**The anatomy of the thymus gland / by Sir Astley Cooper.**

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To the Pupils of Guy's Hospital
with the best wishes of the
Author—

THE

# ANATOMY

OF THE

# THYMUS GLAND,

BY

SIR ASTLEY COOPER, BART, F. R. S.

SERJEANT SURGEON TO THE KING,

CONSULTING SURGEON TO GUY'S HOSPITAL,

&c. &c. &c.



London:

LONGMAN, REES, ORME, GREEN, AND BROWN.

1832.

# DEDICATION

TO

## DR. BABINGTON, F.R.S.

*Late Physician to Guy's Hospital, and Lecturer on Medicine and Chemistry.*

My dear Sir,

WHEN amidst those I have known almost from my childhood, I look for a bright example to the Profession, of Science and of moral conduct, my heart instinctively turns to you.

The duties of Father, Brother, and Relative have been performed by you with undeviating kindness.

You have been as a Friend, most active and sincere; as a Physician, honest, skilful and observing; as a Chemist and Mineralogist, profoundly informed; as a Man, the most disinterested; as a Companion, the most delightful. With pride and pleasure I dedicate the following pages to you.

I am,

Your's truly,

ASTLEY COOPER.

*London, May* 1*st*, 1832.

# PREFACE.

As the preparations which form the foundation of these observations on the structure of the Thymus Gland are carefully preserved, it will at all times afford me great pleasure to exhibit them to those of my professional brethren, whether domestic or foreign, who are zealous in the Science of Anatomy. The Drawings and Engravings are by CHILDE, to whom I am much indebted for his accuracy, punctuality, and attention.

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## On the Thymus Gland.

During the prosecution of my work on the structure and diseases of the Testis, I frequently dissected the fœtus in the various stages of its growth, from the sixth week of utero gestation to the period of nine months, with a view of observing the descent of the Testis.

Taking advantage of the opportunity thus afforded me of examining the different organs of the body at that early period of animal life, I was much struck with the changes in the size of the Thymus Gland, but more especially at the large quantity of fluid which this organ emits when an incision is made into its substance.

Early in my professional life, in dissecting the Thymus of the fœtal calf, I found a similar fluid discharged from every wound of this Gland, and indeed it is a circumstance which may be seen so uniformly, that it cannot have escaped the observation of those who have examined this organ, either in the human subject, or in the quadruped.

I resolved, so soon as the work with which I was then occupied was completed, to ascertain the structure that produced the secretion, to examine the cavities containing it, to trace and inject the vessels by which it is carried away, and to learn the nature of the fluid itself, so as to form a probable conjecture of the use of the Gland in the fœtal and infantile life.

Perhaps there is no part of the body so difficult of investigation as the Thymus Gland in the human subject. Its small size, the delicacy of its texture, its soft and pulpy nature which renders it liable to tear under the slightest force, and the numerous small lobes which are combined to form it, all conspire to produce this difficulty, and to render it necessary to call in the aids which injection, hardening, unravelling, and the most careful and repeated dissection can furnish. But still I am quite ready to confess that it would have been scarcely possible to learn the most important parts of the structure of this Gland, by the examination of it, in the human subject alone; but being aware of its great magnitude in the fœtal calf, and of the circumstance of its containing a large quantity of fluid, I thought its organization would be more easily and certainly ascertained in that animal.

I therefore commenced my enquiries in the calf and in the lamb, and soon found the difficulties of the investigation

were greatly diminished; for I was able to inject it, dissect all its parts, shew their relative situation, learn the structure by which the fluid is secreted, the cavities containing it, the vessels by which the fluid is carried away, and to collect it in sufficient quantity to make it the subject of chemical analysis.

Proceeding from the Gland of the quadruped to that of the human subject, I ascertained the comparative difference in its formation, as well as the points in which they resemble each other, and have preserved the parts so as to exhibit them in preparations from which accurate drawings have been made, to convey to others a knowledge of each as they appear in dissection.

I shall therefore, without further preface, proceed to describe the structure of this Gland in the fœtal calf, and thus having laid a foundation of knowledge of this organ in that animal, shall endeavour to point out its form and composition in the human fœtus.

It is almost unnecessary to say that the subject is deserving of attention; for every portion of the animal body, however minute, should be carefully traced and accurately known.

But when the size of this organ is considered, when the quantity of fluid it secretes both in the human body and quadruped is recollected, when the important situation it occupies near the heart, and upon some of the largest vessels of the

body are remembered, as well as its appearing at the fœtal and infantile period only, it cannot be doubted but that the function which it performs is highly essential to the existence and growth of the fœtus and infant.

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## *On the general Form of the Thymus Gland in the Fœtal Calf.*

The Thymus Gland of this animal is composed of a thoracic portion of an isthmus of a cervical part and of two cornua. The Gland reaches from the anterior mediastinum above the pericardium, to the angle of the lower jaw, extending by its cornua on each side of the neck, and, at the angle of the inferior maxillary bone it doubles upon itself, so that its length is thus somewhat increased.

In describing the situation of this organ and of its different parts, I shall suppose the animal lying on its back.

The thoracic portion of the Thymus is placed under the upper part of the sternum, and it is generally somewhat inclined to the left side. It is situated in the anterior mediastinum, and consequently has the pleura placed upon its sides as it is reflected from the cartilages of the ribs to the pericardium.

Posteriorly, it is attached to that membrane by cellular tissue, and inferiorly it is connected to a strong fascia to be hereafter described, which extends from the cervical entrance of the thorax upon the external jugular veins, and on the arteries from the curvature of the aorta to the aorta itself.

On the sides of the thoracic portion of the Gland pass the internal mammary arteries and veins, which supply it with branches of blood vessels, whilst numerous absorbent glands appear between the thoracic portion and the termination of the jugular and subelavian veins.

The isthmus of this Gland produces the communication between the thoracic, and cervical portions. It is of very small size compared with the two parts of the gland which it joins. It is placed opposite to the upper bone of the sternum, adheres to the vena innominata, and the internal jugular vein descends on each side of it towards the heart. The isthmus passes through a very distinct aperture in the fascia which is stretched over the opening of the neck to the thorax, and extends upon the jugular veins from one vessel to the other, forming a very strong ligament confining this portion of gland in its situation.

As the dissection is further prosecuted the cervical portion of the organ is found placed upon the fore part of the trachia where it is covered by the sterno hyoidei and sterno

thyroidei muscles, and the carotid arteries and internal jugular veins pass near to its outer side.

The cornua of the Gland occupy each side of the trachia and larynx, they are covered near the sternum by the sterno mastoidei muscles which recede from them near the head, and are placed more externally opposite to the division of the common carotid artery into external and internal, and near the os hyoides the cornua are curved upon themselves so as to be doubled at their ends to add to their length, and to increase their surface for secretion, and there they terminate.

Such then is the general formation of the Thymus Gland in the fœtal calf; but upon closer investigation it will be found, that the thoracic portion, although it appears upon superficial examination to be a single body, is really formed of two columns which can be unravelled and disposed in a circle. This circle, however, is not complete, for the two columns which compose it ascend into the isthmus, whence they become small and are knit together in the ligamentous aperture I have described, but still the columns are separate in the isthmus. So the cervical portion although at first sight it appears to be a single body, is really formed of two pillars of gland which advance towards the head from the isthmus having escaped the fascial opening, and are united only by cellular tissue to each other. The cornua are formed by the separa-

tion of the cervical portions into two extended bodies which pass to the lower jaw on each side of the trachea and larynx.

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## *Organization of the Thymus Gland in the Fœtal Calf.*

This organ possesses a general covering of coarse cellular membrane, by which it is united to the surrounding structures, and by which the component parts of this conglomerate gland are held together, and form the general mass of the Thymus.

When this covering is removed, numerous large lobes of which the Gland is composed are rendered distinct.

Beneath this coarse envelope of cellular membrane, a reticular tissue is found, entering into the composition of the lobes so as to connect them with each other, and to unite the different parts of their structure.

Beside this mode of union *a vessel of communication* subsists between the different lobes, which is formed of a mucous membrane internally and of a secretory structure more externally, and thus one portion of the gland has a general communication with the others.

A ligamentous structure passes through the centre of the Thymus joining firmly the different lobes to each other, and serving the additional purpose of supporting the blood vessels which supply it, and the vessel of communication which forms the junction of one lobe with the other. If this mode of combination did not exist, the Gland would be very liable to laceration in parturition, and in the different motions of the animal.

It appears then that the Thymus is composed of a number of lobes of different forms, and which are most distinct in the cornua and least so in the isthmus.

The larger lobes are divisible into smaller, and these are placed nearly opposite to each other on different sides of the central line or axis of the Gland.

When these lobes are first cut into, they appear to be pulpy masses without any distinct organization, but if alcohol be injected into the lobes numerous large cavities will be discovered, from which a great quantity of milky fluid will immediately escape.

It is this structure which I am particularly anxious to point out as being the essential part of the formation of this organ.

When each lobe is unravelled, it is found to be formed in the following manner. The external surface is composed

of small secreting cells, and within it are placed numerous cavities or reservoirs which are lined by delicate mucous membranes marking the boundary of each. Those which are placed in the interior of the lobe are reservoirs to the small cavities which are situated nearer the surface, and for that purpose they are of considerable size, so that many of them are as large as a pea, although of an oblong form.

The size of the reservoirs varies according to their degree of distension, be it of their natural fluid or an injection, but they are so thin and yield so easily that when opened they immediately fall together and close so as not to be apparent without injecting and hardening them.

Their number in each lobe varies according to its magnitude; the secreting cavities upon the surface are small and circular, but the reservoirs open into a central cavity or one nearly central, from which proceeds a vessel of communication between the lobes, surrounded by a portion of gland, which passes from lobe to lobe, to preserve a general union between the different parts of the organ. If quicksilver be thrown into one lobe, it passes, although not very readily, into several of the larger on each side of it.

Each lobe then is made up of numerous small secreting cells, and of larger cavities or reservoirs, and each of the larger lobes is connected by a tube surrounded by a portion

of glandular substance. Thus the organ is constituted of lobes having secreting cavities on the outside, reservoirs within, and a vessel of communication from lobe to lobe.

The central vessel takes a tortuous course so as not to be so easily injected as the gland itself.

The whole when unravelled, has the character of a chain or a string of large beads, the smaller lobes being placed nearly opposite to each other, and the vessel of communication connecting them. *(See Plate* 1 *&* 2.*)*

The cells and reservoirs are lined by an extremely delicate mucous membrane, being as pellucid as the coat of an absorbent vessel. It is of a somewhat elastic nature, for if an aperture be made into any of the cavities after injecting it with quicksilver it readily empties itself, and great care is required in dissection to make it a good preparation.

The vessel of communication is equally delicate with the lining membrane of the cavities, and the parts would not be held together but for the additional ligamentous structure I have described, which strings the lobes to each other, supports and covers the vessel of communication, and this is assisted by the arteries and veins which are distributed to the Gland.

From the transparency of the lining membrane of the cavities, I should not have been able to trace them if they

had not been hardened and rendered opaque by alcohol, to which I sometimes added a solution of alum or oxymurias hydrargyri, and thus I have thickened the membranes and coagulated the fluid which they contain.

Another mode I employed to develope the structure of this Gland, was to inject its cavities with quicksilver, harden them in spirits of wine, and then cutting the Gland through the centre they were easily seen and readily exhibited to others.

My method of injecting them, consisted in passing into the lobes a fine steel pipe. A column of quicksilver of about seven to ten inches should be employed, for if the column exceeds ten inches in height it lacerates the lining membrane, and the quicksilver escapes into the cellular tissue. The quicksilver tube is made to pierce the covering of one of the smaller lobes, and the quicksilver immediately enters the secreting cavities and reservoir, and after filling one small lobe entirely, it passes by the vessel of communication into the nearest large one. Thus two or three may be readily filled, and then the tube should be withdrawn and introduced in the same manner into a lobe two or three from the first until the whole Gland be injected. It is most easily accomplished in the cervical portion of the organ in which the cavities are of greater size than in the cornua, and they

are still larger in the thoracic part, but with less facility injected. After being filled with quicksilver, the Gland should be dried, and a slice of its surface being removed all its cavities will be shewn; or it may be hardened in alcohol or a solution of alum, and when opened the quicksilver escapes and the secretory and retaining cavities become every where distinct, and can be readily exhibited and preserved.

But in this mode of preparing the organ, the weight of the quicksilver enlarges the cavities to rather more than their natural diameters, and I have therefore filled them with air, dried them, and cut them open, but from the pulpy nature of the Gland it is difficult to dry them.

I have also injected them with alcohol, and then thrown them into the same fluid, or into a solution of alum, and cutting them open, the cavities are shewn in the most satisfactory manner.

They may be injected with coloured glue, and hardened in spirits, the glue picked out and the hollow in the lobes will be rendered very apparent, and their natural size and relative situation preserved.

But anxious to shew the cavities unravelled and dissected, so as to prepare them for myself and demonstrate them easily to others, I at length, after much trouble and various attempts, succeeded in injecting them with coloured wax,

so as to fill the secretory cells, the larger cavities or reservoirs and the communicating vessel, and make the injection pass from lobe to lobe, so as not only to shew the structure of a lobe, but the communication of the lobes with each other, and the general formation of the organ.

This mode of preparation gives the great advantage of being with facility dissected, readily preserved, of not being in danger of injury, and of enabling me to convey to others what I have been capable, satisfactorily, to trace in my own dissections.

The Thymus Gland is highly vascular, and its blood vessels are derived from various sources. The arteries of the thoracic portion, and of the isthmus, as well as those of the sternal part of the cervical lobes, spring from the internal mammary and principally from that on the left side, but the arteries of the remaining part of the cervical portion have their origin from the common carotid, whilst those of the cornua arise from the superior thyroideal and external carotid arteries, and two or three on each side from the common carotid.

With respect to the veins of the Thymus Gland, they return the blood from the thoracic portion into the internal mammary veins which accompany the arteries of the same name. But there is also a vein peculiar to this Gland, or at least

chiefly depending upon it, and which is placed parallel with the cervical part and the cornua. The true vena thymica returns the blood of the isthmus, cervical portion, and the beginning of the cornua into the internal jugular veins, whilst some of those of the cornua empty themselves into the superior thyroideal and jugular veins.

Such are the blood vessels of the Thymus, and I am next to trace the *absorbent vessels* and their glands. On the spinal surface of the Thymus, numerous absorbent glands are found, and if these be injected many absorbents are discovered. But upon the posterior surface of the cornua and cervical portion, two large vessels proceed on each cornu and the side of the trachea towards the junction of the jugular veins with the superior cava.

They are sufficiently large to admit a pipe employed to throw in coarse injection; and I can readily inject them with wax, dissect and preserve them so as to make very interesting preparations of them.

They pass nearly straight upon the spinal surface of the cornua, converging a little as they proceed towards the sternum, and terminate in the jugular veins at their junction with the superior cava by one or more orifices on each side.

These vessels are formed to convey the fluid of the Thymus Gland into the veins, although their size is so large as readily

to admit of their being injected with wax, yet I believe them to be more of the structure of absorbent vessels than of excretory ducts.

An excretory duct is in itself a gland, (for example, the ureter) it is generally a muscular tube on the outer side and a secreting membrane within; is free from any valvular apparatus excepting at its termination as the ureter and common duct of the liver. But the vessels I am now describing, although of large size are transparent and possess valves, and above all, if quicksilver be thrown into the absorbent glands of the Thymus, small vessels are filled from them which open suddenly into a tube of considerable diameter, forming the two vessels I have mentioned; and further, to shew that they partake more of the nature of absorbent vessels than the structure of an excretory duct, they cannot be injected but in their course towards the veins from the valves which they contain.

Around the thoracic portion numerous absorbent glands are found which send vessels into the veins at the junction of the jugulars with the superior cava.

These vessels I consider and shall name *absorbent ducts* of the Gland, and they are the carriers of the fluid (hereafter to be described,) from the Thymus into the veins of the lower part of the neck. *(See Plate 2.)*

## The Comparative Anatomy of The Gland.

I have examined the Gland in some other animals, and the following is the result:

In the Dog it is divided into two thoracic and two cervical portions; it is relatively much less in this animal than in the fœtal calf. It consists of lobes which are but loosely connected and they admit of being easily unravelled.

In the lobes small cavities are found which can be injected with quicksilver or alcohol.

In the Dog of six months old I found cavities of considerable size, and the Gland, although larger than it usually is at birth or in the fœtal state, was hollow and had little solid matter in its composition.

In the Kitten, the Gland resembles in form, that of the human subject, and contains numerous small cavities.

In the Ass the Gland is broad, thin, and flat; it is divided into numerous large lobes, which are further subdivided into smaller. Each of the lobes contains numerous cavities which are of considerable magnitude.

The Thymus Gland in the Lamb bears a close resemblance to that of the fœtal calf, being composed of a thoracic portion of an isthmus, of a cervical portion and of two cornua. It is

divided into large lobes, and then into smaller, and they contain secretory cells and reservoirs which are easily injected with quicksilver, and which differ only from those of the fœtal calf, in being absolutely less, although relatively to the size of the animal, they bear the same proportion.

In the Pig, the Gland is formed of two thoracic portions of an isthmus and two cornua; its lobes are of considerable size, and minutely subdivided into smaller lobes, and the Gland is very large in proportion to the weight of the animal.

It contains secretory cavities so full of fluid, that it is very difficult to inject them.

Upon the whole, the Thymus of the calf and lamb, are more readily investigated and made into preparations than those of any other animals which I have examined.

## On the Structure of the Thymus Gland in the Human Subject.

This Gland is formed of a thoracic and a cervical portion on each side. The former is situated in the anterior mediastinum, and the latter is placed in the neck just above the first bone of the sternum and behind the sterno hyoidei and sterno thyroidei muscles.

Between two and three months of fœtal life, as will be seen in the plate, it is so small as to be but just perceptible.

At three months its increase is in proportion to the relative magnitude of the fœtus, and thus it continues to grow gradually and equally to the seventh month, when it enlarges out of proportion to its former growth.

At eight months it is large, but at the ninth month has undergone a sudden change, becomes of great size, and is said to weigh half an ounce, from which circumstance, however, on account of the cavities which it contains and the varieties to which it is subject, no judgment of its bulk can be formed.

It increases after birth, and continues large to the first year, when it slowly disappears to the time of puberty; and

in after age it ceases to have cavities, and becomes a body of very small dimensions.

In a calf of four months after birth, although the size of the Gland is larger than at the birth of the animal, yet the cavities are greatly diminished, not being one third so large as at the ninth month of fœtal existence.

*Haller* says, " In fetu ingens glandula, cumque pancreate et thyroidea omnino glandularum maxima, vix ipso rene minor est. Adulto homini diminuiter, et constricta, exsucca, durior multo, in adipe circumfuso fere sepelitur.

" In modo nato homine thymus granorum vero 28 granorum 90."

*Meckel* says: " Quoique son volume proportionnel ne soit plus aussi considérable jusqu'à la fin de la première année, et quelquefois même jusqu'à celle de la seconde, il continue de croître pendant toute cette période, dans le même proportion que chez le fœtus à terme.

" Mais, à cette époque, il s'atrophie, ses vaisseaux se rapetissent, et le fluide qu'il sécrète diminue. Il s'efface en sens inverse de celui dans lequel il s'était formé, c'est-à-dire de bas en haut.

" On n'en trouve ordinairement plus aucune trace à douze ans, et la place qu'il occupait est alors remplie par de la graisse."

*Hewson* describes this Gland to continue to grow to the end of the first year after birth; from the first to the third year, it is neither perceptibly increased or diminished.

From the third to the eight or tenth year it decreases in size, and gradually wasting until the child has reached between its tenth and twelfth year, when ordinarily it is perfectly effaced, leaving only ligamentous remains that degenerates into a kind of reticular substance.

"I have never," he says, "seen an instance of the Thymus continuing to the time of puberty."

*Cloquet* observes; "Le thymus commence à paraître dans le troisième mois de la grossesse: d'abord très petit, il augmente de volume jusqu'au moment de la naissance, époque à laquelle il pèse ordinairement une demi-once; il continue ensuite de croître jusqu'à deux ans; dès ce moment il s'atrophie, le calibre de ses vaisseaux diminue, et à douze ans il n'en reste ordinairement plus de traces; une graisse un peu grumeleuse remplit la place qu'il occupait."

Such are the statements of these able anatomists respecting its duration and extinction. (See Physiology.)

Although the Gland is usually double, and the one side united to the other by cellular membrane only, yet it sometimes happens that a third thoracic lobe exists, which appears

to join one lobe with the other, but which allows, under a careful dissection, of their being separated.

There are also two other varieties I have seen; the first is the vena innominata passing through the Gland, and the second the same vein placed anteriorly to the cervical lobes.

Indeed I scarcely find two organs alike in form, sometimes they are round, whilst others are of great length, and are so thin that the serpentine disposition of their lobes may be seen without dissection.

The left gland is often larger than the right, but even in this respect so much variety is observable, that it appears if the bulk of the whole be the same, that it is of little importance which may be of the greater magnitude, the right or left gland, as its secretion will be equally abundant.

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## *The Relative Situation of the Thymus Gland.*

In cutting through the sternum in its long axis, and then separating its two lateral portions, so as to give a good view of the mediastinum, the Thymus Gland appears situated behind the first and part of the second bone of the

sternum, and posteriorly to the origins of the sterno hyoidei and thyroidei muscles.

It reaches more than half way down the sternum at birth, viz. to the fourth rib, and extends from thence into the neck near to the thyroid gland.

It is connected to the sternum and origins of the sterno hyoidei and thyroidei muscles by cellular tissue, it adheres strongly by a coarse cellular membrane to the pericardium, anteriorly, and laterally the internal mammary arteries and veins take their course.

The reflection of the pleura descending from the cartilages of the ribs on each side, and continued to the fore part of the pericardium forming the anterior mediastinum, makes its lateral boundaries, and separates it from the lungs; posteriorly it rests upon the vena innominata, and upon the fascia of the thorax which descends from the sternum and first rib to the curvature of the aorta, and to the three large vessels which spring from it, viz. the arteria innominata the left carotid and left subclavian arteries: such then is the relative situation of the gland in the chest (see hereafter.)

In the dissection of the cervical portion of the Thymus, the platysma myoides and external jugular vein are first turned aside, and the origins of the sterno mastoidei muscles are raised; when this has been accomplished, the sterno

hyoidei appear covering and passing over the Thymus Gland. The sterno thyroidei muscles proceed from their origin at the sternum to their termination in the thyroid cartilage, and they cover this organ anteriorly; but when these muscles are removed, the cervical portions of the Thymus are seen on the anterior and lateral parts of the trachea, and just below the thyroid gland, where it passes on the fascia on the fore part of the air tube, and unites with the larynx by ligament.

The internal jugular veins are placed anteriorly and laterally to the cervical portion, and the carotid arteries with the par vagum appear more externally.

The first bone of the sternum and sternal ends of the clavicle cover the junction of the cervical with the thoracic portion of this Gland.

In many of the subjects which I have examined, the cervical portion of the Thymus passes higher upon the right than on the left side, and I have generally seen it joined by a ligament to the larynx, and by vessels to the thyroid gland.

## *The Fascia of the Thorax.*

Having mentioned a fascia which is interposed between the Thymus, the curvature of the aorta and the great arteries which arise from it, as also the trachea, I will now more particularly describe it.

This fascia is wanting immediately behind the upper bone of the sternum, and, leaving a space for the passage of the Thymus Gland, is attached to the edge of the first rib; one portion of it passes upwards and unites itself to the coats of the jugular veins, to the surface of the trachea, and joins the deep seated fascia of the neck described by *Burns*.

The thoracic portion descends upon and surrounds the arteria innominata, left carotid and left subclavian arteries, and extends itself on the coats of the aorta, covering, enveloping and supporting each of the vessels, and inseparably connecting them, without the aid of the knife, with the bones which form the opening of the thorax; a slighter union also subsists between the fascia, the surface of the vena innominata and the pericardium.

This fascia is united to the edge of the first rib as far as its head, and is not only joined to the curvature of the aorta and its vessels, but also descends upon the trachea as far as the division into the bronchi.

The thoracic fascia performs three important offices:

*First.* It forms the upper boundary of the chest as the diaphram does the lower.

*Secondly.* It steadily preserves the relative situation of the parts which enter and quit the thoracic opening.

*Thirdly.* It attaches and supports the heart in its situation through the medium of its connection with the aorta and large vessels which are placed at its curvature.

The opening into the thorax is shut from the neck by the reflection of this fascia upwards on the jugular veins carotid arteries, and upon the trachea, and from the thorax by its forming an infundibulum upon the curvature of the aorta and its large vessels, and upon the trachea. If therefore the finger be attempted to be passed from the neck into the chest, and from the chest into the neck, no openings will be found but those by which the vessels and nerves pass through this fascia.

Of all the parts which enter the chest the æsophagus is the least confined by this structure; as that tube requires that its capacity should frequently change in the act of deglutition, it was necessary that it should be but loosely connected to the surrounding parts to permit of the necessary changes in its diameter.

To allow of this, the fascia forms a crescent from the first

rib on each side to the spine, leaving a large space before the vertebræ for the passage of the æsophagus. In other parts the upper opening of the thorax is shut by this fascia being united to the nerves, arteries, veins, and trachea.

In the fœtal calf and the lamb, a portion of this fascia forms a yoke to the isthmus of the Thymus Gland by crossing it in extending from one jugular vein to the other.

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*The Dissection of the Thymus Gland in the Human Subject.*

The Thymus Gland is formed of two distinct bodies; they are generally separated from each other as regards glandular substance, and therefore may be properly called a right and left Thymus Gland.

The organ is connected to the surrounding parts by an envelope of coarse cellular membrane, which not only fixes it in its situation, but also unites the two Glands of which it is composed, so as to require a delicate dissection to separate them.

When this membraneous covering is removed, the sub-

stance of the Gland is exposed, which is found to be of the conglomerate kind, being formed of numerous lobes which are connected together by a second covering of reticular tissue uniting the lobes to each other, and combining its parts by entering minutely into its interstices.

The lobes of this Gland differ in magnitude, but not one of them appears to be larger than a pea, and they vary from that of the head of a pin to the size above mentioned. When the form of the Thymus is strictly investigated, the lobes are found to be disposed in a serpentine direction around a cavity hereafter to be described.

The Gland may be unravelled and it will be discovered to be composed of a rope on each side, of which the right and left Thymus is constituted, and on each of these the large lobes form knots, and it appears like a necklace of beads, but even these lobes may be still further separated. *(See Plate.)*

In order to succeed in unravelling the Gland, it is necessary to divide the arteries, veins, as well as a mucous membrane, to be described hereafter, as the arteries, veins and membrane unite the lobes to each other to give them a serpentine course, to shorten the Gland, and to lessen the space which it would otherwise occupy.

These ropes are disposed in a spiral course around a central or nearly central cavity, and this disposition of them

is preserved by the arteries, veins, and mucous membrane, by the division of which the ropes are unravelled.

The spiral rope which constitutes the Gland on the right side has no communication with that on the left, although the two Glands are combined into one by cellular tissue, yet in its usual formation, the glandular structure continues entirely separate.

In order to distinctly observe the rope, and to unravel it satisfactorily, it is necessary to dissect it, in part, in water, and then harden it in alcohol, when the dissection may be minutely pursued, and the lobes and their communicating portions be preserved and readily demonstrated.

This rope or chain of gland is composed of lobes of different sizes, connected together by membrane and by smaller portions of gland which surround a large internal cavity.

To proceed with the investigation of the structure of this Gland, remove a very thin superficial slice of each lobe, or of several of these, and numerous little cavities will be seen which may be set open after the organ has been hardened in spirits of wine, and these are the secretory cavities or cells producing the fluid which issues so abundantly.

The lobes being further examined, beside their cells, are found to contain a small pouch at their bases, which leads into a reservoir, so that the secretion which escapes from the

lobes finds a ready entrance into the cavity of the Gland, from which it may be absorbed. *(See Plate.)*

If a pipe be introduced into the Gland, and alcohol be injected, and the organ immersed in strong spirits, or a solution of alum, a large cavity will be filled, which I shall call the reservoir of the Thymus.

This reservoir forms a general communication between the different lobes; it begins from the inferior part of the thoracic portion, and extends from thence into the extremity of the cervical.

The reservoir does not maintain a straight course, but passes spirally, or in a serpentine direction, through the thoracic part of the Gland, and is somewhat more direct in the cervical portion.

With regard to its size, it varies in different places, but generally is the largest near the centre of the thoracic, and it is least at the communication of the cervical with the thoracic part of the Gland.

In the cervical portion it increases, but is less than in the thoracic, yet it still may be distinctly traced.

When opened, after having been injected and hardened, its internal surface appears to be lined by a smooth membrane; but if it be at once dissected in water, this lining membrane is found to be of the mucous kind, for it is rather

villous than smooth, and instead of having a few red vessels, when filled with a vermillion injection, it is found to be highly vascular, and the arteries which are distributed to it may be seen meandering upon its surface and minutely dividing so as to redden every part of it.

Its interior forms ridges, which are produced by small ligamentous bands, which cross the surface of the reservoir in various directions and encircles the mouths of the pouches; these bands are formed for the purpose of keeping the lobes together, of preventing an injurious yielding of the parietes of the cavity, and to give strength to resist too great an accumulation of the secretion.

When the reservoir is floated in water, a number of small openings appear upon its internal surface, and if a probe be introduced into these, it passes into the pouch at the roots of the lobes, so that by these apertures, the secreted fluid escapes into the reservoir.

These orifices are not so numerous as the lobes themselves, the reason for which is, that each pouch communicates with more than one lobe.

The boundaries or walls of the Gland are full of secretory cavities or cells, which are extremely minute; they communicate with each other and open into the pouch of the lobes, and from the pouch into the reservoir.

With respect to the best mode of dissecting and preparing this organ, so as to exhibit the structure I have described to others, it is as follows:

Inject the superior cava with one coloured fluid and the aorta with another, and the arteries and veins of the Thymus are filled.

Then remove it from its surrounding connections and dissect off its envelope of coarse cellular membrane, when its lobes will be distinctly seen.

Pass an injecting pipe into the interior of the Gland and fill the reservoir with alcohol, and not only it, but many of its secretory cavities, will be distended. Put it for two days into spirits of wine or a solution of alum, and it will become hardened so as to preserve the general form of the organ, its reservoir, its pouches, and secretory cavities.

Then cut off its anterior surface nearly to the middle of the Gland and through the thoracic and cervical portions, and an excellent view is thus produced of all the parts of the Thymus.

I have also, in the same manner, filled the reservoir and many of the lobes with coloured gelatin, so as readily to dissect and render them conspicuous to others.

It is not difficult to fill the reservoir with quicksilver by inserting a tube for that purpose into the centre of the Gland,

which may be dried so as to shew it distinctly; but in this mode of preserving it, the weight of the quicksilver dilating the mucous membrane, renders the reservoir somewhat larger than natural, and therefore it does not convey a perfectly accurate idea of its relative size, and I may also observe, that the lobes of the Gland are not completely filled or their secretory cavities, as when gelatin is used.

Next to injecting it with alcohol, or filling it with air, and then hardening it in spirits of wine or alum, the best mode of exhibiting its formation is to fill the reservoir with coloured wax, and then each lobe, the secretory cells, the pouches, and the reservoir will be distended, and the cells rendered quite conspicuous.

The secretory structure may be also well shewn by throwing coloured gelatin into the reservoir, from which it escapes into all the cavities of the Gland, rendering the whole of a red colour; then, cutting open the reservoir after the injection has become firm, remove the gelatin, and the apertures of the pouches will be seen as well as the secretory cavities.

From what I have said of the structure of the Thymus, its composition will be found to be as follows:

*First.* It is composed of a gland on each side, united only by cellular membrane.

*Second.* It is formed of two ropes which can be with care unravelled, and they are of considerable length.

*Third.* The ropes are constituted of small and large lobes which appear as knots upon the rope.

*Fourth.* These are disposed in a spiral or serpentine course, from the upper part of the cervical, to the lower extremity of the thoracic portion.

*Fifth.* Each portion of the rope is a secretory structure.

*Sixth.* The lobes contain secretory cavities or cells, which may be readily shewn by filling the Gland with alcohol, air, gelatin, or even wax.

*Seventh.* A pouch of communication exists between the lobes and the reservoir.

*Eighth.* The Gland has a central cavity or reservoir.

*Ninth.* This cavity is not straight, but spiral or serpentine.

*Tenth.* The reservoir is lined by a very vascular mucous membrane.

*Eleventh.* The ropes of the Gland pass in a spiral or serpentine direction around the mucous membrane, which lines and principally forms the reservoir, and these ropes being united by that membrane to each other, assist in forming the cavity.

With respect to the arteries of this organ, they are principally derived from two sources. Each thoracic portion is supplied by a branch which is sent off by the internal mammary. It enters at the junction of the cervical with the thoracic part, generally on their outer side but sometimes between the cervical portions, and descending upon the middle of the Gland, divides to supply the spirally disposed lobes.

This vessel passes to the inner side of the reservoir and is distributed to its mucous membrane on the one hand, and to the glandular structure on the other.

The other principal artery of the Thymus is sometimes derived from the superior thyroideal, at others, from the inferior thyroideal artery, and descending upon the lobes of the cervical portion, passes into them, and to the membrane of the cavity which they contain, and ultimately, anastomoses with the branch from the mammary artery. These arteries, besides supplying the Gland with blood, serve the purpose of combining the lobes and preventing their separation; for until they are divided, the ropes cannot be unravelled.

*The Venæ Thymicæ* have a different course to the arteries; for although the internal mammary and thyroideal veins, receive small branches from this Gland, yet the principal veins are those which end in the vena innominata.

A considerable vein springs from each thoracic portion, and it passes from the posterior surface of the Thymus into the vena innominata; having received a branch from the cervical portion, and vessels from the thoracic, it is found near the centre of the Gland.

A very small vein enters the thyroideal from the cervical portion, and this vein anastomoses with that of the thoracic part.

The Absorbent Vessels I have only once been able to inject in the Human Subject proceeding from an absorbent gland of the Thymus.

Absorbent Glands are found at the upper part of the sternum in the mediastinum; also a small Gland, between the thoracic portions, and some at the junction of the Thymus with the jugular and subclavian veins, where the principal trunks of the absorbent vessels at all periods of life terminate.

Here the advantage of comparative anatomy is evinced, in the readiness with which the absorbent vessels, their Glands, and the absorbent ducts, can be shewn in the fœtal calf.

*The Nerves* of the Thymus are very minute.

*Haller* says, "Nervi aut nulli aut minimi aliqui a Phrenico ramo sunt."

But I have not been able to discover any branch from the Phrenic going to the Gland, although some pass through the cellular membrane which envelopes it, and to the pericardium.

From the superior thoracic ganglion of the Grand Sympathetic, a nerve proceeds and forms a plexus around the internal mammary artery, and on the superior cava, with which some filaments of the phrenic nerve communicate.

At the origin of the arteria thymica, from the internal mammary artery, a plexus of nerves passes upon the coats of the former artery, and upon it the nerves appear to proceed to the Thymus Gland, but the branches are so minute, that their entrance into the Gland, I speak of with less confidence, than of any other part of the anatomy of this organ. I may add that I have seen a filament from the junction of the Par Vagum and Grand Sympathetic pass on the side of the Thyroid Gland to the Thymus.

## *Physiology of the Thymus Gland.*

That an important function must be performed by an organ so uniformly found, of a size so large, of a highly vascular structure and secreting abundantly, no one who duly considers the subject can for a moment hesitate to acknow-

ledge; and for myself I cannot subscribe to the opinion of those who think this Gland is designed merely to fill a space which the lungs in their expanded state after the birth of the fœtus, may be destined to occupy in respiration.

If this had been the case it would not have been a secretory organ, nor do I believe that nature in her wisdom creates any part of the body upon such views or principles.

*Hewson* was of opinion that the Thymus Gland formed the internal part of the red globules of the blood, and that the red particles were composed of two portions, viz. a small central particle produced by the Thymus, and a vesicular part formed by the Spleen in which the former is embedded, and he uses the following words in his account of the use of the Thymus.

Sect. 94, Page 13. "The Thymus Gland then we consider an appendage to the Lymphatic Glands for the more perfectly and expeditiously forming the central particles of the blood in the fœtus and in the early part of life."

Again he says, Page 85. "That the structure and uses of this Gland are similar to those of the Lymphatic Glands, to which it may be considered an appendage." See Hewson's experimental inquiries.

It is quite at variance with my feelings to find fault with Hewson, who was an excellent anatomist and a highly ingenious man, and for whose memory I have the highest

possible respect, but I cannot agree with the opinion that the structure of the Thymus and absorbent Glands is similar; one is conglobate and the other conglomerate; one is firm and compact, and the other is loose and pulpy; the one contains cells of considerable magnitude when in a distended state, whilst in the absorbent Glands the cavities are small and with so much difficulty traced that there is still a doubt if they be cellular or vascular.

The office which the Thymus is designed to perform is evidently connected with the fœtal stages of existence, as it gradually lessens soon after the child is born, and even when the Gland remains of considerable bulk, its secretory cavities are much diminished. *(See Plate V.)*

It has been already stated, that this Gland secretes a great abundance of white fluid; that it is situated between the veins in which the great absorbent ducts of the body terminate; that to each cornu is attached a large absorbent duct in the fœtal calf, capable of being filled with coarse injection, and that this vessel terminates at the junction of the jugular veins in the vena innominata.

This fluid, although constantly found in the human fœtus, having the appearance of chyle, viz. white like cream, but with a small admixture of red globules, is not easily procured in sufficient quantity to make it the subject of chemical

analysis; but from fœtal calves, two or three ounces may be without difficulty collected, and an abundant opportunity afforded of ascertaining its composition.

The best mode of obtaining it, is, by cutting the Gland into very small pieces, and placing them upon gauze, which being squeezed, the solid is separated from the fluid part, and the latter escapes through the gauze.

The Thymus should be previously immersed in water to deprive it of its blood.

The fluid thus collected from the calf, has the appearance of cream slightly tinged with blood, and to the eye, has the character of chyle.

*Warm water* dissolves a large portion of it.

*Heat* readily coagulates it.

*Alcohol* coagulates it.

*Sulphuric Acid* not only coagulates, but chars it.

*Nitric Acid* coagulates it firmly, first turning it white, and then yellow.

*Nitric Acid diluted*, precipitates a white solid from its solution in water, giving it the appearance of milk.

*Muriatic Acid* coagulates it firmly, and turns it white.

*Liquor Potassæ* converts it into a muco albuminous matter, which falls, in long extended threads, like the saliva in Ranula, and gives it much the appearance of white of egg.

But in order to have a clear and scientific view of the nature of this fluid, I looked around me for a friend upon whose chemical knowledge and accuracy I could rely.

Such a person I found in Dr. Dowler, of Richmond, who has been long known to some of the first medical characters in London, for his talent and acquirements in Chemistry, and who has published an excellent paper in the Medico-chirurgical Transactions. [Vol. XII, Part 1. *On the products of Acute Inflammation.*]

Without telling him from whence the fluid was derived, I sent him several phials of that which issues from the Thymus Gland of the fœtal calf, and requested him to analyze it, which he had the kindness to do, and the following is the letter he sent me in return.

My Dear Sir Astley,

The fluid consists of the following substances, and which are placed in the order of their proportions.

100 parts contain 16 of solid matter.

Incipient fibrin.

Albumen.

Mucus and muco extractive matter. Salts consisting chiefly of muriate and phosphate of potash and phosphate of soda.

Of phosphoric acid a trace.

That the method of examination might be as unobjectionable as possible, the employment of active chemical reagents was avoided.

It was ascertained that the presence of the very minute quantity of free acid destroyed the affinity of the fibrinous particles for each other, for as soon as the acid was either saturated with an alkali, or further diluted with water, they then adhered together.

A portion of the fluid on being dropped into two or three times its weight of water, and gently stirred about will unite with a part of it, and after a short time be converted into a gelatinous looking mass. This mass consists of a solid and of a fluid part, and which may be separated from each other by mechanical means.

It is only necessary to enclose it in a fine linen rag, in such a manner that the latter may form a kind of loose bag around it, and then to gently rub portions of it between the finger and thumb, so as to break down the reticular tissue which retains the fluid portion. The bag must be occasionally gently pressed or carefully twisted, so as to separate this portion as it becomes liberated; towards the end of the process more force may be used.

On opening the bag a viscid looking substance will be found, which when further pressed and dried, bears a close

resemblance to ordinary fibrin, both in its chemical and physical properties. The linen bag used for the separation of the fibrin absorbs a quantity of the fluid part containing other animal matters. These must be separated by means of water, and added to the portion that had already passed through it; when sufficiently concentrated under an exhausted receiver the albumen may be coagulated by heat, and in this way separated from the other animal and saline substances.

The other steps of the examination may be conducted in the usual manner. I am sincerely yours,

THOMAS DOWLER.

A method very similar to this was employed by Dr. Dowler for ascertaining the composition of the buffy coat of inflammatory blood, and of the gelatinous looking masses often effused during the processes of acute inflammation. To these masses the fluid of the Thymus Gland, when treated with water in the before mentioned manner, bears a strong analogy in its structure and composition.

If the fluid from the Thymus Gland be examined in a microscope it is found to contain an immense number of white particles, and a very small quantity of this fluid in serum exhibit those particles in the most satisfactory manner.

It appears by the analysis which I have given from Dr.

Dowler, that this Gland secretes a fluid which contains albumen and fibrin, and the microscope readily discovers white particles in it, and that in short, it secretes all the component parts of the blood, viz. albumen, fibrin and particles, excepting that the particles like those of chyle are white instead of being red.

As to the muco extractive matter in the fluid, it is probably derived from the mucous membrane which lines the reservoir and secretory cavities of the Gland.

It appears to be an error to suppose that this Gland continues for some time after birth to perform the same office as that which it supported in the fœtal state.

I injected the Gland in a child of one month, and I found that the lobes had become quite thinned by absorption, although the reservoirs in part remained, but even one of these was partially obliterated. In a child of four months the reservoir was very small, broken into several portions, and the weight of the Gland which should have been in the fœtus of nine months 240 grains, weighed only 45 grains, or about five times less than in the fœtal state. *(See Plate V.)*

In a calf of four months, the Gland is very large, yet the cells and reservoirs will not receive one half of the injection which will enter in the fœtus of nine months.

I will therefore put the following query.

As the Thymus secretes all the parts of the blood, viz. albumen, fibrin and particles, is it not probable that the Gland is designed to prepare a fluid well fitted for the fœtal growth and nourishment from the blood of the mother before the birth of the fœtus, and consequently before chyle is formed from food, and this process continues for a short time after birth, the quantity of fluid secreted from the Thymus gradually declining as that of chylification becomes perfectly established?

## *Disease of the Gland.*

Parts which have ceased to perform their functions, as the mamma after menstruation and parturition, so frequently degenerate into diseased changes that morbid affections of this Gland might be expected to be frequent, yet in the course of more than forty years experience, I have only witnessed one example of it.

Varieties in size are of common occurrence, but diseased changes of structure are extremely rare.

The following case occurred many years ago.

I was requested to visit a young person 19 years of age, who suffered under so severe a dyspnea that it was with great

difficulty she could remain recumbent for a few minutes, and if a short period of repose was obtained, she started up with a sense of suffocation, and for several seconds struggled violently for breath.

Upon enquiring into the cause of her suffering, I found a swelling which occupied the inferior part of the neck at the upper opening of the thorax, which projected above the clavicle upon each side, and as I supposed arose from an enlargement of the absorbent Glands at the termination of the jugular and subclavian veins.

The swelling had existed for many years, but of late suddenly increased. I ordered leeches to be applied, her bowels to be opened, and on the following day she was somewhat better, but another day brought with it not only her former, but still more aggravated sufferings; I then advised a blister to the upper part of the sternum and to the swelling in the neck, desired the cuticle to be removed, the part to be dressed with the unguentum hydrargyri, and directed her to take calomel and opium, which she accomplished without much difficulty, as her deglutition was less affected than her breathing.

The means which I recommended gave her only slight temporary relief, and she became daily weaker, her legs were adematous and she was unable to get any rest, but

in the sitting posture, and then only with her head inclined forwards, and supported in that position by her sisters; for the moment it fell back, the pressure of the tumour on the trachea and the dyspnea were suddenly increased.

I witnessed her making daily approaches to dissolution, without being able to afford her any permanent benefit; she died after a fortnight, not from any sudden attack of suffocation, but from being worn out by the constant irritation excited by the difficulty in respiration.

I obtained permission to examine the body, and found that the disease was situated in the Thymus Gland; the swelling reached from the curvature of the aorta to the lower part of the Thyroid Gland, and the latter was also considerably enlarged.

The Thymus appeared of a yellowish white colour, and was divided into several large lobes.

The trachea was involved in the tumour, and its sides were compressed by it, so that its transverse diameter was somewhat diminished. The arteria innominata was placed behind it, and the left subclavian, and left carotid arteries to its left side, it surrounded the vena innominata, and upon cutting into the vein, the diseased Gland was found projecting into its cavity, and upon making an incision into the swelling, the reticular texture of the Gland was found to be filled by a white pulpy substance.

In this case, the complaint was compounded of a diseased growth of the Thymus and of Bronchocele, or an unnatural growth of the Thyroid Gland. The latter is so placed that its enlargement little endangers suffocation, because the surrounding parts can yield to the pressure of the swollen Gland; but as the Thymus is situated in the thoracic opening, in its enlarged state it soon reaches the sternum and first rib, by which it is bound, and therefore, its increase is towards the trachea, which becomes enveloped by it, and its function interrupted in consequence of its compression.

The disease appeared to be of the Fungoid kind.

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FINIS.

# EXPLANATION OF THE PLATES.

## PLATE I.

Fig. 1.—The Thymus Gland of the Fœtal Calf unravelled, to shew its ropes, lobes, and the communicating vessel between them.

A. A. The Aorta.

B B. The Thoracic part unravelled and disposed in a semicircle.

C. C. The Isthmus on each side, appearing as a single body before dissection.

D. D. The Cervical portions.

E. E. E. E. The Cornua which pass upon the sides of the Larynx.

Between the lobes some of the vessels of communication appear but they exist between all the lobes.

Fig. 2.—The Thymus Gland of the same animal injected with quicksilver.

A. A. Aorta.

B. Larynx.

C. Trachea.

D. D. Thoracic portion.

E. E. Isthmus.

F. F. Cervical portions.

G. G. Cornua.

In all these parts the Reservoirs are filled with quicksilver.

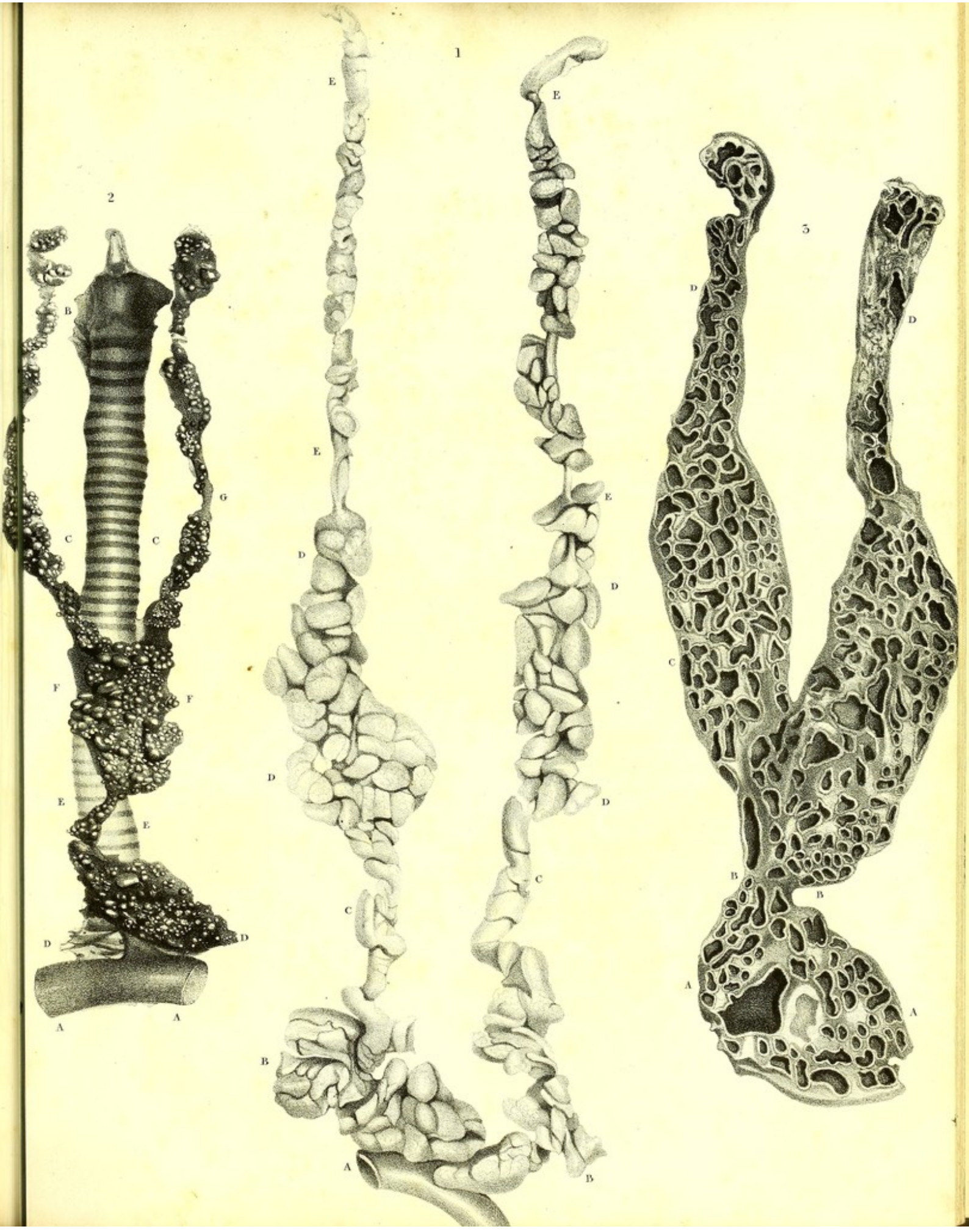
Fig. 3.—The larger cavities or reservoirs of the Thymus Gland after being filled with quicksilver, dried, and cut open.

A. A. Thoracic portion.

B. B. Isthmus.

C. C. Cervical portions.

D. D. Cornua.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## PLATE II.

*Exhibits the Organization of the Thymus Gland of the same Animal.*

Fig. 1.—The thoracic portion filled with wax, and unravelled to shew its lobes, secretory cavities, and the vessel of communication between the lobes.

Fig. 2.—Cervical portion, also filled with coarse injection, and unravelled to shew its lobes and the communicating vessel between them.

Fig. 3.—A section to shew the reservoirs or larger cavities filled with wax.

Fig. 4.—Two lobes; the lower shews the reservoirs filled with wax; the upper, the secretory cells; and between the upper and the lower, the communicating vessel.

Fig. 5.—The secretory cells injected, and in part, corroded.

Fig. 6.—A portion of the Gland injected with quicksilver, hardened in alcohol, and emptied, to shew the reservoirs.

Fig. 7.—A preparation made in a similar manner.

Fig. 8.—A portion of the Gland injected with wax, hardened in alcohol, and then the wax removed to shew the reservoir and cells.

Fig. 9.—Shews the lobes and communicating vessel.

Fig. 10.—Portions of wax removed from the reservoirs, of which they are models.

Fig. 11.—Reservoir and communicating vessel.

Fig. 12.—Lobes, cells, and communicating vessel.

Fig. 13.—A similar preparation.

Fig. 14.—This is the Gland of a Calf four months after birth, showing the diminution of its reservoirs and cells, and is to be contrasted with Fig. 2, of Plate the first.

Fig. 15.—Fascia crossing the Isthmus of the Gland, and passing from one jugular vein to the other.

Fig. 16.—Large absorbent ducts of the Thymus Gland filled with red wax, beginning from the absorbent Glands and terminating in the vena innominata.

Fig. 17.—Absorbent vessels passing from the Thymus into an absorbent Gland.


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## PLATE III.

*View of the Thymus Gland of the Human Fœtus.*

Fig. 2.—The fœtal Gland at rather more than two months.

Fig. 3.—At the third month.

Fig. 4.—Fourth.

Fig. 5.—Fifth.

Fig. 6.—Sixth.

Fig. 7.—Seventh.

Fig. 8.—Eight months from an acephalous fœtus, and broader than usual.

Fig. 9.—At the ninth month.

A. The two Glands separated, and their lobes exhibited.

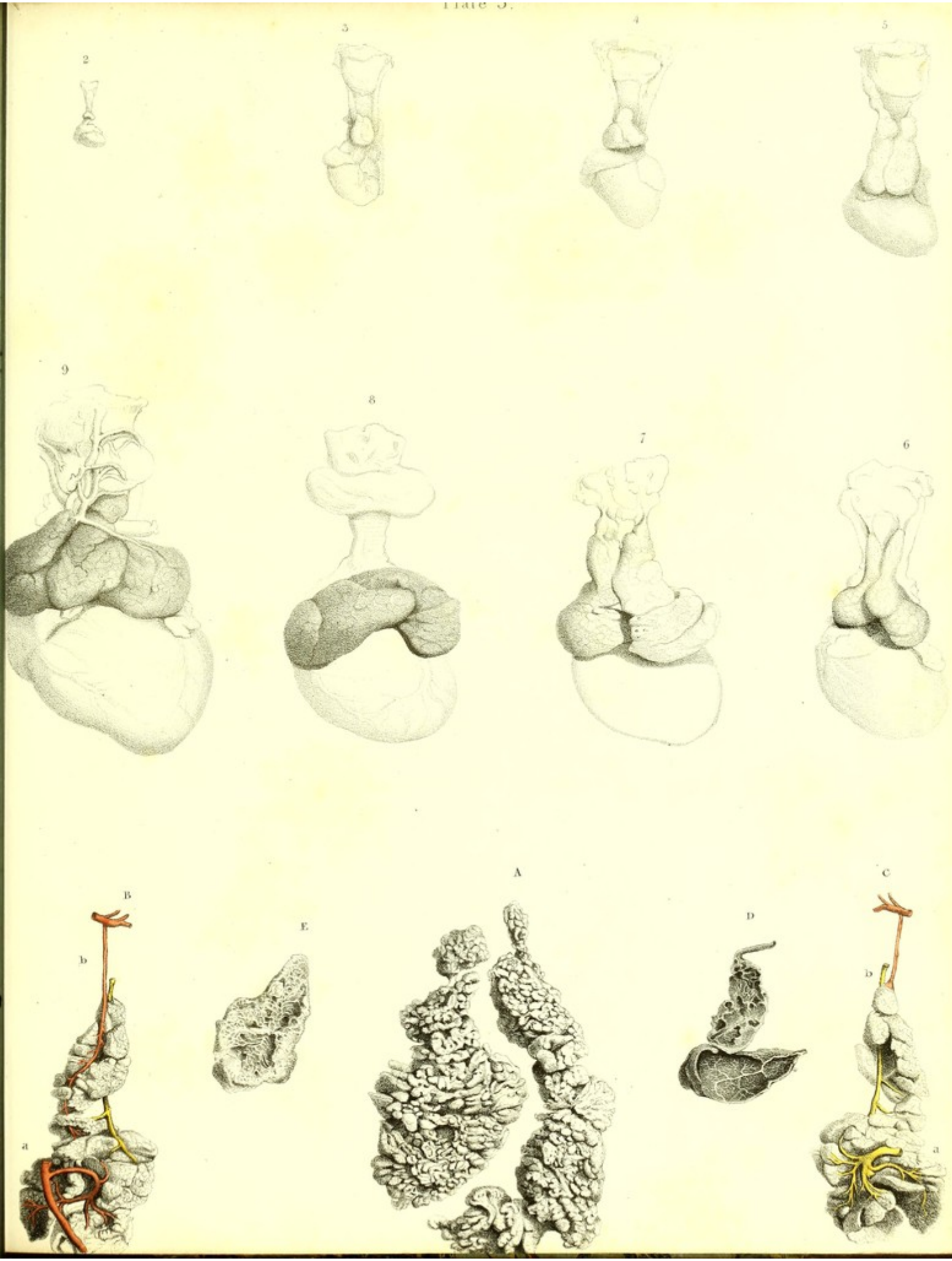
B. Arteries of the Gland; a. branch from the internal mammary artery; b. that from the thyroideal.

C. Veins of the Gland; a. terminates in the vena innonminata; b. ends in the thyroideal veins.

D. Reservoirs of the Gland dried, and injected, to shew the arteries ramifying on them.

E. Mucous membrane of the reservoir injected.

Plate 3.



## PLATE IV.

*Organization of the Thymus Gland of the Human Fœtus.*

Fig. 1.—Shews the serpentine course of the lobes.

Fig. 2.—The Glands injected with wax and partially unravelled.*

Fig. 3.—The spiral course of the lobes shewn by unravelling the rope of which each Gland is composed.

Fig. 4.—The ropes still further unravelled, and portions of the reservoir opened where the lobes coalesce.

Fig. 5.—The Gland injected with wax, and unravelled as far as the reservoir in the centre permitted, the pouches are also seen.

Fig. 6.—The Thymus Gland of a full grown fœtus filled with alcohol and hardened in it, shews the form, course and size of the reservoirs. The mouths of the pouches proceeding from them, and the secretory cells in the walls of the Gland.

Fig. 7.—Portions of the lobes sliced off after they have been distended with alcohol to shew the secretory cells and pouches.

Fig. 8.—Reservoir, pouches, and cells exhibited.

Fig. 9.—Secretory cells or cavities shewn in a posterior view.

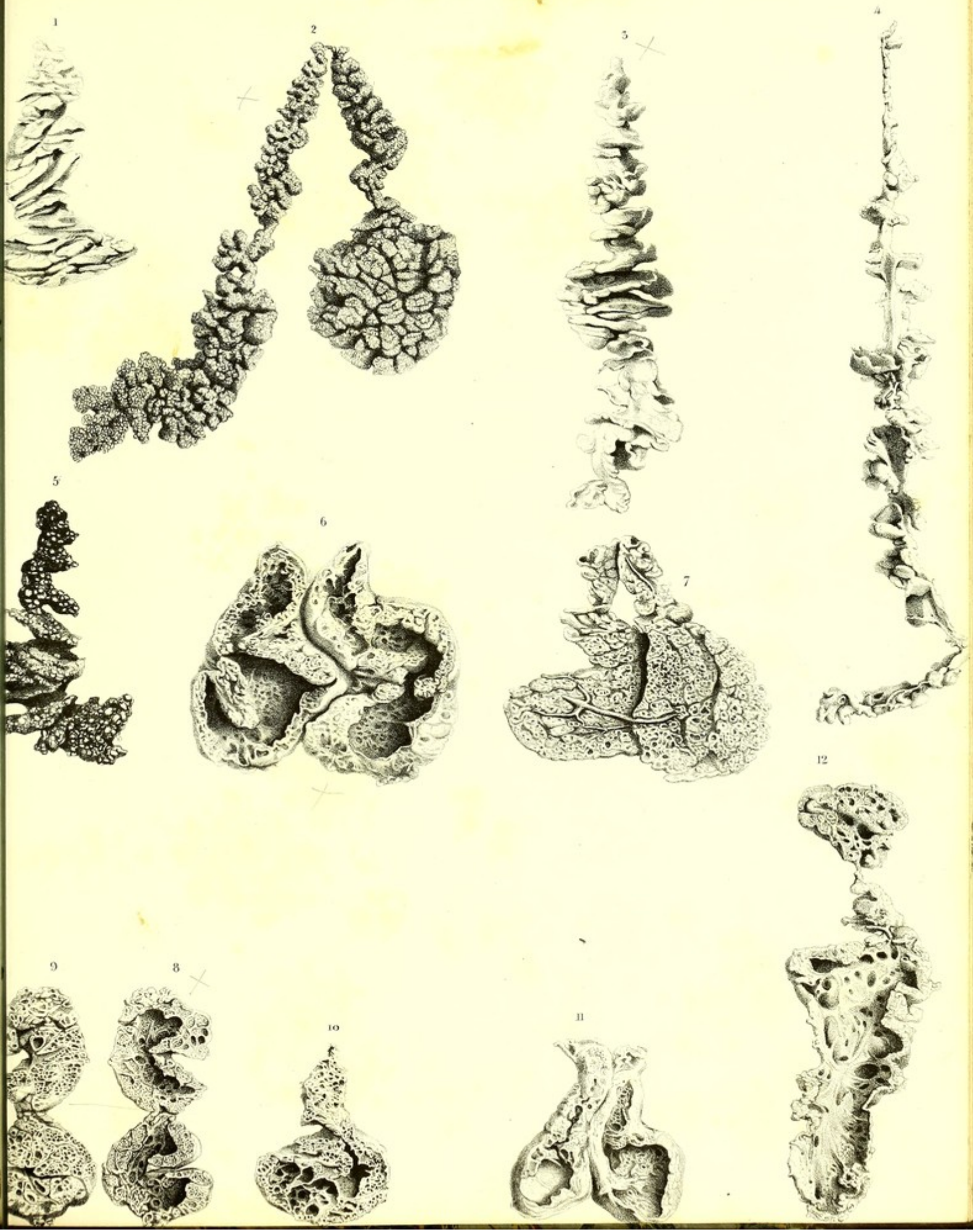
Fig. 10.—Section of a Gland distended with air, and hardened in alcohol, to shew its secretory cells and a part of its reservoir.

Fig. 11.—The two Glands to shew the reservoir, orifices, and the cells.

Fig. 12.—Reservoir opened after being hardened, bands seen in it, and the orifices of the pouches. The rope passing from the cervical to the thoracic portion.

* No. 2 is drawn from one of my best preparations. It shews in one gland the rope, the lobes, and the cells; in the other, the communication between the Thoracic and Cervical Portions. The whole is filled with wax.

Plate 4.



## PLATE V.

Fig. 1.—Reservoir filled with wax and corroded, shewing its form and some of the secretory cells upon its surface.

Fig. 2.—Reservoir filled with wax to shew its form and the pouches from its sides proceeding to the secretory cells.

Fig. 3.—Reservoir and pouches at five months.

Fig. 4.—Reservoir and pouches at six months.

Fig. 5.—Reservoir and pouches at seven months. These three preparations are filled with quicksilver.

Fig. 6.—Secretory cells on the surface of the Gland.

Fig. 7.—A. A. The Gland had been filled with quicksilver, dried and cut open to shew the reservoirs and pouches.

Fig. 8.—Arteries and veins of the Gland which has also been injected with wax. A. A. Gland.*

Fig. 9.—The Thymus Gland of nine months injected with wax to shew its lobes and cells. A. A. Thoracic. B. B. Cervical portion. The heart seen below, the Trachea and Carotid arteries above.

Fig. 10.—The Gland injected with quicksilver, dried and cut open to shew the reservoirs.

Fig. 11.—Glands filled with quicksilver to shew the reservoirs, and the pouches on their surfaces.

Fig. 12.—Minute injection of the arteries of the mucous membrane of the reservoir.

Fig. 13.—Gland one month after birth, lobes in a great degree absorbed, pouches less, reservoir still large, but between A. and B. imperfect.

Fig. 14.—One Gland from a large Child of four months; weight of the two glands 45 grains which is usually 240 at birth. Reservoir diminished and imperfect.

Fig. 15.—Diagram to convey a general idea of the structure of the Gland.

A. Reservoir.

B. B. Pouches.

C. C. Pouches cut open.

D. D. Lobes and secretory cavities or cells, only a few lobes and pouches introduced, to make it more perspicuous.

* The veins injected with yellow wax are seen terminating in the Vena Innominata and Thyroideal veins; the arteries pass to the Gland from the inferior Thyroideal in this subject.

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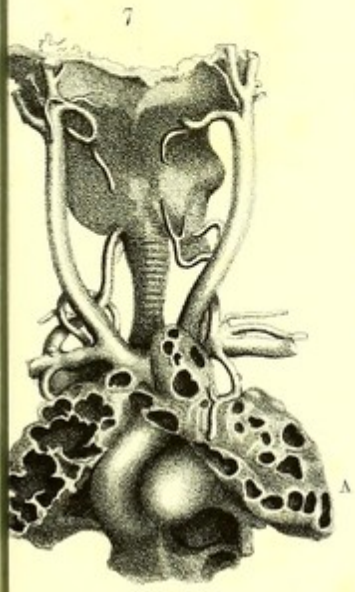
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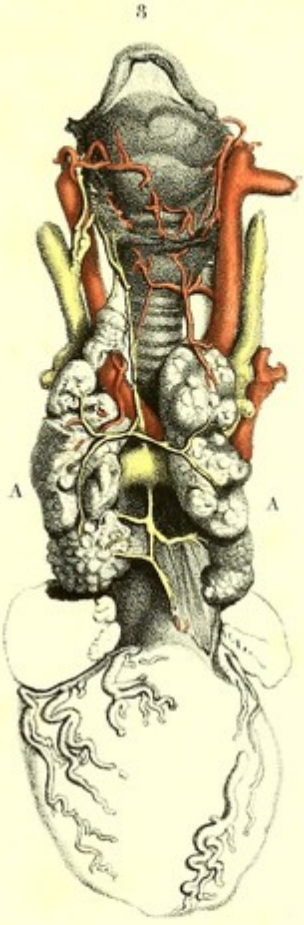
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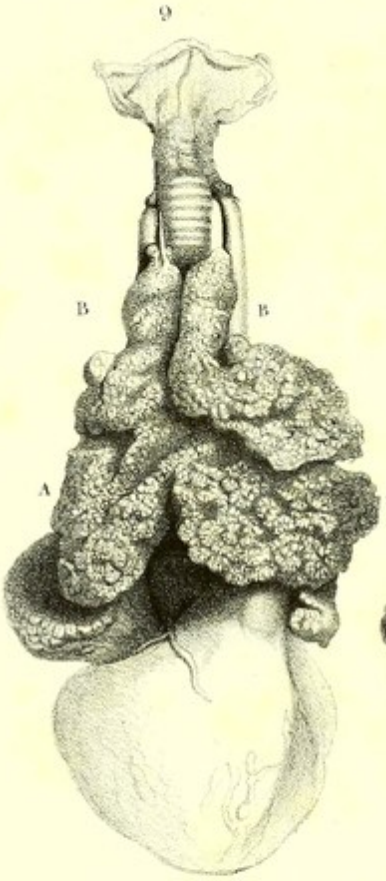
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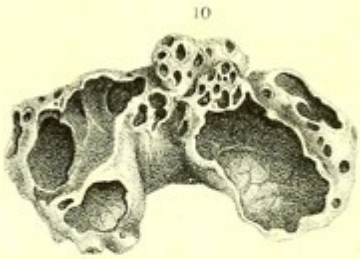
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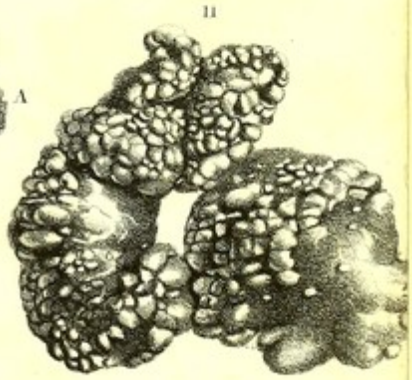
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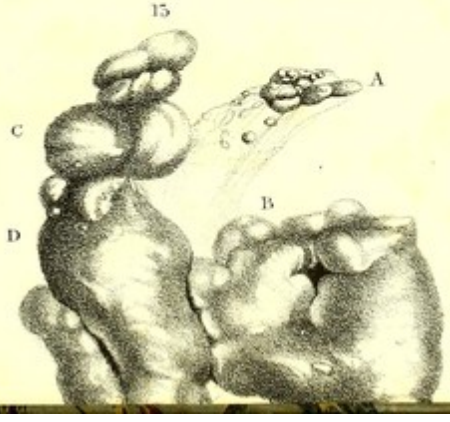
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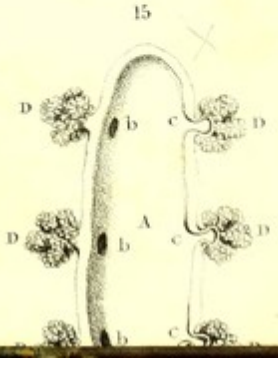
15
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c
D
D
A
b
c
D
b
c