and tapering, though not quite so pointed as in the globiceps. No septum. Mr. Hunter remarks, on the urethra, as being near the centre of the organ in the porpoise, but in the present case it was not much more so than in the mammalia generally. The retractor muscles seemed to be continuous with the muscles about the lower part of the rectum, and strongly developed, though the erectors were smaller than in the globiceps.

This finishes the detail of these dissections; and I think they prove the truth of what has been said with regard to the inaccuracies and omissions that are to be found in the standard authors above quoted; and I have only further to add, if the facts require confirmation, that the most important parts from the last three specimens, as well as those of the first, have been preserved, and can at any time be reexamined.

ART. XII. — MUSCI OF EASTERN MASSACHUSETTS. By JOHN LEWIS RUSSELL, A. A. S., Corresponding Member of the Boston Society of Natural History, &c., &c. Read December 4, 1844.

WOULD we seek for elegance amid the minuter wonders of the vegetable kingdom — for delicacy of structure ; for instances of exquisite design, or for subjects of patient and instructive study ; to no department of scientific research may we turn, with greater hope of success, than to the *MOSSES*. Their tiny roots ; their curious leaves, rigid and like bristles in some, or broad or simple in others, or of the most complicated tissue of network in others, — in all, a great variety : and so fitly adapted to the circumstances of their places of growth ; their anomalous floral organs, but dimly shadowing forth the sexual differences in phænogamous plants ; the grace of their fruitstalks, (*setæ*) ; the proportion, of their capsules ; the peristome of a simplex or else of a complex character ; the columella invested with spores (*seeds*) and operculum, to protect them from injury when immature ; the veil or calyptra surmounting the whole, and cast aside, when no longer needed, by a variety of ingenious devices ; their mode of propagation ; utility to man ; and indirect agency in the economy of the material world : superadded, the names of illustrious men who have made them their study, — these, and other circumstances beside, render an accurate knowledge of them an object of value and of constant interest.

The species mentioned in this paper, were determined from specimens, collected, as will be seen, in the vicinity of Boston ; many of which were presented to me by different friends, and others collected by myself. Those about which I entertained doubts, were compared with authentic American, British and European specimens, in several herbaria, especially in rich collections of B. D. Greene, to whose generosity and coöperation I am most particularly indebted. For their systematic arrangement, I have mainly followed the Synopsis of Genera

— §§ With several fruitstalks, *POLLA*, *Bridel*.

B. (*Polla*) *roseum*. (Schreb.) Br. Fl. p. 63. Muscol. Brit. tab. 29. Synonyms: *Mnium roseum*. Hedw. Sp. Musc. p. 194. Dill. Musc. tab. 52, fig. 77.—*Bryum rosaceum*. M'x. Fl. Bor. Am. II. p. 306. Brid. Bry. Univ. I. p. 696. On comparison of specimens of this superb moss with the *Bryum roseum* of Europe, it would certainly, at first sight, seem to be distinct, although considered identical in Drummond's Musc. Amer. Its habit is very much like that of *Bryum umbraculum*, Hooker, Musc. Exot. tab. 133. It is a profuse fruit-bearer, producing frequently five peduncles from the same stem, exceeding in size the European co-species, and remarkable for its beauty. In shade of pine woods, on decaying logs and stumps of trees. Chelmsford! Also Tewksbury, *B. D. Greene!* I also possess specimens without fruit, which I gathered at Lancaster, N. H., near the White Mountains.

B. (*Polla*) *rostratum*. (Schrad.) Brid. Bry. Univ. I. p. 700. Muscol. Brit. p. 208, tab. 30. Synonym: *Bryum longirostrum*. Brid. Meth. p. 119. On wet rocks, Hingham!

B. (*Polla*) *punctatum*. (Schreb.) Brid. Bry. Univ. I. p. 706. Muscol. Brit. p. 207, tab. 30. Synonym: *Mnium punctatum*. Dill. Musc. tab. 53, fig. 81. An elegant species. On the margin of Cold Spring Brook, Hingham! Also Ipswich, *Oakes!*

B. (*Polla*) *cuspidatum*. (Linn.) Brid. Bry. Univ. I. p. 702. Muscol. Brit. tab. 31. Br. Fl. II. p. 64. Fruit in April. Chelmsford! Also Ipswich, *Oakes!* Also Hingham!

B. (*Polla*) *hornum*. (Linn.) Brid. Bry. Univ. I. p. 695. Muscol. Brit. p. 209, tab. 31. Br. Fl. II. p. 64. Dill. Musc. tab. 51, fig. 71. Gathered in fine fruit at Tewksbury, by *B. D. Greene!* Also without fruit, Hingham!

B. (*Polla*) *marginatum*. (Dicks.) Hook. and Tayl. Muscol. Brit. p. 208, tab. 31. Br. Fl. II. p. 64. Syn. *Bry. ser-*

ratum. Brid. Meth. p. 119. — Bryol. Univ. I. p. 689. With young fruit, October. On moist rocks, Prospect Hill, Waltham!

ARRHENOPTERUM heterostichum. Hedw. Sp. Musc. p. 198, tab. 46, fig. 1–9. M'x. Fl. Bor. Am. II. p. 313. Brid. Meth. p. 121. Synonyms: *Mnium heterostichum*. Brid. Bryol. Univ. II. p. 12. — *Bryum heteropterum*. Dill. Musc. tab. 45, fig. 11. Shade of woods, Hingham! "Environs of Boston." *B. D. Greene!*

BARTRAMIA longifolia. Hooker, Musc. Exot. tab. 68. Brid. Bry. Univ. II. p. 39. In the crevices of shady rocks. Common.

B. fontana. (Swartz.) Br. Fl. II. p. 67. Muscol. Brit. p. 146, tab. 23. Dill. Musc. tab. 44, fig. 2. On rocks over which water trickles. Danvers!

B. crispa. (Swartz.) Brid. Rec. Musc. Vol. 2, Part III. table 1, fig. 4. Brid. Sp. Musc. III. p. 84. — Bry. Univ. II. p. 41. Duxbury! also Ipswich, *Oakes!*

BUXBAUMIA aphylla. (Linn.) Br. Fl. II. p. 68. Muscol. Brit. p. 143, tab. 22. Dill. Musc. tab. 68, fig. 5. A single specimen, discerned by *B. D. Greene*, in the pine woods at Sandwich! Also, a group of several, in a shady spot in woods, South Hingham! (This moss may be justly considered *rare*, as well as singular and curious; and, with the exception of the single specimen gathered several years since by Mr. Greene, it never came under my observation, until I found it comparatively plenty, in the autumn of 1843, just rising into fruit in November.)

MUSCI PLEUROCARPI PERISTOMI.

Mosses with *lateral* fruitstalks: mouth of the capsule furnished with peristome.

APLOPERISTOMI.

(*With single peristome.*)

PTERIGYNANDRUM intricatum. Hedw. Sp. Musc. p. 85.

tab. 18. fig. 1-5. Brid. Bry. Univ. II. p. 179. Brid. Meth. p. 127, &c. On apple trees, Chelmsford! On Elms; Hingham! Found also at Ipswich, by *Mr. Oakes!* (Its habit is densely cæspitose, with surculi irregularly extending outwards, and bearing short, upright branches.) Fruit in December.

Pt. *hirtellum*. Hedw. Sp. Musc. p. 83, tab. 17, fig. 6. Brid. Bry. Univ. II. p. 188, &c. Synonym. *Pterigonium hirtellum*. Schwaëgr. Suppl. p. 108. Investing the bottoms of trunks of trees with a dense, green layer, elegantly extending itself upwards in feathery surculi, and generally abundant in fruit; in which state, after the fall of the operculum, may be easily seen the white teeth of the peristome, singularly cohering at their tips. Common.

LEUCODON *brachypus*. Brid. Bry. Univ. II. p. 210. From collections of *B. D. Greene*, under the name of *Leucodon brevisetum*, and gathered by him in Tewksbury! Also from Ipswich, *Oakes!*

DIPLOPERISTOMI.

(*With double peristomes.*)

A. Interior peristome with free ciliæ.

NECKERA *pennata*. Hedw. Sp. Musc. p. 200. Br. Fl. II. p. 71. Muscol. Brit. Suppl. Tab. 4. On trunks of birch and of some other trees, Hingham! abundant at Hubbardston! also Ipswich, *Oakes!*

N. cladorhizans. Hedw. Sp. Musc. p. 207, tab. 47, fig. 1-7. M'x. Fl. Bor. Am. II. pp. 307, 308. In the shade. Chelmsford!

N. seductrix. Hedw. Sp. Musc. p. 208, tab. 47, fig. 8-13. Brid. Meth. p. 138. Near the roots of trees, Chelmsford!

B. Interior peristome consisting of a reticulated, conical membrane.

FONTINALIS *antipyretica*. (Linn.) Muscol. Brit. p. 140, tab. 22. Dill. Musc. 33, fig. 1. Brid. Bry. Univ. II. p. 655.

Rivers ; streams ; brooks, Common. Seldom found with fruit. Larger than the European co-species in length of stem and breadth of foliage. Hingham ! Chelmsford ! also Marshfield, *Dr. Porter !*

F. squamosa. (Linn.) Muscol. Brit. l. c. Brid. Bry. Univ. II. p. 657. A smaller, flat-leaved species. Western part of the State, *Dr. Porter !* Also, found abundant in brooks at Hingham !

F. capillacea. (Dickson.) Muscol. Brit. p. 142, tab. 22. Br. Fl. p. 74. Dill. Musc. tab. 33, fig. 5. Brid. Bry. Univ. II. p. 660. Hingham ! Also from *Dr. Porter !*

F. subulata. (Pal. de Beauv.) Brid. Meth. p. 186. — Bry. Univ. II. p. 661. Hanging on bushes, principally the *Cephalanthus occidentalis*, Linn., in partially desiccated mill-ponds, and full of fruit in November, Chelmsford ! also, in similar situations, Hingham ! *Obs.* The occasional deprivation of water seems necessary to produce fructification in species of mosses whose habitat is in streams.

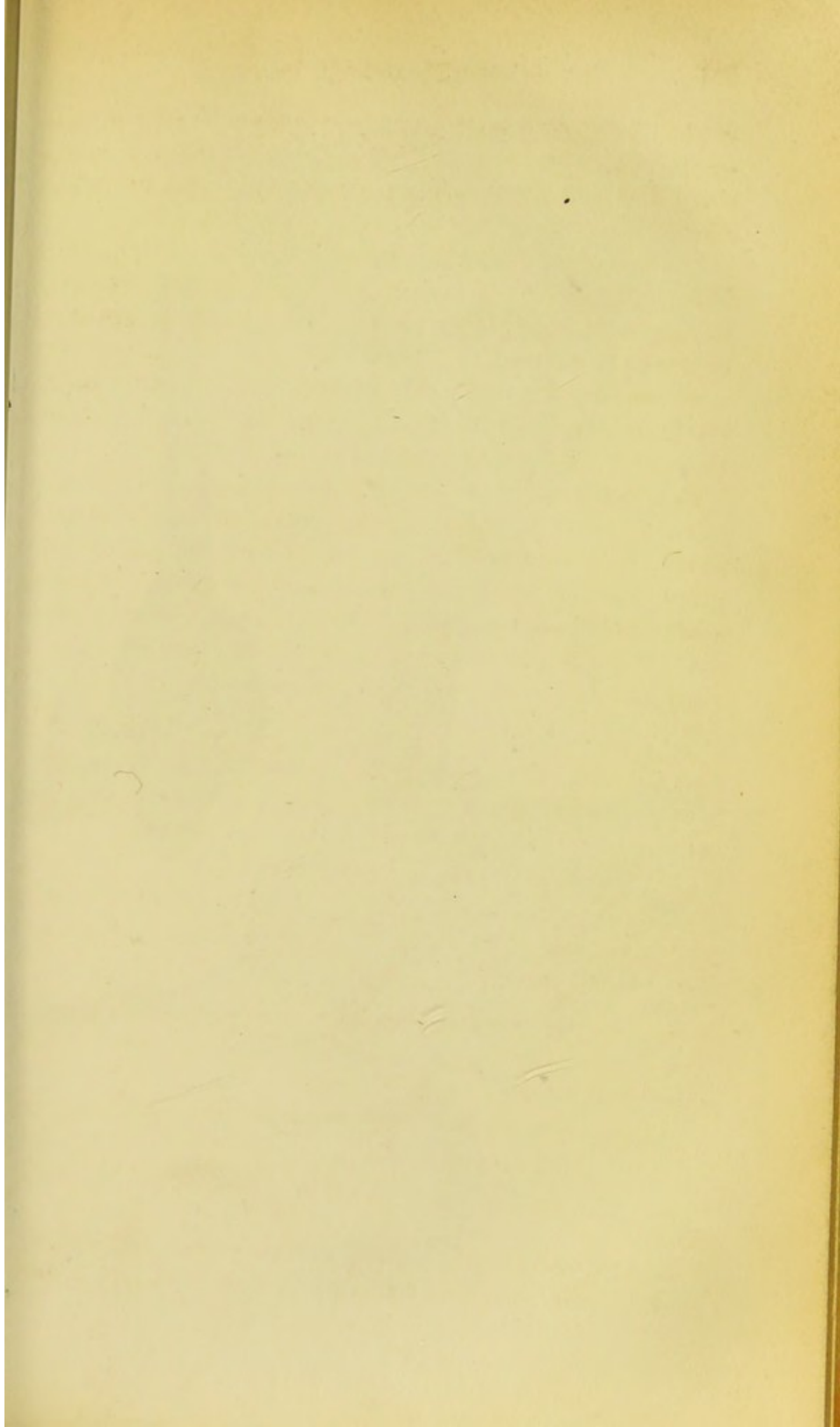
c. Exterior peristome, consisting of sixteen lanceolate, linear, acute teeth, bent inward ; interior, of a membrane split to the base into as many ciliæ, which are frequently connected by transverse bars.

CLIMACIUM Americanum. (Rich'd.) Brid. Sp. Musc. II. p. 45. — Bry. Univ. II. p. 273. A beautiful, tree-like moss, and not uncommon. Hingham ! Chelmsford ! Waltham ! Also Ipswich, *Oakes !*

d. Exterior peristome, consisting of sixteen subulate teeth, bent inward ; interior, of a membrane split into sixteen linear, equal ciliæ, or processes.

LESKEA compressa. Hedw. Sp. Musc. p. 231, tab. 56, fig. 1-7. Brid. Meth. p. 141. — Bry. Univ. II. p. 287. On the ground, and at roots of trees. Plymouth ! Hingham ! Ipswich !

L. acuminata. Hedw. Sp. Musc. p. 224, tab. 56, fig. 14-18. Brid. Meth. p. 144. — Bry. Univ. II. p. 296. Near



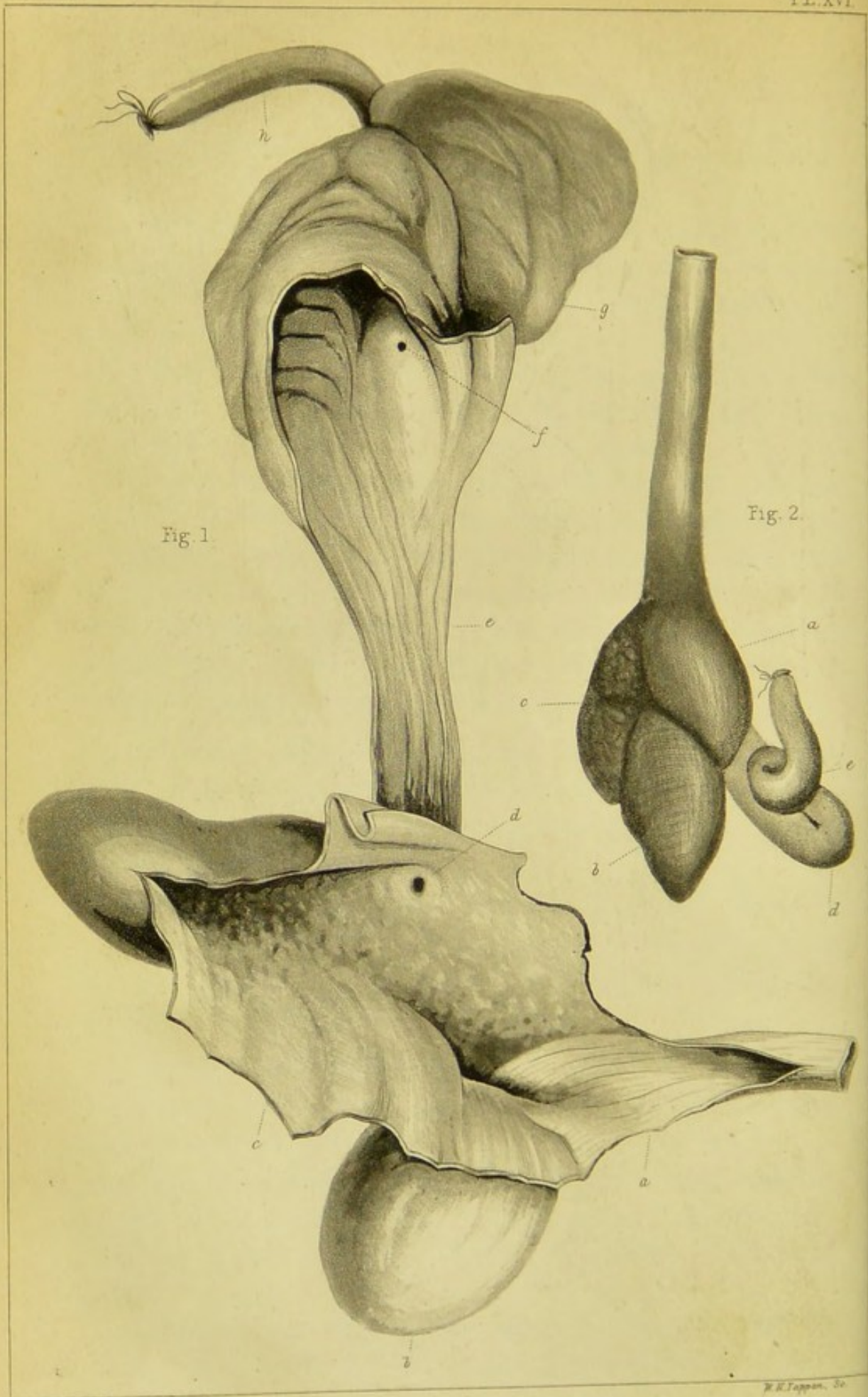


Fig. 1.

Fig. 2.

Fig. 1. Stomach of a Spermaceti Whale
Fig. 2. Stomach of a Dolphin.

W. K. Tappin, Sc.

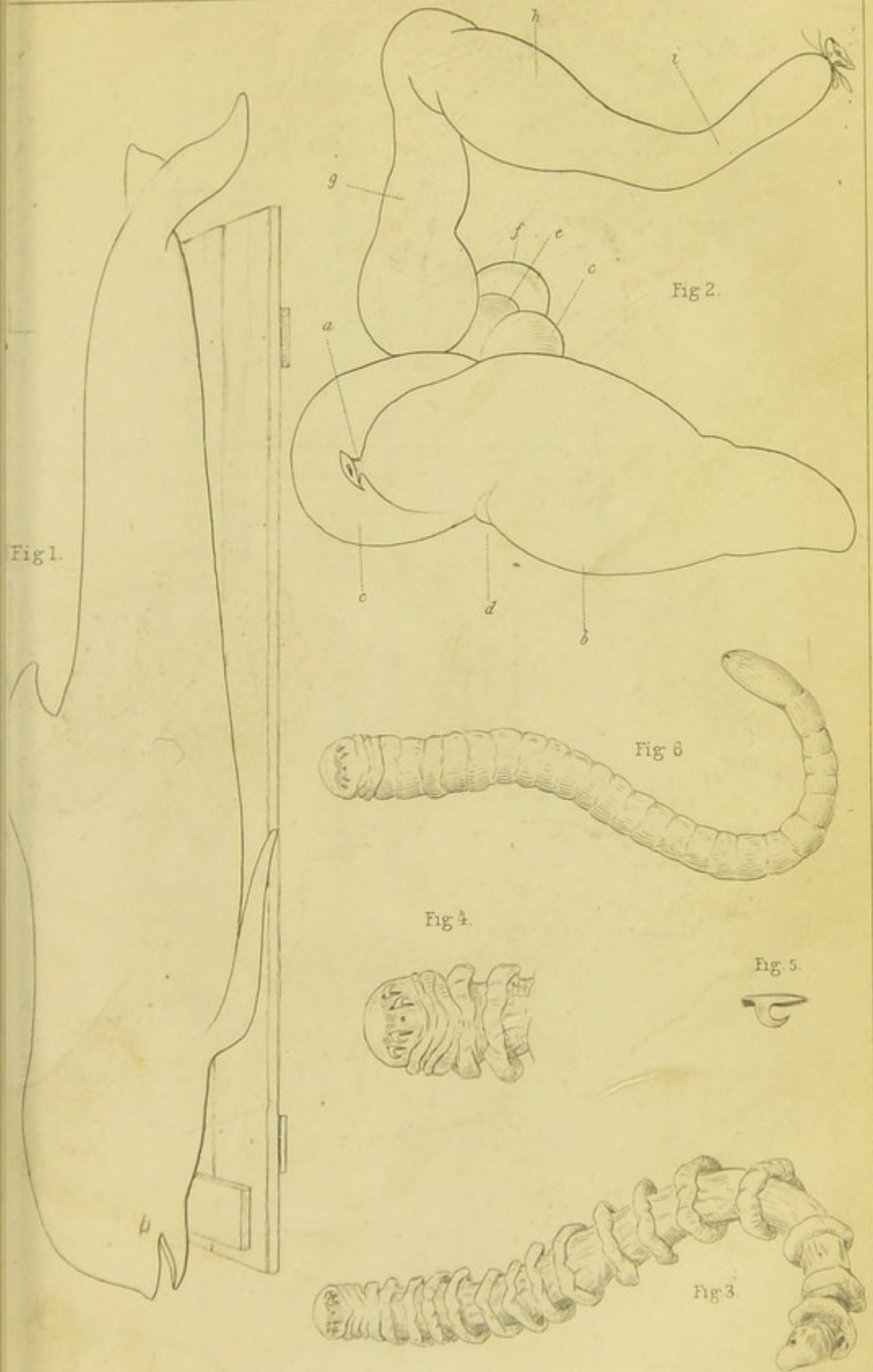


Fig 1.

Fig 2.

Fig 6

Fig 4.

Fig 5.

Fig 3.

Fig 1. *Phocaena globiceps*. Fig 2. Stomach of *P. globiceps*.
Fig 3 4 5 & 6 *Linguatulae*.

