

XI.—*Upon the Thyroid Glands in the Cetacea, with Observations on the Relations of the Thymus to the Thyroid in these and certain other Mammals.* By WILLIAM TURNER, M.B. (Lond.), Senior Demonstrator of Anatomy, University of Edinburgh.

(Read 2d April 1860.)

In the writings of comparative anatomists, considerable difference of opinion is expressed respecting the position and relations of the thyroid gland in the Cetacea, and some authorities even have asserted that it does not exist in these Mammalia.

JOHN HUNTER states* that he has examined several porpoises, *balænae*, and other cetacea, yet “could not observe anything like a thyroid gland.”

MECKEL† believed that he found, in a foetal porpoise (*D. phocaena*), eight inches long, a thyroid gland. He describes it as half an inch broad, two lines thick and high, and of equal depth and thickness both on the middle and sides of the air-tube, in the same position as that in which the gland is found in other mammals. From this examination, however, of so young a foetus, he does not feel disposed to affirm that, contrary to the opinion of HUNTER, it exists in full grown cetacea. In a subsequent paper‡ he mentions incidentally, that in the dolphins the gland is formed of two quite separate lobes. CUVIER§ states that he has found the gland very distinct in many dolphins and porpoises. In these animals it was divided into two parts, and suspended from the trachea opposite the upper border of the sternum, and some distance from the larynx. CARUS|| describes the gland in the dolphin and porpoise as consisting of two parts, entirely separate from each other. It is difficult to say, however, from the text, whether he is giving the result of his own observations, or simply adopting those of CUVIER. Dr MARTYN¶ repeats the statement that the cetacea do not possess a thyroid, and he ascribes the supposed absence of the voice in these animals to the want of this glandular structure.

As I have had, during the last three years, opportunities of dissecting three porpoises, and as I have found in them appearances differing from those which I have quoted from the above authorities, I am induced to offer the following description of my observations. The animals were specimens of the common

* On the Structure and Economy of Whales. Philosophical Transactions, 1787.

† Abhandlungen aus der Menschlichen und Vergleichenden Anatomie und Physiologie. Halle, 1806.

‡ Beyträge zur Vergleichenden Anatomie, 1811.

§ Anatomie Comparée, vol. viii.

|| Traité Elementaire d'Anatomie Comparée, vol. ii.

¶ Proceedings of the Royal Society of London, 1857.

porpoise (*Phocoena communis*), one was a foetus, twelve inches long; another was a well-grown male, three feet ten inches long; the third being a full grown male, between five and six feet in length.

On removing in each of these animals the large sterno-hyoid and smaller sterno-thyroid muscles, a distinct and well-defined glandular mass was seen lying on the anterior and lateral surfaces of the trachea at its upper end, and extending slightly upwards on each side over the outer surface of the cricoid cartilage. Its position thus closely corresponded with that of the thyroid gland in other mammalia. Instead, however, of being divided into two distinct lateral lobes, as described by CUVIER and CARUS, the gland consisted of a single uniform mass, which in the adult animal was two inches long, extending across the middle line, and closely fitting both to the front and sides of the trachea. The median portion of the gland can hardly be described as an intervening isthmus, for in its supero-inferior diameter it equalled that of the lateral portion. This, in the adult animal, was three-fourths of an inch, in the foetus, one-fourth.

In the full grown specimen (which was examined in the fresh state, the other specimens having been for some time in spirits), the gland presented a dark purple tint, and a soft and somewhat succulent aspect. At the upper end of each lateral portion, but separated from it by a slight interval, a glandular mass about the size of a small nut was found, apparently an accessory thyroid. In this respect the gland corresponded in its arrangement to one which is occasionally found in the human subject.

In the smaller adult porpoise, in the interval between the two crico-thyroid muscles, and almost concealed by the plates of the cricoid cartilage, a small glandular mass was situated. It had the same colour as the thyroid; but presented more evident indications of being divided into distinct lobes. It was in contact by its deep surface with the crico-thyroid membrane. It must, I think, be regarded as an isolated portion of the thymus.

In the foetal porpoise, a long and slender glandular process extended from the inferior margin of the median part of the thyroid, downwards along the anterior surface of the trachea, and behind the heart and pericardium, into the posterior mediastinum. This must also be looked upon as a part of the thymus.

Both in the foetal and smaller adult porpoise, the thymus gland was exceedingly well developed. As the thymus closely corresponds in its structure to the thyroid, and as the relations of the two glands are extremely interesting in a developmental point of view, I purpose, in the next place, describing the general disposition and arrangement of the thymus in these animals.

This gland was exposed by cutting through the sterno-hyoid and thyroid muscles, and by turning on one side the upper end of the sternum. It was composed of two large lateral lobes, separated from each other by a thin layer of cellular tissue. These lobes, of a conical form, were situated for the most part behind the first

bone of the sternum, and immediately in front of the upper end of the pericardium. Their apices projected above the sternum into the lower part of the neck, lying in front of the trachea, and extending upwards almost as far as the lower margin of the median portion of the thyroid gland, from which they were separated by the innominate vein. From each of these lobes a long process of

Fig. 1.



The Thyroid and Thymus Glands of the well-grown male porpoise. About one-third the natural size.
The relation of these glands to the wind-pipe, the pericardium, and to each other, is represented.

glandular tissue extended deeply between the structures situated at the root of the neck. That from the right lobe passed in front of the trachea, being in close contact with the anterior surface of that tube, to the left side, where it became connected to the deep process from the left lateral lobe. This transverse communicating portion extended behind the arch of the aorta, so that this vessel, with its ascending carotid branches, was situated between the deeper and more superficial parts of the gland. Connected with the upper margin of the deep process from each lateral lobe was an elongated portion, which extended upwards on each side of the neck as far as the thyroid cartilage, being in close relation with the carotid vessels. These ascending prolongations of the thymus were thus brought into intimate relation with the lateral portions of the thyroid, so that at first it appeared as if they formed a common glandular mass with them. On a closer examination, it was found that they were not continuous, but intimately connected together by a little cellular tissue, on dividing which, the two glands could be separated from each other, without effecting any injury to their proper structure.

On referring to that part of Mr SIMON'S essay,* which treats of the com-

* Physiological Essay on the Thymus Gland, 1845.

parative anatomy of the thymus, I find that he gives an account of a dissection of this gland, which he made in a foetal dolphin. He describes in this cetacean a pericardiac portion of the gland, from which long ascending processes proceed, which extend upwards in close contiguity with the vertebræ, as high as the level of the upper part of the trachea, and then bending inwards in front of that tube, so as to join in the middle line. The figure which he appends, illustrating this description, closely corresponds with the appearances I have seen both in the foetal porpoise and in the smaller well-grown animal. I cannot, however, agree with Mr SIMON in considering this median tracheal portion as forming a part of the thymus. I am disposed to regard it as the thyroid, and as such I have described it in the former part of this paper. My reasons for doing so are the following:—It is situated exactly in the position of the thyroid gland; it possesses a perfect continuity of gland-structure from side to side, so that it does not present the same subdivision into lobes which is characteristic of the thymus; its capsule is much more adherent than that of the thymus, and it can be separated from the ascending processes of the pericardiac portion of the thymus by carefully removing the thin layer of cellular tissue which connects it with them. Moreover, there is no other structure, either on the front or sides of the trachea and larynx, which can be looked upon as constituting a thyroid gland in these mammalia, if this is not regarded as such.*

The persistence of the thymus gland in an animal so well grown as this porpoise is a fact of considerable interest, especially if we take into consideration its large size. That it was in a condition perfectly capable of performing its functions, and not merely a collection of fat-cells, as is generally the case where the gland in the human subject apparently persists for some years after birth, I was enabled to prove by a microscopic examination. On submitting a portion of the gland to a magnifying power of 200 diameters, I found it to consist of lobularly arranged masses of small closely-packed corpuscles, about the size of, and a little larger than, the red corpuscles of the human blood, presenting, in fact, a structure exactly similar to that with which we are familiar in the foetal gland. We are furnished by this illustration with additional evidence of the fact, so especially insisted on by HAUGSTED and SIMON, that the thymus gland is not merely a foetal structure, but that it plays an important part in the animal economy for some time after birth. As I had an opportunity of comparing it at the same time with the gland in the foetal porpoise, there could be no doubt that it had grown considerably after birth, and apparently in a ratio closely corresponding with that of the growth of the animal.

* Since this paper was read to the Society, I have dissected the neck of a foetal Dolphin, probably the young of a bottle-nose (*D. Tursio*). This dissection confirms the opinion I had arrived at and stated in the text, viz., that the glandular structure in front of the upper part of the trachea in the genus *Delphinus* is the thyroid, and not merely a part of the thymus.

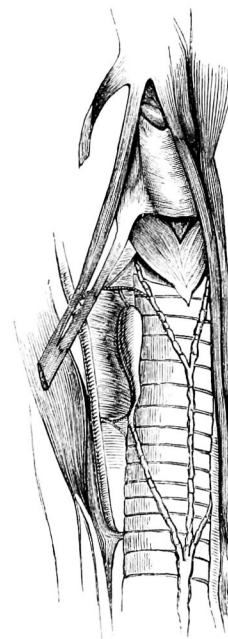
The close connection which I have now shown to exist between the thymus and thyroid glands in these porpoises, strongly indicates that they most probably have originated in a common structure. This view of the common origin of these glands was prominently announced by Professor GOODSIR, in a paper in the Philosophical Transactions,* published many years ago. His investigations were conducted on the embryos of sheep. He describes these glands as, together with the supra-renal bodies, developed from the remains of the blastodermic membrane extending along each side of the spine, from the Wolffian bodies to the base of the cranium,—a separation taking place between them in the process of development.

The porpoise is not, however, the only mammal in which, in the non-fœtal state, a connection may be seen to exist between the thymus and thyroid bodies.

In a fine specimen of an adult male Hartebeest (*Bubalus caama*), in which I dissected some time ago these glands, I found the lateral lobes of the thyroid entirely separated from each other, and lying on the sides of the upper end of the trachea. Connected with the lower part of each of these lobes was a long slender process of gland substance, which descended along the sides and front of the trachea, until it reached the fourteenth ring, when the processes from each side became connected together. At this spot they united with another slender process of a similar structure, which descended from the sides of the larynx. The common gland-mass, formed by the union of these processes, now passed down the front of the trachea, and beneath the sternum, into the anterior mediastinum, undergoing, immediately above the sternum, a considerable augmentation in size. That portion of the structure which was situated at the upper part of the trachea received its supply of blood from the arteries which supplied the thyroid gland. On examining this glandular substance microscopically, I found it to correspond in structure with the thymus gland, for it was essentially composed of numerous small circular corpuscles. Its structure and position warrant us in regarding it as a persistent thymus, and its close relation to the thyroid points to the conclusion that it has been developed along with it.

In a dissection which I recently made of the thymus and thyroid in the Nylghau (*Antilope picta*), I obtained several very interesting facts connected with these glands. The animal which I examined was presented to the Anatomical Museum of the

Fig. 2.



View of one lateral lobe of the Thyroid and of the slender processes of the Thymus of the Hartebeest. about one-third natural size.

* On the Supra-renal, Thymus, and Thyroid bodies, 1846.

University by the Marquis of BREADALBANE. It was a very large example of an adult male, its proportions exceeding in every direction those given by Dr WILLIAM HUNTER, in his description of the Nylghau.* The thyroid gland was exposed in the usual way. It was found to consist of two entirely distinct lateral halves. Each half was seated quite at the posterior part of the side of the air-tube, the upper end being in relation with the outer surface of the cricoid cartilage, the lower end reaching to the side of the fourth tracheal ring. The two lobes were thus separated from each other by the entire width of the trachea. The lobes, wide at their upper ends, gradually became narrower as they extended down the side of the trachea, until they terminated below in an almost pointed extremity. Branches from the great artery of the neck passed both to the upper and lower ends of each lobe. On the anterior surface of the trachea, as well as on the crico-thyroid membrane, in the interval between the lobes of the thyroid, scattered lobules of glandular tissue of a slightly reddish tint were seen. These were not connected with the thyroid, but were lying in the cellular tissue between its lobes. Extending for some distance down the front of the trachea, scattered lobules of a similar glandular substance were found, separated from each other by varying intervals. About thirteen inches above the sternum the gland-lobules became much more closely connected together, and formed two long lines of glandular tissue which extended downwards on the front of the trachea. Immediately above the sternum they became wider, and, in this manner, passed beneath that bone for a short distance, lying in front of the great blood-vessels. Small arteries derived from the carotid trunk passed to this long line of gland-substance. This gland, from its position, was evidently the thymus, the lobules of which, closely aggregated together below, were separated from each other by varying intervals at the upper part of the trachea, some even extending as high as the crico-thyroid membrane. It was thus brought into close relation to, although not actually in contact with, the thyroid.

A microscopic examination satisfied me that it was the thymus,—the great bulk of the gland being composed of collections of small colourless corpuscles, about the size of, or a little larger than, the red corpuscles of human blood, arranged in a distinctly lobular manner. In some parts of the gland were scattered about highly refracting globular particles of varying size, probably fat. They presented a more granular aspect than is usual with oil-globules. Lying here and there in the connective tissue between the lobules of the gland were numerous crystals, sometimes aggregated together in irregular masses, at others arranged in lines, and in some cases scattered about in an indefinite manner. These crystals were all of a prismatic shape, many of them distinctly three-sided, presenting a close resemblance to the crystals of the ammoniaco-magnesian phosphate occasionally

* Philosophical Transactions, 1771.

met with as a urinary deposit. They were soluble in acetic acid without effervescence. The existence of crystals scattered freely about in the cellular tissue of the animal body is, so far as my observation extends, a fact of very unusual occurrence. From the position and microscopic character of this gland, there could be no doubt that it was the thymus.

The evidence that we have now obtained, both by the dissection of this Nylghau and the Hartebeest, shows us, that in these Antilopidæ the thymus is a permanent gland; for there could be no question but that both these animals had reached the adult period of life, and even acquired a considerable age,—their large size, and the worn appearance of the teeth, rendered this sufficiently manifest. So far, then, as regards these animals, the thymus must be looked upon as possessing a more enduring function than has hitherto been ascribed to it in the economy,—not disappearing, or altogether degenerating, in the early period of extra-uterine life, but persisting, even in the adult animal, probably throughout its entire existence.

In conclusion, I may state that I have seen in the human subject indications of a close connection between the thymus and thyroid glands. I have notes of an examination which I made of a child between two and three months old, in which long ascending processes passed upwards from the lobes of the thymus, in front of, and to the sides of, the trachea, as high as the lateral lobes of the thyroid gland, with which they were closely connected by cellular tissue. Each of these ascending processes received a branch from the inferior thyroid artery. This case furnishes us with an example of the thymus receiving a considerable portion of its vascular supply from the artery of the thyroid. The converse of this, viz., the thyroid obtaining a large share of blood from the artery of the thymus, may also occasionally be seen. In a subject in the dissecting-room, I observed the internal mammary artery, which may be regarded as the great thymic trunk, give off a large branch, which ascended, on the right side of the trachea, to the right lateral lobe of the thyroid gland.