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ON

THE ANATOMY

OF THE

BREAST.

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BY

SIR ASTLEY PASTON COOPER, BART.,

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&c. &c. &c.

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TO THE

MEMBERS OF THE MEDICAL PROFESSION.

My dear Brethren,

I dedicate this work to you for two reasons.

First: To express the delight I feel at observing your increased love for the Science of the Profession, and your earnest desire to found your Practice on an intimate knowledge of Anatomy, Physiology, and Pathology.

Secondly: To thank you for your unwearied kindness and attention to myself during a period of fifty years.

Should I by this work add anything to your knowledge of the Anatomy of the Breast, I shall have received the utmost and only reward which I am anxious to obtain by its publication.

With every wish for your prosperity, I have the pleasure to remain,

Your's most sincerely and gratefully,

ASTLEY PASTON COOPER.

Conduit Street,
January, 1840.

INTRODUCTION.

A few years ago, I presented to the public a work on those Diseases of the Breast which bore some resemblance to malignant affections, and had been frequently confounded with them. These abnormal growths, although they might similate with such morbid changes in some of their characters and symptoms, yet differed from them in their progress, in the treatment which they required, and in the probability of a fatal termination.

It was my original design to follow up that work with a description of the Malignant Diseases of the Breast; but upon approaching the subject, I found that much confusion had been created by authors, who, without discriminating between natural and morbid structures, had written on the complaints of this gland. Thus we are told that scirrhus is marked and distinguished by its fibrous character: whereas, the fibrous appearance, in a great degree, belongs to the normal condition of the organ, and is not a product of the disease. Many other equally erroneous statements might be mentioned, and for this reason I felt that it was absolutely necessary to give an account of the natural structure of the Breast, before its morbid changes could be properly explained or understood.

In performing this task, I have restricted myself to describing from my own preparations only; and if every author in our profession would adopt this plan, and merely write on what he is capable of demonstrating, preserving, and exhibiting to others, the medical world would not be overwhelmed with those crude opinions, theories, and conjectures, which, according to the present system of quoting all that has been written, are sure to compose the greater part of the works that issue from the press. My rule has been to publish that only which I could show to those who were sceptical, and were yet desirous of arriving at the truth. The preparations delineated in my works on Hernia, on Dislocations and Fractures, on the Breast, on the Testis, and on the Thymus Gland, are all in good preservation, and can be immediately referred to, as they are either deposited at St. Thomas's or Guy's Hospital, or in my private collection. The parts represented in the present Description of the Structure of the Breast, are all in my own house.

Let all who labour in the Science of the Profession adopt this method, and we shall soon have numerous and useful specimens of normal and of morbid structures. Such preparations, collected both by private teachers, and by the medical persons attached to our different Hospitals, will form a basis of valuable and undeniable publications for the present generation and for posterity.

Those who wish to consult the best foreign authors upon the Structure of the Breast, should refer to the works of Morgagni, Haller, Meckel, Bichat by Roux, Marjolin, and Müller, names which bespeak the highest excellence in the Science to which these anatomists have devoted themselves.

ON

THE BREASTS, OR MAMMÆ.

GENERAL OBSERVATIONS.

WHILST the changes for the reproduction of the species are proceeding in the uterus, Nature is not unmindful or regardless of the wants of the offspring so soon as it shall be born; but in all the class Mammalia she has provided glands to supply bountifully, by the secretion of milk, that nourishment which the young animal will require soon after it begins to breathe. The Breasts, or Mammæ, are formed for this purpose; and soon after the commencement of utero-gestation, they begin to receive an additional supply of blood to prepare for the new secretion; and thus, by an admirable foresight, when the link which united the offspring to the mother is broken, a new and entirely different mode of nutrition is substituted for that which it had previously received.

The mammary glands and the dugs of animals, in order to render them efficient for the above design, are necessarily constituted of two sets of parts,—the internal and external. The first, which is concealed under the skin, is the glandular or secretory organ; the second, which appears externally, and which is called the mamilla, nipple, or teat, is formed to convey the secretion of the gland to the offspring. The former would be of no use without the latter; for, however abundant the secretion of milk, the infant would be unable to receive it, if the nipple, or mamilla, had not been added to the breast, or mamma.

In the human female, the breasts are placed upon the anterior and lateral parts of the chest, in what may be called the mammary region; and here the child, when sucking, is placed immediately under its mother's eye, as it receives the nourishment from her breast. Here it almost irresistibly solicits her tender and regular attention, and the demonstrations of that affection which ought to be, in future life, reciprocal between the parent and the offspring.

The breasts, from their prominence, their roundness, the white colour of their skin, and the red colour of the nipples, by which they are surmounted, add great beauty to the female form; for prior to the age of puberty, the girl and boy differ but little in the shape of the chest, or in its general appearance; but as the breasts develop, the female figure is established in all its elegance.

In age, these glands become in a great degree absorbed, and the flatness of the chest, before puberty, would return, but that in general a quantity of fat occupies the place which they previously held, and thus often preserves the general contour of the chest.

Although, in the human subject, they are placed upon the chest, and are therefore pectoral glands, in other animals their situation varies, for their protection from injury, and for the convenience of the offspring. In woman, in the monkey tribe, in the bat, &c., the mammary glands are placed upon the anterior and lateral parts of the chest; and in the two former at least, with the design that the mother shall conveniently support her offspring, whilst sucking, in her arms. The cow, the mare, the goat, the elephant, the deer, &c., have them placed between their hinder extremities, and then they may be said to be *inguinal*. In the whale, they are placed on the abdomen on each side of the anus, and may be called *abdominal*. But in a great number of animals, they are inguinal, abdominal, pectoral, and even cervical.

The size of the mammary glands is not always proportioned to that of the young: the gland in the cow is much larger in proportion than in the mare, and in the goat than in the sheep: the udder of the cow greatly exceeds in size that of the mare, and the quantity of milk produced is more considerable than the young animal appears absolutely to require. A cow will secrete from fifteen to twenty quarts of milk in the day. Man has availed himself of this apparent superfluity, to take from the cow and the goat their superabundant milk, for his own and his children's nourishment; and after he has removed many quarts of the secretion, sufficient is left for the offspring, not only to nourish, but to fatten it. Nor is size of the gland a certain criterion of the extent of its secretion, as the very large is often more solid than secretory.

The number of glands also very considerably varies; and they are not always proportioned to that of the offspring. In woman there are two; in the cow, four perfect; in the bitch, ten; in the cat, eight; in the guinea-pig, two only: yet the cow has generally only one young, and the guinea-pig has several.

In so far as my examination of the structure of the mammary glands has gone, in different animals, I find that although there are differences in external character, in size, in number, and in situation, yet their true secretory organization is very similar in all, and that, however complicated they may at first sight appear, yet their intimate internal structure really exhibits a remarkable degree of simplicity.

In other glands, as for example in the testis, the source and the serpentine direction of the *arteries* appears to be quite essential to the performance of its functions, as the spermatic artery varies but little in those two respects; but the mammary arteries vary exceedingly in the human subject in their sources, as well as in their course, yet the function of the gland continues the same. Also, in the mammary glands of other animals, the sources of arterial supply are from the epigastric, the lumbar, the intercostal, and the axillary arteries, as in the pig, the hare, and the rabbit; and it therefore appears that if the gland receives its supply of arterial blood, it matters little, as to the secretion, from what source it is derived. The number of excretory ducts in each nipple seems to depend more upon the form of the gland, and the convenience of radiation and suckling, than upon the number of the young, for in general, when there are many teats, each teat contains several milk tubes.

The veins also vary in their course and terminations, as much as the arteries. The nerves which are distributed to these organs, although they arise from the spinal cord and grand sympathetic united, originate in woman from the dorsal nerves, in the pig from the dorsal and lumbar, and in the cow from the third lumbar nerve.

Although, as I have stated, the mammary glands are of simple construction when developed, yet to dissect and prepare their constituent parts and intimate structure for a clear demonstration is a very difficult task; so that I have heard a good anatomist say, "the breast is so complicated that I can make nothing clear of it." It is therefore right that I should state the different circumstances to which I have attended in making the numerous preparations I now possess.

First, then, it is necessary that the breast employed for the purpose should be that of a woman who has been for some time suckling: for the breasts of a woman who dies of puerperal fever, in the first few days or weeks from her confinement, are not in a fit state to be clearly developed, as the milk cells are not completely evolved, and the gland is so loaded with blood, that the ducts and glandules are obscured in it, not only at the time of injection and dissection, but when afterwards dried.

Secondly.—It is usual to inject the ducts with quicksilver; but this injection, although it answers well in displaying the milk cells, yet does not succeed in distinguishing the various lactiferous tubes of the different parts of the gland; and in the subsequent dissection, it is scarcely possible to avoid cutting the ducts, emptying the gland, and spoiling the preparation, however previously beautiful.

It is, therefore, better to inject the gland with size of different colours, or with coloured wax, by which at once each duct is distinctly shown, and even the cells will be displayed.

The various ducts are so interwoven and intermixed with each other, that they can by these means only be distinguished, or their distribution be clearly demonstrated. Quicksilver gives a general idea of the structure, but coloured injections a clear, distinct, and very intelligible view of the whole; and the dissection may be readily conducted, without injury to the preparation.

Thirdly.—To ascertain the quantity of glandulous matter, at different periods of life, it is requisite that the breast be put for a short time in boiling water, when the skin and fat become detached, and the gland, like other albuminous compositions, is left extremely hardened, and perfectly insulated and separated from the surrounding parts. This process furnishes an opportunity of giving an estimate of the quantity of gland, at puberty, in the adult, and in old age; as will be seen in one of my plates. Dried, after being boiled, the gland may be preserved for many years.

Fourthly.—To unravel the milk ducts, and to demonstrate the fibrous tissue of the gland, it is to be macerated in warm water, and dissected from day to day; and its ducts and glandules will be separated and shown. A section of the breast should also be made, from the nipple to the pectoral muscle, and then macerated in warm water, and daily dissected, when the ducts, the secretory structure, and fibrous suspensory tissue, will be shown, between the gland and the skin in the interior of the organ, and in its passage to the aponeurosis of the pectoral muscle.

Fifthly.—To show the connexion of the breast with the fascia of the thorax, the axilla must be carefully dissected in the adult, and its fascia traced.

Sixthly.—The arteries, veins, and absorbents, must be minutely injected. These vessels are large at the period of lactation, but small before and after that process, and are then injected with difficulty.

Lastly.—To trace the nerve in the mammary gland, and in the nipple, the arteries must be previously injected with a fine injection, properly coloured, for if this be not done, it is impossible to distinguish their minute divisions from the finer branches of the arteries.

STRUCTURE OF THE BREAST IN THE HUMAN FEMALE.

The breasts or mammary glands are placed upon the anterior and lateral parts of the chest, and are designed to secrete milk for the nourishment of the infant.

As I have already observed, they are composed of two sets of parts, the *external* and *internal*, the external comprising the nipple, or mammilla, areola, tubercles, and some glands. The internal is the secretory organ, made up of an assemblage of small secreting bodies, or glandules, from which proceed the excretory vessels, or lactiferous tubes, to the nipple. The glandules and ducts are united to each other, by means of a *fibrous* and inelastic membrane, which penetrates the surface of the gland, and sends fibres into all its interstices, and by uniting its small constituent glandulous bodies, forms it into what is called a conglomerate gland.

A cellular membrane, both reticulated and adipose, also enters into the composition of the gland; and in this membrane not only is abundance of fat deposited, but also the arteries, veins, absorbents, and nerves hold their course, and are distributed to the substance of the gland, and to its appendage the nipple.

The mammary gland may, therefore, be said to be composed of Glandules and Ducts, and of the common organization of arteries, veins, absorbents, and nerves, united by an inelastic fibrous structure, and by an elastic cellular tissue, to which is added a projection, or nipple, for the termination of its tubes, and for the adhesion of the child in sucking. The union of these parts constitutes the beautiful organ which gives the name to the class Mammalia.

The mammary region contains the two breasts; one placed upon each side of the thorax, and opposite to each other between the sternum and the axilla, being situated upon the lower part of the platysma myoides muscle, upon the fore part of the pectoralis major, upon the serratus major anticus, and obliquus externus abdominis, and they reach from the third to the seventh rib.

The form of the breasts is hemispherical upon the anterior surface, but flat, or rather concave posteriorly, so that they are thus adapted to the convex surface of the thorax. Their anterior surface has the nipple, or mamilla, projecting from it, to meet the lips of the infant. Their posterior surface, which is smoother, may, from its situation, be called costal. Their marginal aspects are superior, or clavicular, resting upon the origin of the platysma myoides and third rib, inferior or abdominal, placed upon the external oblique muscle and seventh rib. The inner, or sternal aspect, rests upon the pectoralis major and its aponeurosis, and upon the cartilages of the ribs. The outer, or axillary margin, laps over the edge of the pectoralis major, and rests upon the fascia of the thorax, and upon the serratus major and obliquus externus abdominis muscles.

The arched form of the ribs gives to the breast a considerable projection, which facilitates the access of the child to the nipple; but the clavicular and sternal margins are flatter, at the part at which the projection would be attended with no advantage.

The breasts are slung upon the chest, supported by the fibrous tissue, and they are projected at the nipple *forwards* and *outwards*. I have, in my work on the Testis, pointed out the errors of those who paint or chisel from imagination, and not from observation of nature, in placing those bodies of equal height, although the left is usually much lower than the other; and the same remark may apply to the breasts, modellers, sculptors, and painters sometimes represent the nipples as being pointed forwards, and place them as their imagination leads them to conceive them to be, and not as they really are. It is modern artists who fall into this error, for the ancients modelled from the living subject, and gave accurate representations of nature.

This natural obliquity of the mamilla, or nipple, forwards and outwards, with a slight turn of the nipple upwards, is one of the most beautiful provisions in nature, both for the mother and the child. To the mother, because the child rests upon her arm and lap in the most convenient position for sucking, for if the nipple and breast had projected directly forwards, the child must have been supported before her by the mother's hands in a most inconvenient and fatiguing position, instead of its reclining upon her side and arm. But it is wisely provided by nature, that when the child reposes upon its mother's arm, it has its mouth directly applied to the nipple, which is turned outwards to receive it; whilst the lower part of the breast forms a cushion upon which the cheek of the infant tranquilly reposes. Thus it is we have always to admire the simplicity, the beauty, and the utility, of those deviations of form in the construction of the body which the imagination of man would lead him, à priori, to believe most symmetrical, natural, and convenient.

It is proper, however, to observe that frequent lactation, by relaxing the breast, changes the position of the nipple from without, inwards, as the axillary part of the breast descends; but still the child is able to suck in its usual position, because the relaxation of the bosom permits the breast still to be drawn outwards.

It was the opinion of Buffon, that in the natural position of the breasts they formed an equilateral triangle with the upper part of the sternum; but this does not appear to be correct. He says, "Au reste pour que les mamelles des femmes soient bien placées, il faut qu'il y ait autant d'espace de l'un des mamelons, à l'autre qu'il y en à depuis le mamelon jusqu'au milieu de la fossette des clavicules, en sorte que ces trois points fassent un triangle équilatéral."—*Histoire Naturelle.*

The measurement of the Venus de Medicis is, from one nipple to the other, $7\frac{5}{8}$ inches; from the pit between the clavicles to each nipple is $6\frac{1}{2}$ inches; so that the base of the triangle is longer than its sides, and the nipples are more distant from each other than from the neck.

The margins of the breast do not form a regular disk, but the secreting structure often projects into the surrounding fibrous and adipose tissue, so as to produce radii from the nipple of very unequal lengths, and a circular sweep of the knife cuts off many of its projections, spoils the breast for dissection, and in surgical operations leaves much of the disease unremoved.

The breasts are generally two in number; and this number is not given, as has been supposed, to support twins, but as a provision against disease or accident, by which one of them might be rendered useless, or be entirely destroyed.

One breast is fully equal to the nourishment of the child of a healthy woman, as is often proved by inflammatory attacks, destroying the secretory power of one breast, yet the mother is still able to nourish the child with the other.

Twins are rare, but the existence of two breasts is almost universal; I say almost, because exceptions do occasionally occur, of several being found; and not only in the pectoral and axillary region, but some authors relate that in other parts of the body they have been occasionally seen.

However, as I wish principally to describe in this work, that which I have had an opportunity of witnessing myself, I shall give the history of a case of four breasts in the same female, which, through the kindness of Dr. Robert Lee, of Golden-square, Lecturer on Midwifery at St. George's Hospital, I had an opportunity of seeing with him, and the following is his account of the case.

"Mrs. ——, aged thirty-five, was delivered prematurely of a still-born child on the 21st of July, 1835. Soon after the mammæ became excessively painful and distended, and she had a severe attack of fever, with delirium. Although the symptoms became daily more aggravated, a week elapsed before she would permit the condition of the breasts to be ascertained. On inquiry into the cause of this unwillingness to allow the necessary examination of the mammæ to be made, I was informed by her sister-in-law that she had two mammæ and two nipples upon each side, and that this peculiarity, which she was anxious to conceal, had been observed ten years before, when her first confinement took place. After long entreaty I obtained leave to inspect the breasts, and was surprised to find there were two upon each side, as had been represented. The two on the same side were separated by a deep oblique depression. The inferior or pectoral mammæ, as they were afterwards termed by Sir Astley Cooper, were fully developed, and in the natural situation; and their nipples, areolæ, and glands, presented nothing unusual in their appearance.

" Near the anterior margin of the axilla, a little higher up on each side, was situated another mamma, about one-sixth the size of the others. The nipples of these were small and flat, but when gently pressed, a milky fluid, which had all the characters of the milk, secreted by the other breasts, flowed copiously and readily from several ducts, which opened at their extremities. When milk was drawn from the lower breasts, a small quantity usually escaped from the nipples of the superior breasts, and when the draught came into the former, the latter invariably became hard and distended.

" Mrs. —— had previously borne several living children, and five years before this period had twins, when she had a severe attack of uterine inflammation, and suffered much from painful distension of the two upper breasts. In consequence of the flatness of their nipples, she has never been able to suckle any of her children with these. The vagina, orifice of the uterus, and all the other organs, besides the mammæ, in this female, are well formed.

" I mentioned this case to Sir Astley Cooper at the time it first came under my observation, but he did not see it with me until the 28th of February, 1836, several months after the secretion of milk had entirely ceased. When he saw the mammæ, he said there could be no doubt that there were two on each side, an *axillary* and a *pectoral* breast, and that nature had separated them completely from each other. He considered it proper that some record should be given of this case, which he thought to be without a parallel in this country.

" Mrs. —— again became pregnant, and was safely delivered on the 19th of July, 1837, of a living child, which she now suckles with the pectoral breasts, and the axillary breasts again present the same appearances as those which have now been described.

" The preceding case furnishes one of the best examples of quadruple mammæ in the human subject which has yet occurred.

"Robert Lee."

The breasts greatly vary in their extent, but they usually reach from the third to the seventh rib; however, lactation, especially if frequent, the time of life, and the relaxation of warm climates, occasion great changes in their situation and extent, and I have seen them reach to the ninth and tenth rib.

Frequent lactation, even in our own climate, leaves the breasts relaxed and pendulous, and alters both their form and their direction; it is, therefore, right that they should have a sling under them, a cushion, or stays to support them, to prevent their undergoing a change, which may by care, be, in a great degree, obviated. But it is the influence of warm climates which relaxes them most, and hence the women of the East and West Indies, who have had several children, have their breasts hanging to the upper part of the abdomen, suspended by a thin portion of skin from the part at which they originally grew. This relaxation allows them to suckle over the shoulder; the child being suspended from the back, elevates the breast to the clavicle, or if the breast be carried into the axilla, the child can suck under the arm, if the latter be raised.

In Africa the breasts are most remarkably changed in the Hottentot women; and a gentleman who had long resided at the Cape of Good Hope, gave me the following account.

"The Hottentot women are miserable-looking, relaxed, shrivelled, debilitated, and shrunken creatures. Their breasts hang by a fold of skin very loosely upon the abdomen, as a stone does in a sling. The child is sometimes placed upon the back of its mother, who raises her breast to her shoulder, over which the infant can suck. The large nates of the women form a convenient shelf for the child to rest upon. The Hottentot women are in the habit of binding down their breasts with a circular bandage of bark, ornamented by beads, which keep the bandage in its place by their weight." He had the kindness to give me one of these belts, which I have still in my possession.

But this great relaxation of the breasts is not peculiar to the females of warm climates, but is also seen in the coldest regions which man can inhabit. The Esquimaux women, who live in cabins excessively heated through a long winter, are, I am informed, subject to similar changes as those of hot climates, their breasts becoming very pendulous, from the artificially heated atmosphere in which they live.

This change in the position of the breasts from climate and other causes, would be much greater, if the breast had only a connexion with the chest by cellular tissue, but the fibrous structure does not so readily yield to relaxing causes.

The breasts vary greatly in thickness at different parts. The axillary margin is very dense and compact, and the same may be observed of the abdominal margin, but the sternal and clavicular portions are much thinner than the others, and, consequently, project less.

In this way the lower part of the breast forms the cushion, upon which the cheek of the child reposes as it sucks its mother's bosom ; and as to the causes by which this greater thickness and projection are produced, I shall particularly point them out in speaking of the gland, but I may here observe, that upon this structure depends the projection of the nipple, the ready access which the child has to it, and thus two important objects are accomplished.

The sensation imparted to the hand in feeling the breast, at different periods of life, very considerably varies. At the age of puberty, and for many years afterwards, the breast is dense, compact, smooth, and equal ; but so soon as they become employed in lactation, they begin to separate into small bodies with indentations around them, and this arises from the stretch and relaxation of the uniting cellular and fibrous membrane. Even in single or childless women the breasts, towards the cessation of the sexual secretion, become often exceedingly lobulated. In age the lobulated feeling ceases from the absorption of the glandular structure. The return of the menstrual secretion also makes a great difference in the feel of the breasts, as they then become full, tense, and painful, and an ecchymosis sometimes appears. It is of importance to know these changes, as they lead to a clearer diagnosis in disease.

Pressure or injury on the breasts produces a sensation of nausea, and if carried far it excites vomiting, which almost constantly occurs in important operations upon the breast, especially if food has been taken but a short time before.

OF THE STRUCTURE OF THE CONSTITUENT PARTS OF THE BREASTS.

For the more clear and intelligible description of these parts, I shall begin from without and proceed inwards, rather than pursue the course of the milk from its secretion to the orifices of the milk tubes in the nipple, as it will enable me to pass from the simple to the more complicated structures, and I shall commence with the

Nipple, or Mamilla.

This part springs from the convex surface of the breast, and projects forwards and outwards, the point being also generally directed slightly upwards.

It is an organ of the utmost importance to the secretory functions of the breast, for without it the secretion of milk would proceed in vain, as it could not be conveyed into the mouth of the child. It is a cutaneous projection, but it contains within it the terminating extremities of the milk ducts, blood vessels, and nerves, united by a fibrous and cellular tissue.

The nipple is not placed at the centre of the breast, but is situated nearer the abdominal margin of the gland than the clavicular edge. In a well-formed breast the measurements were as follow, in a girl eighteen years of age, who was unmarried.

From the clavicular margin to the nipple, $2\frac{3}{8}$ inches.

From the abdominal margin to the nipple, $1\frac{3}{4}$ inches.

From the sternal margin to the nipple, $1\frac{7}{8}$ inches.

From the outer margin of the breast to the nipple, $2\frac{1}{4}$ in.

From the axillary margin to the nipple, $2\frac{1}{2}$ inches.

The diameter of the breast horizontally was a little more than 4 inches, and vertically nearly the same.

The nipple is placed below a line drawn across the middle of the gland from the sternum to the axilla, and on the outer side of a vertical line from the middle of the clavicle to the abdomen. It is usually placed from one-half to three-quarters of an inch above the lower edge of the pectoralis major.

The form of the nipple is that of a cone, rather rounded at its extremity in the virgin, but it forms a flat surface in the lactating woman, the centre of which is cribriform, being perforated by the numerous terminations of the lactiferous tubes, which are placed in a cleft before lactation, but are spread out upon the surface pending that period. The circumference of the nipple at its base is attached to the areola.

The direction of the nipple is, as I have stated, forwards and outwards, but it is very much changed by lactation, more especially if it be frequently repeated.

In the female infant the nipple is placed upon the edge of the fourth rib. At puberty it descends to between the fourth and fifth ribs; in the adult it reaches the fifth rib. After several lactations it descends to the seventh rib, and sometimes lower; and in this relaxed and pendulous state the child can draw the nipple in any direction which may suit its convenience.

In the child the nipple scarcely rises above the skin of the areola, but it usually grows to the age of puberty; in the adult female it is from half an inch to three-quarters in length; in lactation it is often an inch. After fifty it remains elongated, but relaxed; in old age it is sometimes in a great degree absorbed, and when thus wasted, appears as a mere wart.

The nipple is nearly smooth until puberty. At fifteen years it has a cleft near its centre, in which are the orifices of the lactiferous tubes, and it forms an uneven hemispherical projection.

At sixteen years it is slightly wrinkled; at seventeen it has small papillæ upon its surface. From twenty to forty years the papillæ are large; from forty to fifty the nipple becomes wrinkled; from fifty to sixty the nipple is elongated, and in old age it usually has a warty appearance.

In suckling women the nipple is not only elongated, but its cone is reversed; for its extremity or broadest part, and greatest diameter, was its apex in the virgin nipple, and this change of form renders the adhesion of the child's mouth much more firm and complete.

The colour of the nipple varies at different periods of life, and under different states of the uterus. In infancy it is of a pinkish-red; at puberty of a more florid red. In young women of a slightly brownish red, but in pregnancy it becomes of a very dark colour. In old age it becomes again more of the hue of the surrounding skin, although sometimes it remains very dark. The nipple is often defective, or buried in a cleft, and is sometimes entirely wanting; the first makes nursing difficult, and the second prevents it altogether.

The nipple, or mamilla, is composed of the following structures:—

First, of the common integuments.

Secondly, of the fascia covering and surrounding the lactiferous ducts.

Thirdly, of the milk tubes.

Fourthly, of the common organization of arteries, veins, absorbents and nerves.

Fifthly, of cellular tissue, in which those parts are found.

First, of the common integuments.

The Cuticle.

This texture covers the nipple and projects between its folds and into its depressions. It sends processes into the lactiferous tubes, which processes may be drawn out after continued maceration.

It forms folds and a net-work upon its inner surface, of very irregular and unequal meshes.

It adheres to the cutis by passing between its projections and by entering into its pores; and as its processes into the lactiferous tubes are the largest, it adheres more firmly at the apex of the nipple, than elsewhere on the breast.

In lactating women so soon as the cuticle is removed, the orifices of the lactiferous tubes become very apparent.

In women of light complexions, and more especially those with red hair, the cuticle is extremely thin, and is frequently subject to abrasion from the application of the child's lips in sucking, and the process of nursing is, from this cause, rendered exceedingly, and I might say, almost intolerably painful, and therefore astringent applications are required, or often a shield is obliged to be applied to defend the part and to favour the reproduction of the cuticle.

In similar temperaments, incrustations often form on the nipples of girls, covering their clefts and points, and requiring attention to prevent ulceration, which the unguentum hydrargyri nitratis, or unguentum zinci, are most fitted to oppose. In age an incrustation of a much firmer kind fills the cleft and covers the point of the mamilla.

Of the Rete Mucosum of the Nipple.

Beneath the cuticle is situated the colouring matter of the skin.

It adheres firmly to the posterior surface of the cuticle, and is placed upon the anterior surface of the cutis.

It is not so abundant on the nipple as upon the areola, on which I shall chiefly describe it.

It not only covers the surface of the nipple, but enters, with the cuticle, into its lactiferous tubes. This may be better seen in other animals than in the human female, as the ducts are small; but in the larger quadrupeds, when the skin is dark, the cuticle and rete mucosum may be seen terminating within the lactiferous tubes, at a few lines from their extremities, forming a fringed edge.

The nipple, deprived of its rete mucosum and cuticle, appears white as the skin of other parts of the body.

Some follicles exist in the nipple, and admit the cuticle and rete mucosum.

Of the Cutis of the Nipple.

The cutis forms a considerable portion of the nipple, and it is divided into two surfaces, when the breast is in a state of lactation.

The first forms the disk or circumference of the nipple, and the second its broad, flat, truncated apex, in which the terminations of the milk tubes may be seen in numerous orifices.

The disk is composed of a great number of papillæ, which produce a vascular and sentient surface, and which form its erectile and highly sensitive tissue.

The direction of these papillæ is from the base towards the apex of the nipple, so that they are pushed back as the mamilla enters the mouth of the child, and thus greater excitement is produced.

They lap over the truncated extremity of the nipple, forming a foliage upon its apex.

They form, in their arrangement upon the nipple, broken portions of circles; but when the nipple is elongated and dried, they appear to be spiral.

They form flaps, which are at their edges divided into numerous projections, with serrated depressions between them.

They are directed forwards towards the apex of the nipple, and the papillæ of the child's lips passing from within outwards, meet them in sucking, are received between them, intermix with them, and produce considerable adhesion and sensation.

They are very numerous and large for the size of the part, and rather spongy at their extremities.

They are very vascular bodies, and I have given a figure of them injected. The minute arteries which pass from the base towards the apex of the nipple, send numerous branches to the papillæ cutis, which divide into little bushes of vessels in each papilla, and terminate in veins.

The veins, also, are very numerous, and they will be seen injected, and forming bushes similar to the extremities of the arteries*.

The application of the child's lips, the drawing of the nipple in the motions of the child's head, and the suction produced by its mouth, produce so much excitement as to occasion erection of the nipple.

* Let him who doubts in the direct communication between arteries and veins, look through a microscope at the tail of the tadpole, in which numerous communications between these vessels may be observed. Let him divide all these communications but one, and the vein directly pulsates like an artery. Or if coarse injection be thrown into the human radial and ulnar arteries, it returns freely by the veins. Of this injection I have two beautiful preparations.

This effect has been supposed to arise from the passage of the blood into an elastic, cellular structure, like the corpora cavernosa penis, but there is no such formation in the nipple. It is a state arising simply from the determination of blood into the little bushes or assemblage of capillary arteries in the nipple and papillæ. The blood is propelled forwards to the papillæ by the action of the heart and arteries, so that by this vis a tergo, the capillary arteries become extremely distended, and erection is produced; it more slowly escapes through the little branches of communication with the veins, and which are more distant from and less under the influence of the vis a tergo from the heart, which is the principal source of the circulation; thus a congestion of arterial blood is produced in the capillary arteries. But when the excitement subsides, the blood is no longer directed with the same impetuosity upon the papillæ, and the veins will then remove the congestion in the extreme branches of the arteries, as the vis a tergo has in a considerable degree subsided.

This erection of the nipple may be produced, not only by mechanical causes, as in suckling, but also by mental excitement, as by the influence of the passions.

Moral causes affect not only the nipple, but the mammary gland, and thus occasion a greater determination of blood to it, and a more considerable secretion from its glandules, by the nervous communication between its different parts.

Thus then is formed the papillous surface or disk of the nipple, and as to its apex, and what is, when the breast is in a state of lactation, its truncated surface, it is a cleft generally before the breast secretes; but during lactation the papillæ are everted, and the broad surface of the apex is exposed, and then the orifices of the lactiferous tubes appear, which terminate in a kind of cribriform net-work, between the meshes of which the milk escapes. This net-work being very little elastic, yields but slightly to the pressure of the milk, so that the orifices of the ducts continue of very diminutive size, not only in woman, but in other animals: thus it is that the escape of the milk is prevented, excepting under excessive distension and in the process of suckling.

There is no transverse wrinkling of the lactiferous tube nternally, as Haller states, to prevent the escape of the milk, but, as any one may at once see by cutting open the tubes near their terminations, they are wrinkled longitudinally, to allow of a greater dilatation of the tube behind the contracted orifice.

On the inner side of the cutis, which forms the nipple, it is lined by a fibrous tissue, which passing from the surface of the breast to the skin, covers and encircles the lactiferous tubes. This structure forms the strong connecting medium between the nipple and the gland of the breast; it prevents great elongations and relaxation of the nipple, and it is the chief defence from those injuries and violences which might tear off the mamilla from the gland, separate the ducts, and destroy the function and utility of the organ. This circle of fascia around the ducts is derived from the general fibrous tissue of the breast and thorax.

As some degree of elongation and change of place is necessary to the performance of the functions of the nipple, it also contains a cellular tissue, which is elastic, and admits of change in the form and situation of this projection. In this tissue the arteries and veins are supported, as well as the absorbents and the nerves. It is in the nipple more of the reticular than of the adipose kind, because much fat placed in the substance of the nipple itself, would be attended with great inconvenience, and might, indeed, interfere with the function of the part, and defeat the object of Nature.

Within this reticular tissue are placed the lactiferous tubes as they proceed to their termination upon the truncated surface of the nipple, which tissue permits them to be elongated and drawn into capillary tubes at the time of sucking.

Thus, then, the nipple is formed of the common integuments with numerous papillæ upon its disk, of an apex with cribriform openings for the termination of the lactiferous tubes, within the integuments, of a fibrous tissue, and more internally still, of a reticular tissue conveying the blood vessels, absorbents, and nerves; lastly, of the lactiferous tubes, as they proceed to their termination.

The arteries of the nipple are principally four :—

First, the thoracica longa sends branches to its outer or axillary side.

Secondly, an external mammary artery which is also often a branch of the former, is distributed particularly to the nipple and breast, and both the first and second are derived from the axillary artery.

There are also two principal anterior branches.

First, one from the *internal mammary* artery, which passes from the inner side of the thorax between the second and third ribs to the anterior surface of the chest, on the outer part of the sternum, and descends to the upper part of the nipple.

Secondly, there is another large anterior branch, from the internal mammary, which usually appears upon the fore part of the chest, and which is found generally between the cartilages of the fourth and fifth ribs, and passes to the sternal side of the nipple; however, varieties occur, and in my plate, two arteries pass between the third and fourth cartilages, and one between the fourth and fifth.

To the upper part of the breast an artery which penetrates the pectoralis major, derived from the thoracica suprema, passes to the upper part of the nipple, and small anterior branches perforate the intercostal muscles of the third and fifth spaces between the cartilages, to proceed to the inner, lower, and back part of the nipple.

The upper of the principal anterior branches is derived from the internal mammary artery, and the lower from the internal mammary intercostal arteries.

These arteries greatly vary in their course; however, their sources are generally from the axillary and from the internal mammary arteries.

They pass to the basis of the nipple, and there they have lateral branches of communication, and from these proceed parallel arteries, which are continued from the basis to the apex of the nipple, and send vessels to the papillæ at the apex; whilst others pass backwards to the lactiferous tubes, and entering the centre of the gland, communicate with the deeply seated arteries which enter at the back of the organ from the intercostals.

The veins of the nipple originate in bundles or bushes of capillary veins, from which larger branches arise that form a net-work at the roots of the papillæ cutis, and then they enter much larger veins, which pass to the base of the nipple.

The veins beginning thus at the nipple pass into large branches of veins, which enter a venous circle at the areola, and from this circle veins proceed from the nipple to the axillary and cephelic vein of the arm, also into a vein which pierces the intercostal muscles between the cartilages of the second and third ribs, and which enters the internal mammary vein, and one which penetrates below the fourth rib the intercostal muscles, to terminate in the internal mammary intercostal veins.

Other veins are found less regular in their course than those which I have described, entering the axillary, the cervical, internal mammary, and both kinds of intercostal veins; *viz.*, those of the vena azygos and the internal mammary vein.

The absorbents of the nipple, which are very large and numerous, proceed from its basis along the surface of the gland to the axillary fascia, where they pass through its cribriform absorbent opening or openings to terminate in the axillary absorbent glands immediately behind the fascial aperture, and a little above it, and close to the edge of the pectoralis major. But the absorbents on the sternal side of the nipple take two courses into the anterior mediastinum, *viz.*, between the second and third cartilages of the ribs, and between the fourth and fifth.

The nerves of the nipple, or mamilla, are two sets:—first, the posterior, or axillary; secondly the anterior, or sternal, as they proceed to one or the other part of the breast.

First, the posterior, consisting principally of the fourth and fifth dorsal branches, which penetrate the intercostal muscles behind the breast, and proceed supported on branches of arteries to the base and apex of the nipple. The third dorsal also sends a branch upon the arteries which descend to the nipple.

Secondly, the anterior, consisting principally of the reflected branch of the fourth dorsal nerve, which penetrates the intercostal muscles between the cartilages of the fourth and fifth layer of intercostal muscles, close to the outer part of the sternum, and accompanies the artery to the skin and base of the nipple on its sternal side.

The third nerve gives a branch to the anterior artery, which artery descends to the nipple; and the fifth, which is generally very small, now and then observes the distribution of the fourth.

To these branches of nerves is the nipple indebted for its capability of excitement from mental and mechanical stimuli, and for its high sensibility.

In addition to the structures which I have described, there are, at the apex of the nipple, the numerous and minute orifices of the lactiferous tubes, which amount to more than twenty orifices when in great numbers, and from twelve to fifteen in others, but I cannot be sure that all the openings are lactiferous ducts, as some may be follicles only.

OF THE AREOLA.

THE circle of skin which surrounds the base of the nipple has that name.

It is of a circular form, and is nearly upon a level with the surrounding skin.

The nipple springs out from it near its centre before lactation, but below the centre in lactating women.

It forms a smooth surface until the period of puberty, and then it has little eminences and tubercles upon its surface.

The diameter of the areola in a child is about half an inch. At puberty, and in young women, it is an inch; during lactation, it is two inches or more; and although, in after age, its colour diminishes, its diameter remains almost the same, excepting in very old persons, in whom it disappears.

The colour of the areola is rather darker than that of the nipple, but it varies in infancy, at puberty, in lactation, and in old age.

In the infant it is of a pinkish red; at puberty, of a darker red; in lactation, it becomes of a very dark colour, approaching that of the negro skin; in age it remains dark, but in old age it sometimes loses its colour, which becomes like that of the surrounding skin. This change of colour in the areola, in pregnancy, is of use both to the medical man, and to the female herself, in conveying information of her pregnant state, and is therefore much relied upon as a sign of that change in the uterus; but I have known a diseased and excited state of the uterus after marriage, when that organ had become enlarged, but not impregnated, produce a swelling of the breasts, and a discoloration of the areola; so that it is not an invariable criterion.

The change of colour, in the areola, which occurs in gestation, is attended with an increase of the size of the breast, and often with a secretion from the nipple. The cause of the change of colour I shall hereafter consider.

The areola is composed of the common integuments, somewhat modified.

Its *cuticle* is thin, like that of the nipple. It has a firm adhesion to the areola, because it passes between the papillæ, and into the wrinkles and folds of the cutis; and it therefore separates by putrefaction less readily than that of the surrounding skin, but more easily than that of the nipple.

It is thin, that it may not interfere with the sensibility of the cutis behind it. Like the cuticle of the nipple, it becomes, in women of light complexion, very frequently abraded, from the irritation of the child's lips, and a change in the mother's own secretions, and those in the mouth of the child.

The anterior surface of the cuticle of the areola takes on the forms of the parts behind it; but its posterior surface is reticulated in larger and smaller meshes, which are received between the folds of the true skin.

The rete mucosum of the areola might have its existence doubted in infancy, on account of its want of colour; but as the age advances, the areola darkens, and the colouring matter becomes very apparent even through the cuticle.

Its peculiar arrangement is readily distinguished, by raising the cuticle of the areola by maceration, spreading it in alcohol, which fixes it, and then by viewing it, by means of a slight magnifying power, a dark reticular texture may be perceived, placed upon the edges of the folds of the cuticle, and upon its inner surface; and to this deposit upon the reticulated surface of the cuticle, its own reticular appearance is probably owing.

If the cuticle, with its lining of rete mucosum, be separated in water, the rete mucosum may be washed off in flakes of different sizes.

If the areola be steeped in alcohol, and the cuticle be then raised, the rete mucosum will be chiefly left upon the cutis.

The deposit of this substance does not appear to be reticulated, but that character it derives from the form of the inner side of the cuticle, as above mentioned; but it seems to be deposited in small flakes, the aggregation of which produces a sheet of colouring matter.

The quantity of rete mucosum secreted must depend greatly upon the quantity of blood determined to the part. As soon as the influence of the uterus and ovaria is felt by the breasts, and they swell from more blood being determined to them, the rete mucosum is more largely secreted, and the colour of the areola and nipple becomes darker.

When the pregnant state of the uterus enlarges the breast, by increasing the flow of blood to it, the rete mucosum increases in quantity; but still more in lactation, when the nipple and areola are greatly excited, the depth of colour is the greatest, and the best opportunity is afforded of observing the colouring matter.

As the circulation declines in age, the rete mucosum diminishes in the areola.

The menstrual secretion has, from the change thus produced upon the breast, some influence upon the colour of the nipple and areola.

The effect of a hot climate by determining large quantities of blood to the skin, produces also a greater quantity of rete mucosum, and the change of complexion which climate produces, depends upon the greater or less circulation in the integuments, and accounts for the lightness of complexion in the northern parts of Europe, and its darkness in those who visit the south of Europe, or the East and West Indies.

The tanning which exposure to the sun in the summer of our climate occasions, is depending upon a similar cause.

With respect to the secretion of the rete mucosum, it is probably thrown out by the highly vascular surface of the cutis, not separated in the common state of the skin, but very visible under great determinations of blood to the cutis.

When I first visited the Museum of St. Thomas's Hospital, which was in the year 1784, there were three beautiful preparations, made by a Mr. Baynham*, of a vascular membrane, upon the cutis. They were made from subjects which had died of the small-pox, and which he injected; and when he had raised the cuticle and rete mucosum, he found a separable, delicate, but distinctly vascular membrane, upon the surface of the cutis, and between it and the rete mucosum; these preparations, I believe, are still in the museum, but an unusual determination of blood to the skin is required, to render the membrane separable and demonstrable.

* Mr. Baynham was a demonstrator of anatomy to Mr. Else, predecessor to Mr. Cline at St. Thomas's Hospital.

Of the Cutis of the Areola.

When the areola is examined with attention after the separation of the cuticle and rete mucosum, its surface is found to be covered with papillæ like those of the nipple, but of smaller size, although still extremely distinct. They are smallest at the circumference of the areola, but gradually increase in size as they approach the nipple.

They are disposed in circles, their bases fixed in the cutis, and the apex of each is directed towards the nipple, so that they are opposed to the papillæ of the lips of the child.

They are very vascular and sensitive bodies.

Their use is three-fold. First, they give a greater adhesion to the infant's lips in sucking; and secondly, they add to the sensibility and sympathies of the areola with the mammary gland; thirdly, they form a surface which is embraced by the child, and received into its mouth, so that the large lactiferous tubes behind the areola are emptied by the pressure of the lips of the infant.

The areola is, therefore, to be considered as an extension of the nipple, the base of which latter is lost in the former; its structure is very similar to that of the nipple, or mamilla.

The areola is a very vascular structure, and its arteries are the same as those supplying the nipple, being derived—first, from the axillary artery; secondly, from the internal mammary artery between the second and third cartilages; and thirdly, from the internal mammary artery between the cartilages of the fourth and fifth ribs, beside other smaller branches. They most minutely divide upon the papillæ of the areola.

The *veins* form an ellipsis on the areola, and around it, which receives the branches of the nipple and areola, and then they pass into the larger veins, as those of the nipple.

When minutely injected, the veins form a most beautiful net-work.

The *absorbents* of the areola take the same course as those of the nipple into the axilla, and they pass into the anterior mediastinum, chiefly between the second and third, and fourth and fifth cartilages of ribs.

The *nerves* are the same as those which are distributed to the nipple, *viz.*, the fourth and fifth posterior from the direct dorsal branches, and the fourth anterior or reflected nerve, to the anterior part of the areola, this nerve passing through the intercostal muscles between the cartilages of the ribs: the second and third anterior nerves send filaments, also, upon the internal mammary branches, which descend towards the areola, and the third posterior dorsal sends a branch upon the arteries descending to the breast from the axillary artery.

The areola, then, is to be considered as a part of the nipple, and a continuation of the organ of sucking. It, as well as the nipple, is received into the child's mouth, and is compressed by its lips and gums, and is drawn forward by them to compress and elongate the milk tubes. The larger milk tubes and reservoirs are placed behind the areola; and here, where the milk is collected, the compression is most effectual in emptying them, and in forcing out the accumulated secretion. So soon as the milk already formed is removed, the draught furnishes a fresh supply, and so it continues until that draught ceases.

Of the Tubercles of the Areola.

At the base of the nipple, and upon the surface of the areola, numerous tubercles appear in the skin; often they are placed upon the circumferance of the areola, where it joins the smooth skin.

In these there are orifices very visible to the naked eye.

The orifices vary in number from one to five.

The tubercles perform three offices: first, they discharge from their little springs a lubricating secretion; secondly, they add to the firmness of adhesion of the child's lips; and thirdly, they give greater sensibility to the areola, and sympathetically excite a larger secretion from the mammary gland.

It is a curious circumstance that such excellent anatomists as Morgagni, Meckel, and others, should have thought that the orifices in these tubercles had communication with the lactiferous tubes, and that the milk could be squeezed through them, and therefore in this way that the milk might be in part discharged; but that this opinion is not true, let any one satisfy himself, by grasping the nipple between his fingers, and then pressing upon the mammary gland; no fluid but a small drop of mucous matter will escape from the tubercles, either in the living or the dead subject. When the breast is in a state of lactation, the fluid issuing from these tubercles is whiter than after lactation has ceased.

Secondly. Let him examine the areola and nipple when it has become putrid, and he will see numerous little glands around the base of the nipple, and behind the areola, which are rendered distinct from being discolored by the putrefaction. These glands are small and lobulated: they vary in size from that of a small to a large pin's head, but are of an oval form.

Thirdly. I am able to force injection into these glands through their external openings, and I have beautiful preparations of them thus injected, and not one of them communicates with the lactiferous tubes.

Fourthly. A fascia separates entirely these glands from the lactiferous tubes.

They are, therefore, only mucous glands, formed to lubricate the nipple and areola, and to defend them from the friction of the child's lips, and the irritation of its secretions.

Those glandular tubercles which surround the nipple upon the areola, are more evolved than those situated at a greater distance.

These glands are very much enlarged in lactation, and pour out a fluid, which is coagulated by alcohol, and its appearance is like that of white of egg. The fluid they secrete has a tendency to lessen that excoriation which, when it does occur, renders suckling almost an agony.

If a breast be subjected to putrefaction, these glands are so darkened, as to become readily distinguishable on the internal surface of the cutis.

The glands are extremely vascular: they are lobulated and cellular. Each orifice opens into an arborescent vessel, or vessels. *(See Plate.)*

The *Skin* around the areola, and which covers and forms the surface of the breast, is particularly smooth, and generally very white; and the cause of this in each is the fascia of the breasts being received into, and intermixed with, the cutis, so that it is rendered smoother than elsewhere, whilst the glistening fibres of the fascia increase its whiteness.

It is in this way, also, its firmness is increased; and thus it is enabled to resist injuries.

A very few straggling hairs appear on it, as well as a slight down of finer hair.

A number of sudatory glands are perceptible upon the surface of the skin, from which much perspirable and mucous matter can be squeezed; for if the breast be gently wiped dry, and then compressed, it will continue to perspire largely after being several times dried: this is more especially the case if the cuticle has been separated by putrefaction; indeed, it is but little observable without it.

These pores often contain a fine hair, but they also secrete a fluid to cover the surface of the breast.

If the cuticle be raised by maceration and putrefaction, it is drawn out from these pores, into which the rete mucosum also enters, and which leaves them of a dark colour.

After the separation of the cuticle and hairs, I can throw coloured fluids into them, so as to make beautiful preparations. *(See Plate.)*

The orifices lead to little glands, which are placed in the cutis itself, appearing like the heads of small pins within the meshes of the true skin.

They differ from those of the areola, which project a little under the cutis, whilst these are buried in it, but the pore which they contain leads into an arborescent duct and gland. In the plates may be seen these sudatory glands injected, dividing into several branches, sometimes from two to five.

Thus, then, at the base of the nipple and areola, there are *areolar* mucous glands; but in the skin around, a smaller *cutaneous* set pour out a similar secretion, and from or near the same orifices small hairs proceed.

OF THE INTERNAL PARTS OF THE BREAST, OR MAMMARY GLAND.

Having now described the appendage to the breast, which is so absolutely necessary to the due performance of its functions, I shall proceed to point out the secretory part of this organ.

The parts which enter into its composition are:—

First, the fascia mammæ.

Secondly, the lactiferous tubes, or milk ducts.

Thirdly, the glandules in which the milk is secreted.

Fourthly, the milk cells.

Fifthly, the common organization of arteries, veins, absorbents, and nerves.

Sixthly, the fat and cellular tissue.

First, of the *fascia mammæ*. This is divided into two layers; the superficial, and the deeper layer of the breast, between which the gland of the breast is included.

If I begin to trace this fascia from the sternum, I find both layers adhering to the ligamentous substance which covers that bone. From thence they proceed towards the breast, when one layer separates from the other, to include the breast between them.

The anterior or superficial layer passes upon the anterior or cutaneous surface of the breast: here it forms a fibrous covering, but not a true capsule, spread upon the surface of the gland, and passing between the gland and the skin; but it also enters the interior of the secretory structure.

Here it sends out two sets of processes of a fibrous nature from its two surfaces.

Anteriorly, large, strong, and numerous fibrous or fascial processes, to the posterior surface of the skin which covers the breast, into the substance of which it is received, and with which it is incorporated.

It is by these processes that the breast is suspended in its situation, and I shall therefore call them the *ligamenta suspensoria*.

By these processes, the breast is slung upon the fore-part of the chest, for they form a moveable but very firm connexion with the skin, so that the breast has sufficient motion to elude violence; yet by this fibrous tissue it is, excepting under age, lactation, or relaxation, prevented from much change of place.

The ends of these ligaments are spread out and incorporated with the posterior surface of the skin, and give it its whiteness and firmness.

When raised and dried, the preparations of these ligamentous processes form a curious, irregular surface of folds, between the skin and the mammary gland. They are seen in a section of the breast, spread out and lost upon the inner surface of the skin at their anterior extremities. *See Plate.* When the breast is placed in its natural position, the posterior extremities of the ligamenta suspensoria are spread over the fore-part of the gland, support numerous folds of the glandular structure, penetrate the substance of the organ, and everywhere connect the portions of glands to each other.

A process of this fascia proceeds to the nipple, surrounding the ducts which are contained within it, and it becomes the principal and very powerful connecting medium between the gland and the nipple, so as to prevent this latter important part from being separated from the breast by violence.

Between the ligamenta suspensoria, the lobes of fat are placed, which serve further to defend this organ from injury.

The uses of the ligamenta suspensoria are to connect the nipple to the breast, the breast to the skin, and to fold up the gland to increase the secretory organ, without spreading it more widely over the surface of the chest. They also enclose the adipose matter of the breast.

Whilst the anterior or superficial layer of fascia is thus spread over the anterior surface of the breast, the posterior or deeper seated layer, when it has reached the margin of the gland, passes behind it, and sends forth two layers of fibres. The anterior of these fibres pass on the back of the gland, sending processes of fascia into the organ to unite its parts, and other fibres which pass from one ridge of the gland to the other posteriorly, giving it a smoother surface than that of the anterior part of the breast, as it is not folded in the same manner.

The other fibres of this deeper seated fascia pass backwards, and are united to the aponeurosis of the pectoralis major.

Thus, then, the breast is supported by the two portions of fascia; the superficial layer connecting it to the skin anteriorly, and forming the ligamenta suspensoria, and the posterior layer of fascia joining it to the pectoral muscle, by its aponeurosis; and between these two processes it swings, and yields to pressure and to violence. Whilst the fascia thus affords support, it also firmly unites the different portions of the gland to each other, throughout the whole of the substance of the organ, by entering into its interior composition.

In tracing the constituent parts of the mammary gland, I shall be able to explain it most perspicuously, if I begin the description from the nipple, and proceed to the minute structure of the gland, in opposition to the course of the milk.

The breast, as regards its secretory structure, consists of the following parts :—

First, of the straight lactiferous tubes in the nipple, or *the mamillary tubes*.

Secondly, of these tubes suddenly enlarged at the base of the nipple, and under the areola, and which contain a large quantity of milk: these are the *reservoirs*, or areolar tubes.

Thirdly, of these tubes becoming arborescent in each part of the gland, and forming the mammary ducts.

Fourthly, of *glandules*, disposed in lobuli, which constitute the principal part of the mammary gland, and from which the milk tubes originate.

Fifthly, of the milk cells, into which the milk is first secreted by the mammary arteries.

Sixthly, of the common organization of arteries, veins, absorbents, and nerves.

Lastly, of the fat, and cellular tissue.

First, *Of the straight*, or *mamillary* tubes.

When the nipple is examined with attention, in a woman whose breast is not in a state of lactation, the papillæ which cover its sides to its apex form petals, like those of flowers, which reach to, and overlap, a part of the apex; and between them, on the apex or point of the nipple, may be observed a cleft, in which the orifices of the lactiferous tubes are closely huddled together.

But during lactation, when the cone is reversed, and the papillæ are everted, the orifices of the lactiferous tubes are placed upon the truncated surface of the apex of the nipple.

The greatest number of lactiferous tubes I have been able to inject, has been twelve, and more frequently from seven to ten. But the greatest number of orifices I have been able to reckon has been twenty-two; however, some of these might have been follicles only, and not open ducts. I have had delineated two preparations of straight tubes, in one of which I found thirteen, and in the other twenty-two.

Their size also varies; for some of the orifices and straight tubes are much smaller than others, some only admitting a bristle, whilst others are as large as a common pin.

They commence in a cribriform surface formed by the skin, with some mixture of fibrous tissue; so that these orifices do not increase much, or yield to the pressure of the milk. A probe of large size will pass to their orifices, if introduced from the gland, but it cannot be made to escape through the orifice of the duct, without employing great force to overcome the resistance, and even to lacerate the orifice; in that respect resembling the urethra in the female, which will admit the little finger from the bladder, but only a probe at its orifice.

From this structure it is that the milk is prevented from escaping, excepting under a very strong vis a tergo; not from a transverse wrinkling of the lining of the duct, as has been supposed.

When the mamillary or straight tubes have passed these orifices, they begin to dilate, and to assume a conical form, gradually increasing in diameter to the basis of the nipple, and are therefore much larger than at the apex of the mamilla.

They are surrounded and enveloped by the fibrous tissue which lines the nipple, and which sends fibres between the tubes to keep them in their situation, and to strengthen them, and prevent their laceration.

The branches of arteries pass between the tubes, and, by their minute distribution, render them highly vascular, and the veins which return the blood are larger than the arteries, bnt less parallel.

The arteries of the nipple also send branches backwards into the interior of the gland, to meet those arteries which enter from behind the breast.

The nerves pass parallel to the arteries, and are sometimes supported by their coats, as they accompany those vessels.

The arteries, veins, absorbents, and nerves, are found in a cellular tissue, which enters into the composition of the nipple, and passes between the ducts which it contains; and this part is chiefly reticular, and not adipose, or it would interfere with the functions of the nipple.

When the straight or mamillary milk tubes are cut open, they are found to be lined with a mucous membrane, which is wrinkled longitudinally, and which is highly vascular. The wrinkles in the mucous membrane arise from their elasticity, and that of the surrounding parts: they are not the cause of the non-escape of the milk, but they allow of a great increase of their diameters to receive the milk. The mucous membrane with which they are lined is highly vascular.

Secondly, The *areolar portions* of the tubes, or *reservoirs*, begin at the basis of the nipple, extend under the areola, and to some distance into the gland, when the breast is in a state of lactation.

Their greater size than that of the mamillary tubes is in part owing to the loss of the pressure of the nipple, but principally to the number of branches of milk tubes which enter them from the breast; five or six large branches are combined in a reservoir.

These receptacles are of a conical form, like the mamillary tubes; and they begin from the extremities of the larger branches of the milk tubes, and terminate in the straight ducts of the nipple.

The appellation of reservoir is less applicable to this portion of the ducts in the human subject than in other animals, as they retain less milk; but even in the human female, these large and numerous cavities will in their assemblage contain a large quantity of milk.

In the cow, the mare, the goat, the ewe, the deer, and the rabbit, the reservoirs are very large, and in the cow particularly they are of enormous size, so as to be able to retain at least a quart of milk or more, depending upon the size of the udder.

In the human subject they generally radiate from the nipple, although some of them pass directly backwards to the posterior or pectoral surface of the gland.

Their calibre is out of all proportion larger than that of the straight or mamillary tubes, and much larger than that of the milk tubes, which form their continuations.

When cut open, the reservoirs are found to be lined with a very vascular mucous membrane, like the mamillary or straight ducts, but they have a fibrous coat upon the outer side of this, which preserves their form, and which gives them their power of resistance to the great dilatation which the milk would otherwise produce.

The blood vessels, which supply them with vascularity, are derived from the retrograde branches of the arteries of the nipple, and from the deep-seated arteries of the breast, which rise to meet them. The use of these reservoirs is to supply the immediate wants of the child when it is first applied to the breasts, so that it shall not be disappointed, but be induced to proceed with sucking until the *draught* be produced, when it receives a stream of milk from the lactiferous or milk tubes by a vis a tergo.

The next tubes in order, in tracing the structure of the gland in the opposite course to the milk, are the *mammary*, *lactiferous*, or *milk tubes*. They begin from the glandules, or secretory structure, in small and numerous branches, and increasing in size, terminate in forming the reservoirs.

They divide into branches, which increase in number as they proceed from the centre to the circumference; and their general appearance when injected, resembles that of the root of a tree.

The radiations of one of the mammary tubes sometimes occupies from one-sixth to one-fifth of the circumference of the breast. On the sternal and clavicular aspect of the breast, a single duct radiates to the margin; but upon the axillary and abdominal aspects, two or three ducts ramify to the circumference of the gland, so that two or three ducts are placed upon each other.

From this cause arises the greater thickness of the lower and outer part of the breast, which enables it to form the cushion upon which the cheek of the child reposes. To this circumstance I have before alluded, and it shows by what simple means nature effects the most important purposes.

The branches of the ducts do not radiate equally to the circumference, for some are much longer than others, and are lost on the fascia which encircles the breast, rendering its margins unequal.

In other parts the ducts at the margin of the gland are turned upon the gland, so as to form a kind of hem at its circumference, and to produce also a thickening of the substance of the breast from this cause.

Many of the mammary tubes upon the anterior surface of the breast are turned forwards to the skin, and connected to it by the ligamenta suspensoria; so that in removing the skin from the fore part of the breast, many of them are necessarily divided.

The breast is not formed into regular lobes by the ramifications of the ducts, because they ramify between, and intermix with each other, so as to destroy the simplicity and uniformity of their divisions.

The most simple idea which can be formed of the mammary ducts, especially at the lower and outer part of the breast, is, that supposing them to resemble the roots of trees, as they do, that one root is growing between others, destroying regularity, and distinctness of their growth. Or suppose one hand applied upon the back of another, and the fingers introduced between each other, and then the fingers of one hand inclined to the right, and those of the other to the left, it conveys the idea of the above-mentioned intermixture.

On the posterior surface of the gland, the ducts ramify more smoothly and equally, and pass in more regular ramifications to the gland, which is here much smoother than it is anteriorly.

The mammary ducts do not communicate with each other, as is easily shown by throwing injections of different colours into the ducts, or by injecting one duct only.

If various colours are thrown into each duct, they proceed to the gland without any admixture of colour. If one duct be most minutely injected with quicksilver, it does not escape into any other. And this remark is also applicable to the mammary glands of other animals, where there are many, as in the hare, the bitch, and the pig, the ducts are separate and distinct from those of the other gland.

I have only seen one instance to the contrary of this position, in injecting a milk tube from the interior of the gland towards the nipple, two large branches of ducts crossing each other, where they laid in contact, the injection found its way by rupture, or by a deviation from the natural structure, from the one into the other duct, of which I have given a figure; and as this has only occurred once in more than two hundred times, it shows that it is not the result of a common structure. In the cow, the goat, and the ewe, in which there are different glands terminating at each teat, in a single duct, when the injection is thrown into one teat, it does not escape into any other gland.

After lactation, when the mammary gland is injected, the lactiferous or mammary tubes appear cellular, and more resemble large absorbent vessels than arteries or veins, for wherever two or three large branches enter, a sudden increase of size is produced, so as to form a little pouch, open at each end. These dilatations are also seen during lactation, when two or three branches are received at any part of the ducts.

The mammary ducts are formed by a fibrous coat upon the outer side, and within, by a mucous membrane. The latter is highly vascular, so that when injected with red sise, by the arteries, and dried, it is sure to be highly reddened by the injection.

Of the Gland.

The mammary ducts begin directly from the glandular structure, in very fine and minutely divided radiated branches, and after becoming larger and larger as they approach the areola, they terminate in the reservoirs.

The gland is constituted by the union of a number of glandules, which are connected by means of the fibrous or fascial tissue of the gland.

When injected and unravelled, they appear of considerable size; but when further examined, these larger bodies are divided into small glandules.

Between these glandules, the mammary tubes may be observed to ramify, and from these bodies their branches directly spring.

When these glandules are filled with injection, and for a long time macerated in water, and unravelled, they are found to be disposed in lobuli; and when a branch of a mammary tube is separated, with the glandules attached, the part appears like a bunch of fruit hanging by its stalk.

The body of the gland is formed by the union of these little glands, everywhere interspersed through it, and united by fibrous tissue.

Their size depends upon the state of the breast; after puberty they exist, but are not easily separated or unravelled.

In lactation they are large, may be minutely injected, and distinctly developed. In age they diminish gradually, and after a time disappear, leaving the ducts still distinctly ramifying, but without the true glandular structure.

On the anterior surface of the breast, the glandules are drawn towards the skin by means of the ligamenta suspensoria, and form folds or loops which resemble the petals of flowers, as, for example, the rose when unfolded.

Upon these folds of the ligamenta suspensoria, the glandules are seen injected. *(See Plate.)*

By this disposition of the glandules, the surface for secretion is greatly increased, whilst the space which the breast occupies, remains the same in regard to its circumference.

This formation of the gland also renders it more prominent, and the nipple, consequently, of easier access to the lips of the infant.

The margin of the gland is extremely irregular; for it forms numerous processes, which proceed into the surrounding fibrous and cellular tissue.

The lower and outer part of the gland, *viz.*, the axillary and abdominal aspects, are some of them folded upon the anterior, and some upon the posterior surface of the gland at its edge, giving it there additional thickness, and assisting in forming the cushion already mentioned.

Also at the lower and outer part of the gland, the number of ducts and glandules is greater than elsewhere, and they are placed one before the other, so as to give to the gland great additional density.

The posterior surface of the breast is not folded and looped up like the anterior; but the ducts and glandules are, in the larger part of this surface, disposed in ridges connected by a fibrous membrane, which mats them together, and enters between the ridges into the interior of the gland.

The breast then is made up of an assemblage of glandules, united by a fibrous tissue, and is therefore called conglomerate, because it is constituted of a number of glandules conglomerated together.

When put into boiling water, the best idea of its form is obtained, as, like other albuminous structures, it becomes hardened, so as to be easily preserved: the nipple will then be seen to be not exactly in the centre of the gland.

From the nipple, the gland begins to form little petals, like those of a blooming rose, and they are turned forwards to the skin, to which they are connected by the ligamenta suspensoria; and in the depressions between them, the fat is lodged. *(See Plate.)*

On the clavicular and sternal edge, the disk of the gland is very irregular in the length of its radii from the nipple, some parts projecting much further than others; but on the axillary and abdominal margin, the gland is turned upon itself at its edge, and forms a kind of *hem.*

The posterior surface of the gland is smoother than the anterior, and forms a number of rows, and the depressions between them being less, there is not so much fat deposited as on the anterior surface of the gland.

The glandules vary in their size, from that of the head of a pin to the bulk of a small tare, when the breast is in a state of lactation.

Their figure is oval when they are uninjected, and they are more pointed at the extremity farthest from the nipple, than at the place at which the mammary duct enters them.

They require that the breast, when in lactation, should be long macerated to render much of them distinct and separate, as they appear in my plate. They are there seen with the ducts connected, in the progress of maceration; and they have been minutely unravelled, and the mammary tubes traced into them.

They are, when uninjected, rather flattened upon their surfaces; but when filled with injection, they become rounded and partially divided by several depressions.

They appear upon the festoons or loops which the ligamenta suspensoria support, upon the fore part of the breast.

But the best view, showing one of the lactiferous tubes from the nipple to the margin of the breasts, is that in one of my plates. In this the small origin of the mamillary lactiferous tube appears, and its conical shape is seen: then it forms the reservoir into which mammary lactiferous tubes are entering at different angles. Next the foldings of the gland appear, and upon five of these folds more particularly the glandules are injected and displayed, so as to give to them an exact demonstration of their appearance when in a state of lactation.

Of the Milk Cells.

When the lactiferous tubes are minutely injected, they are found to proceed from each glandule, and when an injection is made of the glandules with quicksilver, sise, or wax, they will be seen to be composed, in their interior, of numerous cellules, which are the milk cells.

Their number is very great; it varies much, and it would therefore be an act of folly and inutility to endeavour to reckon them. The glandules themselves differ in their size, and therefore the number of the cells will be proportioned to the magnitude of each glandule.

Their size in full lactation is that of a hole pricked in paper by the point of a very fine pin; so that the cellules are, when distended with quicksilver or milk, just visible to the naked eye.

They are rather oval than round, being slightly elongated where the branch of the lactiferous tube springs from them; but they appear more rounded to quicksilver, and when distended with milk, than when filled with wax.

When well injected and dried, the glandules form a kind of foliage in the breast, and each leaf is filled with these cellules. In the fullness of lactation, these leaves are full of cells, which can be readily injected and demonstrated; but at other periods they do not admit of being filled, and a most minute injection may then be made of the lactiferous tubes, yet no cells appear. In one of the plates these cells will be seen injected with quicksilver, and magnified four times; but in the same plate they are seen injected with yellow wax, and magnified six times, to render them easily demonstrable.

The lactiferous tubes I have seen become cellular, as they spring from the milk cells, but only just at their commencement, and under very minute injections.

The cells are lined with a continuation of the same mucous membrane as that which lines the inner surface of the lactiferous tubes. Of this, I judge by minute injections of the arteries, where the inner membrane is seen to possess the high vascularity of a mucous membrane, rather than the minor arterial supply of a serous surface. Also in the larger animals, as in the cow and the rhinoceros, the mucous membrane lining the ducts has no break in it, but may be seen to be continued so far as the parts can be traced by the eye, and by magnifying powers*.

The milk cells possess a considerable degree of elasticity, but in the human subject less than in other animals.

The arteries which supply these cells with blood, secrete the milk, and they become very large in lactation; but their divisions, as will be seen in the plate, become extremely minute on the glandules, and around the cells. From the blood which they convey, the milk is secreted and poured into the interior of the cells.

The veins return into the general circulation that blood which is not converted into milk.

Absorbent vessels arise in great numbers from the milk cells of all the animals I have minutely injected. In my plate of the absorbents, they will be seen abundantly arising from the milk cells and lactiferous tubes; for the preparation is principally composed of these vessels, but a few milk cells and tubes are also filled, from which the absorbent vessels have arisen.

The absorbents upon the surface of the breast are injected by single vessels from the base of the nipple.

* Also after the secretion of milk has ceased, the secretory structure is often loaded with mucus.

These vessels perform the double function in the breast, of absorbing the more watery part of the milk, so as to render it more nutrient than under its first secretion; but they are also employed under great accumulations, in the absence of the child, when they relieve and unload the vessels.

Still accumulations of milk do occasionally occur, in one or more of the milk tubes, producing great enlargement, pain, and distension, and rendering it necessary that the surgeon should discharge the fluid by the lancet. See my work on those diseases of the breast which are not malignant.

The *nerves* which enter the secretory structure of the gland are extremely minute, and their smallest branches accompany those of the arteries, and are distributed with, and supported by, them, to sustain by their presence the secretion of the milk.

From this description of the structure of the parts the function of this organ appears to be easily explained.

The milk is secreted by the arteries into the *milk cells*, from which it is forced forwards by two causes; first, by the elasticity of the cells, which is proved to exist in many animals by injecting the cells minutely with quicksilver, and then if one of the ducts be pricked with a needle, all the lactiferous tubes become instantly emptied: but in woman this occurs less than other animals.

Secondly, by the vis a tergo of the continued secretion, one portion of milk forcing forward the other, in a minor degree when the child is not applied, but when the draught occurs, a sudden rush of blood increases the secretion, and rapidly hurries the milk forwards to the nipple, to supply the wants of the infant.

The milk is conveyed from the cells which are found in every point of the gland into the *mammary ducts*, which form radii, converging all of them towards the areola; and as these vessels are increasing in their diameters, little opposition is made to the progress of the milk, as it courses from the smaller to the larger tubes.

When the milk is thus brought by the mammary tubes to the areola, it is received into the *reservoirs*, and in these, and in the mammary ducts, it is retained until the infant begins to suck; and here it will be seen that the form of the tube is reversed, for the mammary tubes are constantly increasing towards the nipple; but the reservoirs are large towards the gland, and become smaller towards the nipple, which gives them a power of retention until the discharge of the milk is required.

The milk next passes into the mamillary ducts, or straight tubes of the nipple.

These, like the reservoirs, are conical, with the apex of the cone turned to the point of the nipple, and as their orifices at the nipple are very small and unyielding, the milk is also again retained until the act of sucking removes it; and when the draught occurs, abundance of milk is hurried forwards to the reservoirs and mamillary tubes.

The infant's lips and gums, and the suction produced by the exhaustion of the air in the mouth, not only mechanically empty the mamillary tubes, and overcome the resistance of their orifices, but also, by rendering them finer capillary tubes, assist, upon hydraulic principles, in giving rapidity to the passage of the milk.

OF THE FAT OF THE BREAST.

Nature for several reasons has abundantly supplied this organ with adipose matter.

First, to preserve the contour of the organ, by filling up all the depressions between the glandules.

Secondly, to regulate the temperature of the gland under exposure, whether from the poverty which preludes the possession of proper covering, or the caprices of fashion, which forbid its being worn.

Thirdly, for the purpose of allowing the breast to float in an oily fluid, for the adeps is fluid in the heat of the living body; and the gland thus eludes the injuries to which it might otherwise be liable.

Fourthly, to defend it from, and to lessen the effects of violence upon the part, which heavy blows or falls might occasion.

In a large and fat person, the breast is far removed from the skin, and from the pectoralis major muscle, by the immense quantity of adipose matter placed before and behind the gland, and in the intervening structures.

On the anterior surface between the gland and the skin, we find the fat deposited in very large lobes between the ligamenta suspensoria and anterior folds of the glandular substance on every part of the breast, and it also exists between the layers of fascia beyond it.

It is not a secretion of the fibrous tissue of the ligamenta suspensoria, but of a vascular membrane, which lines those ligaments, and which is of the cellular adipose kind.

If, then, the breast be minutely injected by the arteries, and then dried and put in turpentine, this membrane is directly demonstrable, loaded with fat in its interior.

But it is not a simple containing membrane, for it forms processes which cross the fat in various parts of the lobes, dividing, but supporting them.

Beside these dividing processes, numerous minute cells are formed in the vascular membrane, into which the fat is deposited as in other adipose structures of the body.

It is, then, a thick cushion of fat placed under the skin, which enables women of the lower class to bear the very severe blows which they often receive in their drunken pugilistic contests; for I have seldom known them to suffer immediately any serious consequences from such encounters.

Very thin women, whose breasts are unprotected by this mode of defence, sometimes show severe bruises; but these in a fortnight or three weeks disappear. Yet it is very certain that at distant periods women apply with tumours in their breasts, which they frequently impute to blows.

The fat is also deposited behind the breast, in the posterior layer of fascia, and in the ligamentous or fascial loops which connect the breast to the aponeurosis of the pectoralis major muscle.

It is here formed in the same manner as on the anterior surface of the breast, that is, in a vascular, adipose, and secreting membrane, covering lobes of fat, which are situated in the fascial interstices, and which forms small divisions of the lobes, and little cellules, to secrete and contain the fat.

When the period of lactation is passed, and the breast begins to be absorbed, fat is abundantly deposited, to fill up the deficiency of glandular matter, and to preserve the natural form of the part. But in very old age, both the gland and the fat become absorbed, and the chest is then flattened like that of the male.

OF THE ARTERIES OF THE BREAST.

These vessels are subject to great variety, both in their origin and their course. Their sources seem to be of little importance, if the glandules of the breast receive a proper supply of arterial blood.

The same circumstance may be observed in other animals, that the arteries take their origin and course as is most convenient for the supply of the gland. In some, they observe the same origin and course as in women; but in others, they are derived from the epigastric, lumbar, intercostal, axillary, and internal mammary arteries.

The most common supply of arterial blood in the human subject is derived from the axillary and internal mammary arteries. The axillary sends two, and sometimes three branches of arteries, and the internal mammary generally three; but there are many smaller branches from different sources.

These arteries may be divided into posterior and anterior: the former passing from the axillary artery, and the latter from the internal mammary; and there is generally a large vessel entering the pectoral or costal surface of the breast, and sending its branches through the gland, to meet the others upon the surface of the organ.

The posterior arteries are derived from the axillary.

First, from the *thoracica longa*, which arises from the axillary artery, and descending upon the chest at the outer edge of the pectoralis minor, passes over the origins of the serratus major anticus, to which it gives branches, and to four layers of intercostal muscles; and sending arteries into the cavity of the thorax through them, these ramifications anastomose with the aortic intercostal arteries.

As this artery passes upon the outer side of the gland of the breast, it sends branches into and upon it, more especially to the parts below the nipple.

But the true *external*, or *posterior mammary artery*, is sometimes a branch of the thoracica longa, and sometimes a separate vessel from the lower part of the axillary artery. It descends at the outer edge of the pectoralis major towards the nipple; it sends branches above and below the nipple, and into the nipple itself, and it also supplies the secretory structure of the breast.

The *thoracica suprema* also, after sending branches to supply the pectoralis minor and the pectoralis major, sends branches which perforate the latter muscle, and are distributed to the upper part of the breast.

Besides these posterior arteries, there are small branches from the aortic intercostal, which pass through the intercostal muscles with the direct branches of the dorsal nerves, and proceed with them to the breast.

The arteries on the sternal side of the breast are principally three.

They are derived from the internal mammary artery and from the mammary intercostal arteries*.

The internal mammary artery arises from the inferior part of the subclavian. It courses forwards and downwards into the cavity of the chest. It is situated upon the inner side of the cartilages of the ribs, close to their junction with the sternum, and in its course sends forth two sets of arteries internally, mammary intercostal arteries, which anastomose with the aortic intercostal. Secondly, it sends branches through the intercostal spaces between the cartilages of the ribs, which are distributed to the parts of the external surface of the chest, and some of them to the breast itself. After giving off these branches, it proceeds to the abdominal muscles, upon which it anastomoses freely with the epigastric artery.

* The intercostal arteries are from two origins: the posterior are from the aorta or aortic intercostal; the anterior from the internal mammary, or mammary intercostal arteries.

It is generally the second perforating branch of the internal mammary artery which descends to the breast. The fifth arising from a mammary intercostal artery also passes to the gland and nipple.

The second (sometimes the first or third) branch of the internal mammary artery perforates the intercostal muscles between the second and third cartilages of the ribs, and after passing the intercostal muscles, appears upon the fore-part of the chest. It then descends to the upper part of the nipple, anastomosing with the thoracica suprema, and with the fourth anterior artery, on the surface of the breast.

The fourth anterior artery passes between the fourth and fifth cartilages of the ribs, and proceeds directly and transversely, from the sternum to the nipple, when it anastomoses with the second, and these two, with the external mammary and thoracica longa.

Besides these most frequently formed arteries, the gland upon its pectoral surface, where it adheres to the aponeurosis of the pectoralis major, receives one, and sometimes two, deep-seated branches from the mammary intercostals, which, between the fourth and fifth, and fifth and sixth ribs, perforate the intercostal muscles, and pass into the pectoral or concave surface of the breast, supplying the gland with arterial branches, which freely anastomose with the superficial anterior and the arteries behind the nipple.

Besides these arteries, there are small branches from the third of the anterior or internal mammary artery, and some from the fifth and sixth.

The epigastric, as it anastomoses freely with the internal mammary artery, has some influence upon the circulation in the breast.

The arteries upon the cutaneous surface of the breast are lodged in the festoons formed by the ligamenta suspensoria, and proceed to the nipple. There, their extreme branches pass each other at the base of the nipple. They send branches forwards from the base to the apex of the nipple, which are parallel to each other, and divide into very minute branches, which supply the papillæ and the ducts. They also send branches from the base of the nipple backwards into the gland at its centre, and they freely anastomose with those arteries which enter the back of the gland, and they then distribute their ramifications to its substance.

OF THE VEINS OF THE BREAST.

The branches of veins arising from the nipple pass from its papillæ in parallel branches to its base, and then form radii to an ellipse behind the areola at its margin. Their beautiful and minute division into branches upon the papillæ will be seen in the plate, and these, with corresponding divisions of the arteries, constitute the erectile tissues.

From the ellipsis of veins four principal branches proceed, beside others which are less important.

These are distributed on the fore-part of the breast in a net-work of very free and frequent communication.

They are much more numerous than the larger corresponding branches of arteries.

They, in their principal cutaneous branches, do not accompany the arteries; but some which are deeper seated do, as well as those of the interior of the gland, but many of these afterwards rise to join the superficial veins upon the surface of the breast.

With respect to the terminations of the veins:—

First. They end by two large branches in the axillary vein, and by several branches in the vein accompanying the arteria thoracica longa.

Secondly. They terminate in, or communicate with, the cephalic vein.

Thirdly. One passes into the internal mammary vein (of which there are generally two), between the first and second, or sometimes between the second and third rib.

Fourthly. A deep-seated vein passing from the back of the breast, enters the fourth mammary intercostal vein, *see Plate,* and is then continued into the internal mammary vein.

Fifthly. A plexus of veins passes over the clavicle to terminate in the external jugular and subclavian veins.

But although the above are the principal terminations, yet they communicate with other branches of the internal mammary veins; and in a putrid body they colour the skin, and exhibit a beautiful and extended plexus, passing in all directions from the circumference of the breast.

With respect to the deep-seated veins of the gland, they for the most part accompany the arteries, but are somewhat larger, and they terminate in the superficial plexus under the skin, and in deep-seated veins upon the costal surface of the breast, which pass to the intercostal veins.

When the breast is in a state of lactation, the veins, like the arteries, divide into numerous capillary branches, which are spread upon, and form a plexus within the glandules and which return that blood from the arteries which is not converted into milk.

The course, both of the arteries and veins on the anterior part of the breast, is through apertures in the ligamenta suspensoria, which form sheaths upon them, and preserve them in their situation.

In lactation both sets of vessels are somewhat serpentine in their course, as in most of those parts which change their size, as the uterus, or are much exposed to pressure, as in the scalp, or to interruptions of the circulation, as in the lips.

As the vessels are extraordinarily increased in some malignant diseases, and excessively distended with blood, so as to produce much pain to the patient, from this accumulation and distension, in addition to other causes, I have for more than twenty years been in the habit of bleeding in these complaints, by opening the veins of the part. When the pain is severe, and the functions of the chest are embarrassed, it affords instantaneous and great relief.

For this purpose, I have always in my case, a needle which cuts upon each side, its edges being lancet-shaped, and after placing my finger on a large vein, formed by the junctions of several veins, and between the breast and the clavicle, I prick the vein with this instrument. A lancet would answer equally well; but it excites more apprehension on the part of the patient, and makes a larger wound.

The opening is much smaller than that produced in bleeding in the arm.

The quantity of blood considerably exceeds that drawn by leeches; and it may be extracted in three or four minutes to the amount of from four to six ounces, and the surgeon avoids the long-continued exposure which the application of leeches requires, and the trouble and inconvenience of the continued fomentation afterwards.

The pain which the operation gives, no woman will apprehend, and she smiles the moment the puncture has been made: she must be very pusillanimous who would not submit to this trifling operation.

As soon as sufficient blood has been drawn, a piece of lint and adhesive plaister should be applied over the puncture, to prevent any subsequent bleeding.

In describing the arteries and veins of the breast, it is impossible that I can be insensible to the varieties of their origins and course; but I believe that I have described the sets which are the most commonly observed, and to point out all their varieties would be quite useless.

OF THE ABSORBENT VESSELS.

THESE vessels always exist in great numbers in the breast, and when the gland is in a state of lactation they are readily injected and demonstrated.

They are divided into a superficial and deep-seated order. The first are cutaneous, and are most connected with the nipple and the mucous glands of the skin; and the second arise from the interior of the glandular and secretory structure of the mamma.

The superficial arise from the nipple, as will be seen in my plate, and they pass principally upon the surface of the gland, behind the skin, on its axillary side.

In my injections I find them as follows:—

First, they pass upon, and then under, the superficial fascia, and between it and the aponeurosis of the pectoral muscle. They are next continued over the intercostal muscles, between the third and the fourth ribs, and they then ascend to opposite the third layer of intercostal muscles.

Here they enter the absorbent or cribriform opening, or sometimes there are two openings, in the fascia axillæ, as it passes from the edge of the pectoralis major to that of the teres major and latissimus dorsi mnscles, and which fascia shuts up and forms the floor of the axilla.

Having passed through this fascia into the axilla, they enter the first set of axillary absorbent glands, and form a considerable plexus of absorbent vessels between them.

They then rather descend to the third and fourth ribs to enter another set of absorbent glands, which are placed between the third and fourth ribs, and second and third intercostal spaces, and they then ascend to the second rib.

Here they form a large and elaborate plexus upon the axillary vein, from one to two inches below the clavicle, and reaching the first rib, they again enter absorbent glands.

From these glands, situated upon the first rib, an *absorbent trunk is formed,* of the size of a large crow quill, which is placed close to the inner side of the axillary vein, and between the first rib and the clavicle, (*see Plate,*) and this absorbent trunk terminates at the angle formed between the right jugular and right subclavian vein, where the absorbents of the right arm, and those of the right side of the neck, also end in the veins.

There is an opening formed for this vessel under the costo-clavicular ligament, with a distinct margin on each side.

The place of termination of the absorbents in the vein is a little above and behind a line drawn from the middle of the clavicle, above the first rib.

On the left side, the absorbents of the breast form a similar absorbent trunk, which terminates at the angle of the left jugular and subclavian veins, at which angle the thoracic duct also ends.

Besides this course of the absorbents from the breast and through the axilla, there are other absorbent vessels which pass behind the axillary vein, artery, and axillary plexus of nerves, to join the absorbents of the arm. They also pass through several absorbent glands, and ascending before the axillary plexus of nerves, they mount behind the clavicle, and before the axillary blood-vessels, to terminate on each side at the angle of the jugular and subclavian veins.

Thus there are two courses of the absorbents from the breast through the axilla; one internal to the blood-vessels, and between them and the ribs; the other, which is more external, joins the absorbents of the arm, and passing behind the vessels and nerves of the arm, then crosses the nerves and the axillary artery, to enter the angle of the jugular and subclavian veins.

If, therefore, the absorbent glands in the axilla are obstructed by disease of the breast, other absorbent vessels carry their fluid into the absorbents from the arm, and when their glands are obstructed, other absorbent or lymphatic vessels are found to pass behind the scapula from the axilla, to enter the cervical glands above and behind the clavicle.

The absorbents of the sternal side of the nipple principally take two courses.

The first accompanies the vein and the artery to the second intercostal space between the second and third cartilages of the ribs, and penetrating the intercostal muscles, they pass to the anterior mediastinum, where they accompany the internal mammary artery and vein, and enter some absorbent glands.

A set of absorbent vessels from the sternal side of the breast, placed lower down, enter the intercostal muscles, between the fourth and fifth cartilages of the ribs, and join the former in the anterior mediastinum.

After entering the anterior mediastinum, a part of those which pass from the right breast join some vessels from the convex surface of the liver, and are continued into the angle of the right jugular and subclavian veins, whilst those absorbents of the left breast, which enter the anterior mediastinum, pass to the angle of the left jugular and subclavian veins.

The *deep-seated absorbent* vessels, which can be best injected from the ducts and milk cellules whilst the breast is in a state of lactation, arise from the mucous membrane of the lactiferous tubes and milk cells, and form a plexus of great beauty in the interior of the gland, as will be seen in the plate.

These numerous absorbents, as seen in the preparation, unite into two principal vessels, which pass into the axilla, and there enter the same absorbent glands as those which receive the superficial absorbents.

Those on the sternal side of the nipple pass into the anterior mediastinum, though some of them turn round above the nipple, and enter the axillary glands.

The deeper-seated absorbents many of them join the superficial upon the convex or cutaneous surface of the breast, and after passing through the glands in the axilla, terminate with them at the angle of the jugular and subclavian veins.

But the absorbents of the concave or costal surface of the breast take a different course. They penetrate the intercostal muscles behind the breast, and enter absorbent vessels which accompany the aortic intercostal arteries on the axillary side of the breast, but on the sternal side they join the internal mammary intercostals: the former pass into the thoracic duct in the posterior mediastinum; the latter enter those vessels in the anterior mediastinum which I have already described.

A most extraordinary opinion has been broached, that the absorbents carried the chyle to the breast,—an opinion at variance with the nature of the fluid, entirely inconsistent with every injection which I have made, as they all pass from, and not towards, the breast, and irreconcileable with the valvular structure of these vessels.

In malignant diseases, the absorbent glands being obstructed, the process of absorption can no longer proceed in its natural course; but lateral communications at the origin of the absorbents in the cellular tissue, allow of absorption out of the common course of the vessels. I have a preparation which shows the plexus of vessels of communication at the roots of the absorbents, from which other vessels arise, taking a course into other glands; and thus when the glands in one axilla are obstructed, those of the other axilla will become similarly affected by absorbents passing from the disease across the chest.

In disease, when the axillary, or clavicular side of the breast is affected, the absorbent glands in the axilla which are immediately connected with the mammæ, are diseased; and next the absorbents from the arm, and their glands; and then the arm becomes greatly enlarged. The cervical and subclavian glands are involved in the disease, and the absorbent vessels behind the scapula are affected.

When the sternal side of the breast is diseased, two lines *may be traced of absorbent enlargement;* first, from the breast, sometimes to the first and second, at others to the second and third intercostal spaces; and secondly, to the fourth and fifth intercostal spaces between the cartilages of those ribs, and then the disease proceeds concealed behind the sternum, within the anterior mediastinum.

When the disease is seated in the posterior or costal surface of the breast, or when the axillary glands are much affected, the disease enters the chest through the intercostal muscles, and passes between the pleura and the ribs, often in its course affecting the pleura, and producing tubercles in it, and it excites inflammation of this membrane, so as to cause adhesion between the costal and pulmonary pleura, and these adhesions become also malignant.

I have seen the pleura to great extent thus diseased, towards both of the mediastina, with some adhesion of the lungs, and where they did not adhere, accumulations of water had taken place in the cavity of the chest.

Not only are the absorbent glands diseased in malignant complaints, (respecting which I shall not proceed any further at present,) but the absorbent vessels themselves become morbidly changed and obstructed, the tubercles are enlarged just under, and sometimes in the skin, and they form hard and knotted swellings in the circumference of the nipple.

The absorbents are provided in great numbers in the breast, to model it under its various changes, in growth, lactation, and decay; to perfect the milk, and to absorb it, under extreme distension of the cells and milk tubes.

OF THE NERVES OF THE BREAST.

THE nerves which are destined to supply this organ are with the greatest difficulty traced to their minute branches, and ultimate distribution; nor can they be dissected with any certainty, unless the arteries are injected with coloured matter, to enable the anatomist to discriminate between the minute branches of arteries and nerves.

They are derived from the dorsal nerves; but still only from a part of that class of nerves: they are called dorsal, because they spring from the spinal cord within the vertebræ of the back.

The dorsal nerves, like the other spinal nerves, originate from three sources.

First, from an anterior root, which appears upon the anterior portion of the spinal cord.

Secondly, from the posterior root which is ganglionic; and the first after passing the ganglion unites with the second just beyond the ganglion.

Thirdly, of the grand sympathetic nerve, which unites with the dorsal nerves, near the place of junction of the two former nerves.

Thus they are constituted to give motion from the first origin; sensation from the second or ganglionic, and to support general connection; secretion and involition by the grand sympathetic.

It is not my intention to describe all the branches of the dorsal nerves, but only those immediately connected with the breast.

The dorsal nerves, when they reach near the middle of the sides of the chest, by passing in the groove at the inferior edge of the ribs, divide into two portions, into a direct and a reflected branch.

The *direct* penetrate the intercostal muscles at the lower edge of the ribs, and pass directly forwards to the parts upon the surface of the chest.

The *reflected* are continued forwards at the lower edge of the ribs, in the groove which contains them, the artery and vein, until they reach the cartilages at their junction with the sternum: here they penetrate the intercostal spaces, and pass to the parts of the fore-part of the chest, being reflected backwards towards the sternal part of the breast.

The direct nerves are placed posteriorly to the breast; the reflected are anterior or sternal.

First, of the direct, or posterior.

The first dorsal nerve principally forms a part of the axillary plexus of nerves; but it sends off a posterior branch to the axilla, and back of the arm; it also forms a small reflected nerve which penetrates the fore-part of the chest, and is distributed to the pectoralis major muscle and skin below the clavicle.

The second posterior dorsal nerve passes out of the chest below the second rib, and sends down branches upon the external mammary artery towards the breast; in my plate a nerve from the second dorsal descends to the posterior surface of the breast, and also gives branches to the pectoralis major.

The third direct or posterior dorsal nerve divides into two principal branches; one passes to the part of the chest just above the breast, and the other branch is distributed upon the external mammary artery.

The fourth dorsal nerve appears just below the fourth rib, emerging through the intercostal space from the inner part of the chest. It almost immediately divides into two nerves; the upper branch passes to the external mammary artery, and descends with it to the upper part of the mamma. The second branch passes upon the surface of the breast and advances to the basis of the nipple, where it divides into branches which supply its papillæ.

The fifth direct dorsal nerve appears emerging under the lower edge of the fifth rib, and it is continued below the edge of that rib to the gland of the breast, upon the surface of which it passes and divides into numerous branches which supply the lower part of the nipple, and there joins with the fourth nerve.

The sixth direct or posterior nerve is divided into two. It passes below the breast, but sends some filaments to the vessels below the nipple on which it is distributed, some of its filaments ascending upon the arteries towards the breast.

The seventh dorsal has no communication with the mammary gland, or the mamilla. From my dissections, then, it appears that the fourth and fifth posterior nerves are most directly distributed to the breast, but that the third descends upon the vessels which are afterwards distributed to the nipple and gland, and that the sixth sends some filaments upon the extremities of those arteries which have passed the nipple, but which send branches into the gland.

The fourth and fifth posterior or direct nerves form a plexus at the basis of the nipple and areola, and with the branches of arteries are distributed to the papillæ. The nerves which pass to the sternal side of the nipple join with the anterior on that side of the nipple and areola.

The third, fourth, and fifth nerves have lateral communications with each other by distinct branches of nerves.

The Anterior or Reflected Nerves.

In the subject from which my figure was delineated there was a reflected nerve (which, however, does not always exist,) between the first and second ribs. This accompanied the first branch of the internal mammary artery, and was distributed to the skin of the fore-part of the chest and to the pectoralis major.

The second anterior nerve passed out of the chest between the second and third ribs, and sent branches to the skin of the anterior and upper part of the chest above the breast, below the clavicles, and anastomosed with the second posterior or direct nerve.

The third anterior or reflected nerve divided into two branches; the first passed across the chest above the breast, the second descended for some way upon the anterior branch of the internal mammary artery which supplies the breast and nipple at its upper part.

The fourth anterior nerve was divided into two branches which passed through separate holes; the first proceeded upon the surface of the breast to the basis of the nipple, the second to the upper and inner part of the gland of the breast.

The fifth joined the lower part of the fourth, and distributed a few filaments to the skin at the lower part of the breast.

The sixth anterior passed below the breast.

It therefore appears that the third anterior or reflected nerve passes upon the vessels which descend to the breast, and that the fourth goes to the base of the nipple anteriorly. The fifth, which passes below the breast, is but a small nerve.

As a strong connection or sympathy exists between the uterus and the breasts, it has been supposed that the epigastric artery might be the cause of such sympathy, and that more blood might be sent by it to the internal mammary artery and to the breast itself after delivery than before, by means of the anastomoses between the epigastric and internal mammary. This is very probable, but it is not the cause of the sympathy, but the effect of it, more blood being determined to the breast than before in consequence of that sympathy, by means of the free anastomoses existing between the blood-vessels,—a mechanical effect of that connection. For myself I see no other cause but through the grand sympathetic nerve, the branches of which are incorporated with the dorsal nerves of the breast, and are largely distributed to the uterus to connect the two parts in function.

It may be objected to this opinion that the grand sympathetic nerve is connected with the other spinal nerves, and that, consequently, other parts should similarly sympathize. They certainly do strongly sympathize, but the effects are as dissimilar as the functions of the organs; and it is owing to the breasts sympathizing strongly only under certain states of the uterus, as, for instance, in lactation, that it is more the subject of observation.

There is a drawing, from a dissection made by Mr. Pears and myself, given in the *Philosophical Transactions* of 1805, of a woman of twenty-nine years, who might be said to have had no ovaria, in whom the menstrual secretion never occurred, and the usual appearances of puberty on the surface of the body were absent, whose breasts were not more evolved than those of the male, and in whom the uterus was infantile.

Mr. Pott also mentions a case of ovarian hernia in which he removed both ovaria, and the woman grew fat and never afterwards menstruated.

From this it appears that imperfection in the ovaria has at least as much effect upon the evolution of the breast, and other sexual organs, as a defective state of the uterus; and the removal of the testes produces similar effects upon the evolution of certain organs in the male.

OF THE EVOLUTION OF THE BREAST.

In the fœtal state the mammary gland is found opposite to the future nipple, rounded, embedded in the adipose tissue under the skin, and from the redness of its colour and high vascularity, it is easily distinguished from the surrounding parts, forming a circumscribed and very distinct body.

Whilst in this state the nipple is cleft, and there is a cavity in it rather than a prominence, but the cavity is surrounded by broken papillæ.

From the cavity a white and rather solid secretion can be squeezed, which nurses are in the habit of doing with considerable force soon after the birth of the child; they fear that its accumulation will occasion inflammation, and they use an improper manipulation likely to excite it; a sponge and warm water are all that is required.

This gland is very vascular, and is readily injected by injecting the fœtus generally.

The nipple contains ducts which I have injected with mercury. The greatest number which I have injected has been six, but there are probably more.

This gland exists in the male as well as in the female, as I shall in future show. *See Plate* 1 *of the Male.*

Immediately after birth a section of the gland still appears of a red colour, and is rather larger than in the fœtus.

For twelve months it remains a rounded body about the size of a large pea, still distinguishable by its colour from the surrounding parts.

The best mode of seeing it is by making an incision through the nipple and centre of the gland, to the aponeurosis of the pectoralis major, in a full-grown fœtus.

After twelve months, it loses much of its colour, and it requires minute attention to dissect and develope it, so as clearly to make out its character.

Examined at from two to three years of age, the breast appears separated from the surrounding cellular tissue, from its being enclosed in a fascia which not only covers both its surfaces, but enters into its composition; and by this mode of investing it, renders the gland a distinct and separate organ.

It is covered by the two layers of fascia, as in the adult state, one passing before the gland, to connect it with the skin, and one behind it, to join it with the aponeurosis of the pectoralis major.

I have given views of the appearance of this gland, at three, at four, at six, and at nine years; at which ages it will be observed to differ but little, excepting that at nine years it is less rounded in its figure.

The nipple is a cleft or cavity in the fœtus; but soon after birth it becomes a cone, and an areola appears around it, which increases but little to the ninth or tenth year, when it becomes somewhat larger, and not quite smooth upon its surface.

At twelve years, the nipple is rounded, and the areola becomes prominent, and generally small glands appear upon its surface, and at its margin, where it is connected with the surrounding skin.

At fourteen years, the nipple is still more increased, small clefts appear between the papillæ, which begin to evolve. The areola rises a little around the nipple, from the evolution of the gland behind it. The colour of the nipple is now of a bright red; that of the areola a little darker; and the roundness and prominence or intumescence of the breasts appear.

At fifteen years, a cleft often exists instead of a nipple, and in this cleft the orifices of the milk tubes are concealed.

At sixteen years, the nipple and areola are much evolved, and the former is divided on its apex into numerous papillæ. The areola is of a darker red.

At seventeen years, the nipple is evolved, and fitted for its future office. The areola is more than an inch in diameter, and its tubercles and glands are very large. A few straggling hairs appear.

At twenty, the appearances are much the same as at seventeen years.

At puberty, the mammary glands enlarge, and become prominent, and the breasts assume their roundness, intumescence, and agreeable form, the beauty of which is heightened by the rosy colour of the nipple and areola, and the meandering of the veins under the firm snowy whiteness of the skin, giving it altogether a marbled appearance.

It is not merely the gland that grows, but the fat which is added to the cellular tissue gives to the breast a part of its additional prominence.

When puberty commences, the nipple is surrounded by an intumescence from the evolution of the gland around it, and behind the areola; and another intumescence appears from the evolution of the breast around the areola, forming the mass of the gland.

With respect to the changes in the gland itself, they are as follow:—

At the ninth year, the gland increases in its diameter, and forms a thin margin under the skin.

At eleven and twelve, the diameter of the gland is greatly increased.

At thirteen years, it is rather concave upon its anterior surface: its edges are turned up, the cause of which is, that the breast grows faster than the ligamenta suspensoria; and it sends forth its processes, which unite with the ligamenta suspensoria; and fix them to the skin: the glandules also appear. *See Plate* 2.

At fourteen, the growth has been very considerable; the diameter of the gland is much increased.

At sixteen, the breast is seen greatly evolved; and at this period some of the lactiferous tubes can be injected.

At twenty to twenty-one, the gland has obtained its full size before lactation. The two layers of fascia are perceptible, with the ligamenta suspensoria going to the skin upon the fore-part of the gland, with the fat between them, and the posterior layer of fascia passing to the back of the gland, and to the aponeurosis of the pectoral muscle. *See Plate* 2.

In the adult state, and about the middle age, the colonr of the nipple is of a brownish red, and that of the areola a little darker. The gland is distinctly lobulated, and its parts move more freely upon each other than at the earlier periods of its evolution.

It appears, then, that in infancy the rudiments of the future gland are formed, and that at puberty a sudden and increased determination of blood to the part, evolves those rudiments into the beautiful organ that I am now attempting to describe.

OF THE EFFECTS OF GESTATION AND LACTATION ON THE BREAST.

The breasts at this time receive much larger quantities of blood, and they generally swell and become painful, feeling heavy; they are tender to the touch, and painful in themselves, and if small before, they now undergo their evolution.

The nipple grows, and its papillæ become foliated and protuberant. *See Plate* 2.

The areola becomes darker in its colour, thicker in its substance, and its diameter increases from one to two inches. The darkness of its colour arises from a great accession of the rete mucosum, which is now easily perceived, demonstrated, and separated. The increase of the areolar diameter is owing to a real growth, and to the skin being stretched by the increase of the gland; and its greater thickness arises from the developement of the papillæ of the areola.

The tubercles and glands of the areola and those of the surrounding skin of the breast are rendered much more distinct and prominent than before.

When sections are made into the mammary gland, at the commencement of lactation, it is found to be exceedingly loaded with blood, and to be from this cause of a red colour.

The ducts are much larger, and capable of readily receiving injection.

The cellules are not at first developed, and therefore the breasts of women who die from puerperal fever are not the best subjects for injection.

When the arteries and veins are injected, they are found to be exceedingly enlarged upon the surface, and in the interior of the gland, and are rather tortuous in their course.

When lactation has commenced, and is established, and after a few weeks' suckling, the nipple becomes very large and truncated at its apex, so as to form a broad flat surface, upon which the orifices of the lactiferous tubes are evolved; and the areola, as well as the nipple, can be in a great degree drawn between the lips of the infant when it is sucking. The papillæ of the areola become of larger size, and increase the adhesion of the lips, and the sensibility of the part. The ducts and reservoirs enlarge, and milk cells can be discovered and injected in all the glandules.

Of Sucking.

The act of sucking is performed by the infant's lips and tongue embracing the nipple and areola, by its gums compressing them, and by some exhaustion of air being produced in its mouth. The gums and tongue draw the mamillary ducts into capillaries, by which the passage of the milk is further facilitated: the exhaustion of the air in the infant's mouth induces additional atmospheric pressure upon the surface of the breast. It is certain, however, that a child is able to suck who has a deficient lip and palate, as in the hare lip, if the defect is not of the worst description.

No muscular power resides in the ducts, but they possess considerable elasticity in many animals; and in women, if the ducts be distended with mercury, it returns with some force when the injecting pipe is removed.

A defective nipple sometimes prevents sucking, although the nipple must be very imperfect which forbids it.

In the first few days after the birth of the child, nurses are in the habit of preparing the breasts for the child, by gentle friction and by drawing them out, and, as they express it, *by breaking the strings*.

The child assists the escape of the milk by its little hands, which are employed in compressing and pulling the breast, to empty the ducts, and to produce a further *vis a tergo* upon the milk tubes.

Of the Milk.

This is a white fluid, secreted in certain glands of the class Mammalia, for the nourishment of their offspring.

The component parts of this fluid unite the qualities of animal and vegetable matter, and are diluted and combined by a watery solvent. As a food, the milk is the chief, and often the only support of the offspring, and generally most conduces to render it healthy.

Its colour depends upon a number of oily globules, which float through the fluid when it is first drawn, and form an opaque emulsion with the caseous matter. These globules may be so far separated by filtration as to leave the serous parts of the milk quite clear, as I have several times done by repeated filtrations with good blotting paper, and rendered the remaining fluid clear and transparent.

The first change which milk undergoes, after it has been drawn and kept at rest, is of a mechanical nature: the oily matter of the milk is not chemically combined with it; hence it soon rises to the surface of the milk, and forms a layer of cream, and the fluid is thus unequally divided into cream and milk.

If the cream be separated, exposed, and dried, it forms the solid food which is called cream-cheese.

If the milk be suffered to stand after the separation of the cream, it sooner or later, according to the temperature, undergoes a chemical change, which consists in the production of an acid termed lactic acid, and a precipitation of the animal, caseous, or albuminous matter of the milk, whilst a clear liquor remains above, and in this manner the milk is divided into curds and whey.

Thus we have already seen cream, curd, and whey, produced from the milk by means, partly mechanical, partly chemical.

The whey thus separated and submitted to slow evaporation, leaves a quantity of sugar, so that the whey is composed principally of water and sugar. But if milk be further decomposed by ignition, an ash remains, which is composed of alkaline and earthy salts.

Although the above is the mode in which milk spontaneously separates, or is changed by other processes, yet still the separation is not complete: some cream remains with the milk; some curd and butter continue with the whey.

The cream resembles a vegetable fixed oil in its elements. The sugar is also of a vegetable nature. The albuminous element, or as it is now called, caseum, from its being the basis of cheese, is composed of the constituents of animal substances, and earthy matter is contained in it, fitted to become one of the component parts of the bones; whilst these vegetable and animal components of milk are suited to the nutrition of the child, the water of the whey dilutes and holds them in a state of minute suspension or solution, and fits them for passing through very minute vessels.

Of the Cream.

This is the oily part of milk, and it also contains a little curd and a good deal of whey.

It is composed of oily globules, which differ from those of the blood, in their colour, which is white instead of red; in their specific gravity, which enables them to float whilst the red globules sink in serum; and in their inequality, as regards their size, for they are of very different magnitudes as regards each other.

The proportional quantity of cream to milk in cow's milk is from one-eighth to one-fourth, but usually the former, in twenty-four hours; but a certain portion continues to separate even for several days.

Butter.

By the agitation of cream in a churn or bottle, it separates into a solid and fluid part: the solid is butter; the fluid is what is called butter-milk.

The butter first forms in little lumps, which gradually aggregate until it becomes a large body by attraction of aggregation, or the union of one small body with another, and then the butter-milk can be squeezed from it.

If butter be melted at 180°, and a quantity of curd be separated from it, which it does by falling to the bottom, the butter will keep for a great length of time; but if the curd remains, the butter becomes acid and rancid.

It is oily and inflammable; but it makes a very excellent and nutritious food, only it requires considerable digestive powers to convert it into nourishment.

It yields, by distillation, oil, water, and a pungent volatile acid, the sebacic.

It forms soaps with alkalies, giving rise to the formation of a series of fatty acids, described by M. Chevreul.

A quart of good cream makes a pound of butter.

The butter-milk which is left when the butter has been separated in churning, has a sourish taste, and is a kind of emulsion. It may be cleared by repeated filtrations.

Of the Curd, Albuminous Element, or Caseum.

It is called the latter, from its being the most important constituent of cheese.

This, the solid matter, is of an animal kind, which spontaneously separates from the milk by a chemical change, during which the milk becomes sour.

The usual mode of separating the albumen or caseum, in making cheese, is by rennet.

Rennet is made by pouring warm water upon the digestive stomach of the calf, putting it in salt and water, and set by for use; and when this is mixed with milk, it coagulates it, especially with the aid of heat. The albuminous portion, or curd, may be also separated by alcohol, wine, sugar, and acids, by nitrate of silver, alum, sesqui-chloride of iron, and tincture of galls.

The caseous matter contains a considerable quantity of nitrogen, like other animal substances.

A lactometer to estimate the cream, and an hydrometer the curd in solution, become good means of estimating the quantity of each.

Curd or caseum differs from true albumen, as white of egg, in being precipitated from its watery solutions by acetic acid: it is to a certain extent soluble in the caustic alkalies and lime-water. Ammonia dissolves cheese, and acids precipitate it from its alkaline solutions.

Curd, the basis of cheese, is white, insipid and inodorous, insoluble in water, but very soluble in the alkalies. Like albumen, it is precipitated from its solution by alcohol; but unlike albumen, it is coagulated by acetic acid. It appears, indeed, that curd bears as much resemblance to albumen and fibrin, as in the vegetable kingdom, starch does to gum and sugar.

Of the Whey.

This is the fluid which remains after the separation of the cream and caseum, and it consists of water, sugar of milk, a few salts, and still a little curd.

It is of a blueish-white colour and sweetish taste, and of an agreeable flavour.

Of the Sugar.

When the whey is evaporated slowly it leaves a substance which appears like honey, and when this is further dried it looks like brown sugar.

It is a little gritty upon the tongue, its taste is saline, and also resembles that of brown sugar. When digested with alcohol, and evaporated, it forms white crystals. It contains twelve per cent. of water.

This sugar possesses the remarkable property of being converted into lactic acid, by digestion with certain animal products; and this fact explains the developement of that acid in milk, during the spontaneous coagulation and separation of the curd.

Of the Salts in Milk.

Some are soluble in water, others are not.

The salts soluble in water are, chlorides of sodium and potassium, sulphate of potass, phosphates of potass and soda, with lactates of potass and lime.

The salts not soluble are, phosphates of lime and magnesia, with very small quantities of phosphate of iron.

Human Milk.

The account which I have thus given of milk is from the cow, but we will compare the this history of their with that of the milk of the human female, so far as I have observed it, and I have been often supplied with it for the purpose of observation.

Human milk, when first drawn, appears more blue in its colour than that of the cow, indeed, it resembles whey, or cow's milk much diluted with water.

It has a sweetish, but also a saltish taste. Soon after it is drawn, like cow's milk, it changes, if it be at rest, by a mechanical separation, from the less specific gravity of cream; the cream separating upon its surface so that it divides itself into cream and milk, but with this striking difference, that the milk in the human subject appears semi-translucent like whey, instead of being white and opaque as in the cow, so that it may be almost said to divide into cream and whey.

During the first ten days of its remaining at rest there is abundance of cream, and a little curd separated from the development of lactic acid.

In thirteen days there is a little more curd separated.

In twenty-two days a greater quantity of curd appears, some floats and some sinks to the bottom of the vessel.

At the end of a month, the cream floats upon the surface—loose and clotted curd floats in the whey.

In five weeks a considerable quantity of curd is produced, and still more in two months.

Milk kept for a year in glass stoppled bottles divides into cream, curd and whey, but is not further changed in appearance.

If cream be exposed for a fortnight, oil begins to separate, so that in a month, oil, cream, curd and whey, become developed.

Lastly, it vegetates, producing abundance of confervæ upon the surface.

Of the Cream.

Its specific gravity is 1·021.

The quantity of cream is abundant, if the woman be healthy; but it varies according to the age of the child, the habits of life, the food, the health and tranquillity of mind of the mother. In these respects women widely differ from other animals.

The quantity of cream in several experiments was as follows :—

8	measures of human milk gave	2	measures of cream.
22	„	5	„
17	„	6	„
26	„	6	„
8	„	2	„
17	„	4	„

So that the cream in comparison with the milk is from one-fifth to one-third, varying with the health, the food, the habits, and state of mind of the mother.

The quantity of cream also varies as the time elapses from the birth of the child.

	Measures of Milk.		Measures of Cream.
On the 8th day	17	gave	6
At 2 months	14	„	2
„ 4 „	17	„	$2\frac{1}{2}$
„ 5 „	21	„	$2\frac{1}{2}$
„ 7 „	14	„	2
„ 8 „	16	„	$2\frac{1}{2}$
„ 9 „	14	„	2
„ 12 „	25	„	4
„ 14 „	14	„	3
„ 16 „	14	„	4
„ 17 „	13	„	4
„ 18 „	11	„	3

A woman who was very poor, and had an exfoliation of the os frontis,

7 measures of milk gave only 1 of cream.

A woman highly fed,

9 measures of milk had $3\frac{1}{2}$ of cream.

The cream of human milk, agitated for a length of time, did not produce butter; but milk and cream mixed together produced, by long agitation, a white and soft solid, in small bodies, which became an aggregated white butter; but with difficulty, and after a length of time.

In five minutes, there were formed minute bodies; in ten minutes, larger; in a quarter of an hour, yet larger; and in twenty minutes, a large lump of a white solid, which, when warmed, separated an oil.

Of the Curd, or Albuminous Element.

This appears less early than in cow's milk, but separates gradually after ten days or a fortnight, and continues to do so for a length of time.

Rennet warmed with human milk produces pellicles of curd after a short time.

Boiling also separates pellicles of curd.

Acetic acid curdles it abundantly.

Sugar of Milk.

When the cream and curd are separated, the whey is found to contain abundance of saccharine matter, which is the sugar of milk.

To render the sugar pure, it must be repeatedly dissolved and crystallized.

It dissolves in water slowly, and requires three parts of boiling water, and nearly double of cold water, for the purpose.

It is a little soluble in alcohol, but more if it be weak; when evaporated from water it is brown, but from alcohol it is white.

Sugar of milk is converted by nitric acid into the oxalic.

The sugar of milk affords a large proportion of nutriment, and of the mildest vegetable kind.

I sent to my friend, Dr. Rees, of Guildford Street and of Guy's Hospital, several specimens of human milk.

Its specific gravity, 1035·8.

Its solid contents, 12 per cent.

Exposed to galvanism, the caseum coagulated in flocculi, but it did not adhere around the positive pole, as it does in cow's milk, which was probably owing to the less coagulability of the caseum of human milk, by the acid generated at the positive pole of the battery.

The quantity of curd or caseum was small in these specimens.

The colostrum, or milk which is at first produced after parturition, appeared at first of a yellow colour, and thick consistence; but when it had stood twenty-four hours, it separated abundance of imperfectly-formed cream upon its surface.

9 measures gave 6 of cream and 3 of milk.

The milk had a slight tinge of red, the cream a somewhat deeper tint.

The colostrum of the cow contains a great number of particles of various sizes, apparently made up of numerous cohering globules, so as to present an extremely granular appearance: these granular bodies, which are absent in ordinary milk, are completely soluble in ether, and consequently are composed almost exclusively of fatty or oily matter.

Being myself unequal to minute chemical inquiries, I requested my friend, Dr. Golding Bird, Lecturer on Natural Philosophy at Guy's Hospital, to send me an analysis of what had been done in the chemical history of milk, as well as the result of his own inquiries; and for the following observations upon that subject, I am entirely indebted to him, as I also am for an admirable analysis of the milk of the porpoise, which I believe had been never previously examined. Dr. Bird writes as follows:—

" Milk is a white opaque fluid possessing a bland, sweetish taste, secreted by certain glands in Mammalia, and designed for the nourishment of their offspring.

" The specific gravity of cow's milk, which may be assumed as the type of the different varieties of this secretion, is about 1·030. This, it is obvious, is far from being constant, as it must necessarily vary with the amount of solid matters present, and which depend upon the health, vigour, age and nourishment of the animal, as well as on the time that has elapsed since parturition, and other causes.

" Under the microscope, myriads of extremely minute globules are seen floating in milk; these, on account of their extreme minuteness, appear black at their edges, and with a magnifying power of 100, the largest of them does not exceed in diameter, according to Raspail, ·00039 inches. On the addition of a drop of solution of potass, the globules are seen to vanish and a limpid fluid is left.

" As the opacity of milk depends on its holding in diffusion myriads of opaque globules, Sir A. Cooper has by straining it repeatedly through a filter sufficiently fine, separated the opaque particles. On submitting this to the test of experiment, I have also found it to succeed most perfectly, a nearly limpid fluid resulting after the milk had been repeatedly filtered.

"The simplest mode of regarding milk is that of an emulsion, formed by the intimate mixture of a fatty matter termed *butter*, with an albuminous constituent, called in chemical language, *casein*. The intimacy of the mixture is doubtless increased by the presence of sugar of milk, as saccharine substances are well known to possess the property of forming imperfect emulsions with oils.

"Cow's milk contains on an average about 10 or 11 per cent. of solid matter, made up of organic and saline constituents.

"When milk is permitted to repose for a few hours, a large proportion of its oily constituents, mixed with some of its caseous matter, slowly separates from the mass of fluid, and being of lower specific gravity than the latter, rises and forms an opaque layer on its surface. This lighter portion is termed *cream*, and the milk from which it is thus separated is popularly termed *skimmed milk*, because the cream is skimmed off, for the purpose of being converted into butter. The specific gravity of the cream is on an average 1·0244, and that of skimmed milk 1·0348, the greater gravity of the latter affording a sufficient explanation of the phenomenon of the cream floating on its surface.

"If the milk from which the cream has been thus separated, be left to itself, it sooner or later undergoes a spontaneous change, some free lactic acid becoming developed, and the albuminous constituent, *casein*, separates in large white coagula. The developement of lactic acid, in all probability, arising from the reaction of caseous matter on the saccholactin, or sugar of milk, as lately pointed out by M. Fremy. This always takes place with greater rapidity in warm than in cold weather, and is hastened during an electric state of the atmosphere, as during a tempest. The addition of a small quantity of any free acid, or of the well-known *rennet*, greatly facilitates this change and consequent coagulation of the caseous matter. The serous fluid from which the *casein* or *curd* has been thus separated, is popularly termed *whey*.

" When whey is submitted to evaporation so as to free it from a large proportion of water, it on cooling crystallizes in small brownish grains; constituting sugar of milk. In Switzerland a very large quantity of this sugar is procured from the whey left after separating the curd in the process of cheese-making, and is used by the peasants for all the purposes to which cane-sugar is applied in this country.

" Sugar of milk consists of,

Carbon	45·94
Hydrogen	6·00
Oxygen	48·06
	100·00

" It is generally stated to be incapable of undergoing the vinous fermentation, although an alcoholic fluid termed *koumiss*, has been long prepared by the Tartars from mare's milk. It is now, however, placed by the researches of Hess, (Poggendorff. *Annalen.* 21., 194,) beyond a doubt, that sugar of milk is capable of being converted into alcohol by fermentation, although not with so much readiness as cane or grape-sugar.

" A layer of cream formed on the surface of milk by repose, is by no means homogeneous, for on carefully examining it, two distinct portions, not, however, separated by any very evident line of demarcation, may be made out; of these the uppermost is richest in butter, and the lowest n caseous matter. The average proportion of cream separated from milk by repose, is about one-eighth, but this varies considerably.

" When cream is submitted to mechanical agitation, as in a churn, it separates into two portions, the one being a soft fatty substance of an agreeable odour, constituting the well-known butter, the other is a more serous fluid holding some casein, sugar, and saline matters in solution, and termed butter-milk, the petit-lait of the French. Butter generally contains about one-sixth of its weight of caseous and other matters mechanically mixed with it; these by careful fusion become separated, and then the butter may be kept for a longer space of time without becoming rancid.

" After butter has been carefully fused, filtered through paper whilst melted, and well washed with water, it is nearly pure; in this state, 100 parts of hot alcohol dissolve 3·46 parts of it. Butter thus purified, contains, like all other fats, *oleine* and *stearine*, with the addition of a third fatty ingredient peculiar to butter, and hence named *butyrine*.

" Anything like a quantitative analysis of milk can, it is obvious, be considered in no other light than that of affording an approximation to the average proportion of its principal ingredients. The following are the results of the analysis of Berzelius.

1000 parts of *skimmed milk*, of specific gravity 1·033, contained

Water	928·75
Caseous matter with traces of butter	28·00
Sugar of milk (saccholactin)	35·00
Lactic (acetic) acid, acetate of potass, and traces of a salt of iron	6·00
Hydrochlorate and phosphate of potass	1·95
Phosphate of iron	0·05

1000 parts of *cream*, of specific gravity 1·024, consisted of

Butter	45
Caseous matter	35
Sugar of milk and saline ingredients	44
Water (*butter-milk?*)	876

" By incineration, caseous matter leaves above 6·5 per cent. of ashes, consisting chiefly of phosphate of lime.

"The caseous matter, or casein, of milk, constitutes the basis of cheese: it may be considered as bearing the same relation to milk, that the albumen does to blood. It is, indeed, more than probable, that casein is but a modification of ordinary albumen, and hence may, in a physiological sense, be considered as the albuminous principle of milk. Casein is precipitated from its solutions, as in milk, by the addition of acids, which indeed appear to combine with it, for by separating them by a very simple chemical process from the coagula, the casein once more becomes soluble in water. A familiar example of the coagulation of casein by an acid is met with, in the vomiting of curdled milk by suckling infants; the coagulating agent in these cases, is probably hydrochloric acid, which, from the researches of Dr. Prout and Leopold Gmelin, appears to be constantly present in the stomach. The rationale of the disappearance of this disagreeable symptom, on the administration of a few grains of chalk or magnesia, is hence sufficiently obvious.

"Casein, when rendered as pure as possible, consists, according to the analyses of Gay-Lussac and Thenard, and Berard, of—

	Carbon.	Oxygen.	Hydrogen.	Nitrogen.
Gay-Lussac and Thenard . .	59·78	11·41	7·43	21·38
Berard	60·07	11·41	6·99	21·51

"Damp casein, when set aside in a warm place, rapidly undergoes putrefactive fermentation, and a complex mass results, consisting, according to Prout, of two substances, termed caseic acid and caseous oxide, or, according to Braconnot, chiefly of a matter termed aposepodine.

"Milk drawn shortly after parturition, differs in its physical and chemical character from milk drawn at a more distant period. This variety is termed *colostrum;* that of the cow is yellow, mucilaginous, and occasionally mixed with blood; it contains but mere traces of butter or other fat, and appears to contain albumen as one of its ingredients, as by exposure to heat, it completely solidifies, like so much serum of blood. The specific gravity of the *colostrum* of the cow is about 1·072. This secretion does not turn sour like milk, but readily putrefies; and in three or four days after the birth of the calf, is replaced by the ordinary lacteal secretion.

"The colostrum of the cow, ass, and goat, has been submitted to examination very lately by MM. Chevallier and Henry. They state the property possessed by this secretion of undergoing coagulation by heat, although they have not mentioned albumen among its ingredients. It is probable that it was confounded with the mucous matter, stated by these gentlemen to be present in the fluid. The following is the result of their analysis of the colostrum of the cow:—

Casein	15·07
Mucous matter . .	2·00
Saccholactin, or sugar of milk	?
Butter	2·60
Water	80·33
	100·00

"On taking a retrospective glance at the above remarks on the composition of cow's milk, which I have taken as a standard or type of this class of secretions, we cannot help being struck with the peculiar manner in which the different component parts appear to be arranged, for the more ready nourishment of the new-born animal. Milk may be physiologically regarded as made up of three classes of ingredients; the first containing those which resemble vegetable secretions in the absence of nitrogen; the second including those which contain abundance of nitrogen, and consequently afford a proper pabulum for the growth of the young animal; the third class containing those ingredients which, in the present state of chemical physiology we have no safe grounds for supposing are *digested*, or their elements re-arranged by vital chemistry, and hence differ from the first two classes in being rather *appropriated* by the vital influence of the infant animal, than assimilated to form such combinations.

A. *Ingredients of milk in which nitrogen is absent.* Sugar of milk, fatty matters.

B. *Ingredients of milk in which nitrogen is present.* Caseous matter.

C. *Inorganic, or saline ingredients.* Salts of potass, soda, lime, and iron.

"The latter class contains those earthy salts which constitute the chief ingredients in osseous structures; and all being dissolved in, or diffused through, abundance of water, become fitted to pass or drain through the minutest vascular tissues."

The lacteal secretions of other Mammalia, so far as they have been examined, appear to differ from the milk of the cow rather in the quantity and proportion of their respective constituents, than the super-addition or subtraction of any particular ingredient. Occasionally, the fatty matters present, are found to differ slightly in the products of their saponification with alkalies, and in the character of the acids produced: thus the fat of the milk of the cow, goat, and porpoise, yield respectively butyric, hircic, and phocenic acids.

The following is a comparative view of the composition of the milk of the cow, ass, goat, sheep, and mare, from the analyses of Henry, Chevallier, Luiscius, and Bondt.

	Cow.	*Goat.*	*Ass.*	*Sheep.*	*Mare.*
Casein	4·48	4·02	1·82	4·50	1·62
Butter	3·13	3·32	0·11	4·20	traces
Sugar of milk	4·77	5·28	6·08	5·00	8·75
Saline matters	0·60	0·58	0·34	0.68	89·63
Water	87·02	86·80	91.65	85.62	

ON LACTATION.

This is the function by which milk is secreted in the mammary gland and conveyed to the offspring for its nourishment and support.

The secretion of milk commences on the third or fourth day after the birth of the child, but there is a fluid produced during the latter part of gestation, which is not true milk. The milk will continue to be secreted for many years.

Soon after the birth of the child, the blood which had been abundantly conveyed to the uterus during the period of gestation being no longer there required, is directed to the breasts for the secretion of milk.

But both a constitutional and local excitement are required for its production.

The constitutional increased action, is marked by the usual symptoms of irritative fever, by a white tongue, a dry hot skin, a quick and hard pulse, and a disposition to a costive state of the bowels.

The local effects are hardness, pain, and tension of the breasts, and the excitement is generally greater with the first parturition than with subsequent children.

This assemblage of symptoms constitutes what is denominated the milk fever, and its accession is on the third and fourth day after delivery, sometimes earlier, particularly with the first child, and at others much later. Its degree depends upon the irritability of the person's constitution, and is, consequently, the greatest in nervous, irritable, and delicate persons. It is succeeded by a calm and tranquil state of the constitution, and by the commencement of the secretion of milk.

Some preparation is made for the changes in the uterus and breast by the suspension of the monthly sexual secretion soon after gestation commences, when the breasts increase in their bulk, become tender to pressure, and they often previously to the birth of the child secrete a fluid, by which the gland is prepared for the secretion of milk and the lactiferous tubes to convey it.

The natural and most effectual mode of relieving the loaded state of the breast, and of producing the secretion of milk, consists in the application of the child to the nipples, which encourages the secretion, and this should be done so soon as the fatigue of delivery is passed. It has the additional advantage of drawing out and elongating the nipple, and of fitting it for its future office, an attention which is frequently required after a first delivery.

If the child be too weak to perform this office, the nurse supplies its place, and sucks the mother, or uses a pump to draw off the secretion. But if the breast continues swollen and inflamed, and the milk does not appear, purgatives and leeches will be required to lessen the inflammation and excitement of the constitution, and fomentations and poultices will be necessary upon the breasts to encourage and assist in the production of the secretion.

The secretion of milk may be said to be constant or occasional; by the first, the milk tubes and reservoirs are *constantly* supplied by means of a slow and continued production of the fluid, so that the milk is thus, in some degree, prepared for the child.

By the *occasional*, is to be understood that secretion which is called by mothers and nurses, the *draught* of the breast, by which is meant a sudden rush of blood to the gland, during which the milk is so abundantly secreted, that if the nipple be not immediately caught by the child, the milk escapes from it, and the child when it receives the nipple is almost choked by the rapid and abundant flow of the fluid; if it lets go its hold, the milk spirts into the infant's eyes.

Even the sight of the child will produce this draught, or sudden rush of blood and copious supply of milk, as the thought or sight of food occasions an abundant secretion of the saliva.

The draught is also greatly increased by the child pressing the breast with its little hands, by its drawing out the nipple by its tongue, lips, and gums, and by the pressure of its head against the breast.

In other mammalia, so far as we can judge, a similar process occurs, and the same effect is produced by the animal striking the udder with its head, and forcibly drawing out the teat.

Observe the foal playing with the teat, drawing it out forcibly and striking the udder of the mare with its head; and the lamb sucking for a short time to empty the large reservoir of the gland of the accumulated milk, and then beating the udder of the ewe with its head as if to put it in mind of secreting more to supply its still pressing wants.

In the human subject the milk is often so abundant, that a limpet shell is obliged to be worn to catch it, and to prevent the mother's dress from being constantly wet and uncomfortable.

The mother is quite sensible of the *draught*, as the feeling it produces is very strong, but she is also informed of it by the sudden escape of milk even when the child is not applied to the breast; if a thought, or irritation of the nipple, excites the sudden secretion.

The quantity of milk which can be usually squeezed from the mother is about two ounces from one breast, but necessarily varies with the state of the health and mode of nutrition; as to the quantity produced by the draught I know of no means of accurately ascertaining it.

A woman who milked her right breast for my information, and whose child was four months and a fortnight old, produced:—

On the Saturday Morning	.	2 oz.
„ Sunday Morning	.	2 „ 2 dr.
„ Monday Morning	.	2 „
„ Tuesday Morning	.	2 „ 6 „
„ Tuesday Evening .	.	1 „ 3 „

At seventeen months after delivery, a woman milked out 2 oz. when the child had been seven hours absent from the breast.

I have often had this experiment made, and have almost constantly found that the morning's milk is greater in quantity than that of the evening, and the same observation generally applies to the cow.

As to the quality of the milk, judged of by the quantity of cream, it varies with the health and mode of nutrition of the mother.

The secretion of milk will continue for many years in an healthy mother, if it be encouraged by the application of the child to the breast; and many women continue to suckle in a belief that it lessens the tendency to pregnancy, and others from the better motive of believing it to be the best food for their child.

A woman had abundance of milk at eighteen months after delivery; another suckled her child for twenty-one months, and the child had no other food. Mr. Wakefield, of Battle Bridge, Pentonville, told me that he knew a woman who had suckled her two successive children, at the same time, and I have heard of an instance in which a wet nurse suckled two consecutive children.

In general, women give up suckling when they become again pregnant, because gestation generally diminishes the quantity and impairs the quality of the milk.

Mr. King informed me that when travelling in the Arctic circle (?) he had seen an Esquimaux boy play out of doors with his bow and arrow, and come into a hut, to receive the milk of his mother's breast; and many children in our own country play about a room, and then run to their mother's breast, and sometimes fetch a stool to stand upon, whilst they pursue the process of sucking.

Nine or ten months is, however, a good general time for weaning the child, when it is provided with teeth, and can take other food for its nourishment; but this depends upon so many circumstances of health and convenience, that it must be left to the feelings of the mother and the judgment of the medical attendant to determine upon its propriety.

If the mother wishes to wean her child, and she still secretes abundance of milk, the best mode of removing it is by giving an active purgative in the morning, and she should apply evaporating lotions of Liq. Plumb. Diacetat. dilutus, unciam, cum Alcohol, uncia; this lessens the local action, and prevents inflammation by the diminished temperature which its evaporation produces.

When inflammation in the breast is generally diffused through the gland, it stops its secretion; but if it attack only a part of the breast, the other continues to secrete.

If an abscess forms in a part of the breast, the secretion will still proceed in other parts; and when the abscess is opened, and the inflammation is subdued, milk often escapes at the opening by which the matter was discharged.

If one breast be inflamed, and ceases to secrete, the other gland will continue its secretion.

If a woman be the subject of a severe fever, her milk will generally cease to be secreted.

In general, the secretion of milk ceases soon after the child is weaned; but it sometimes continues to a subsequent delivery.

Some women are prevented from suckling by want of milk; some by want of strength; some from a deficiency of the nipple; but too frequently it is the result of caprice, the fear of trouble, the dread of spoiling the figure, and from anxiety to avoid the confinement which it enforces; and in some from the contrary desire of having many children.

However, it is quite true that there are women who are too feeble to continue to be nurses, after giving suckling a fair trial. It injures their digestive powers; they feel a sinking sensation in the stomach; loss of appetite; pain in the chest, back, and head; violent spasms from its influence upon the nervous system, and becoming emaciated, they are compelled to give up a duty which they have been most anxious to fulfil.

In general, when a woman is a nurse, and she becomes again pregnant, she is obliged to give up suckling, as the milk is deteriorated in its quality, often disagrees with the child, making it vomit, and it is so disagreeable to the infant that it refuses the breast.

The quantity of milk which a woman is capable of secreting, cannot be estimated by the size of her breast, as it often is large and hard rather than secretory, or it is loaded with adeps, and produces but little milk. The same remark applies to quadrupeds, as the cow with the largest udder does not always give the most milk. I know a lady, who, before pregnancy, has scarcely any breast; but it evolves largely in lactation, disappears in a great degree when the child is weaned, and again evolves with the next child. Now that she has ceased to have children, her breast is as small as that of a man, so that the chest in that respect resembles that of the male.

If a child sucks one breast more than the other, it becomes much larger than the other.

After the first few weeks of lactation, there is little difference in the milk of three, six, or nine months, as is proved by the children of wet nurses being older or younger than those they suckle, yet still the children they nurse are well nourished. The same thing is proved by nurses suckling consecutive children. Dr. Walshman and Dr. Key, two of the most experienced accoucheurs I have known, informed me that they did not believe that the age of the milk made any essential difference. However, there is a feeling upon this subject on the part of the mother, which may be indulged, as she and the nurse are better satisfied, if the children be nearly of the same age; and Dr. Merriman thinks that the child of the wet nurse should be about two months older than the new-born child.

Women who labour hard, if they are well nourished, have abundance of milk; but if their food be scanty in quantity, or poor in quality, they soon sink under fatigue, and lose their milk.

A child may be deprived of its mother's milk, and pine for her breast, and if returned to it after several weeks, the secretion of the gland will return, and the child be supported by it.

If a woman be healthy and she has milk in her breast, there can be no question of the propriety of her giving suck. If such a question be put, the answer should be, that all animals, even those of the most ferocious character, show affection for their young, do not forsake them, but yield them their milk, do not neglect, but nurse and watch over them; and shall woman, the loveliest of nature's creatures, possessed of reason as well as of instinct, refuse that nourishment to her offspring which no other animal withholds, and hesitate to perform that duty which all animals of the Mammalia class invariably discharge?

Besides it may be truly said that nursing the infant is most beneficial both to the mother and the child, and that women who have been previously delicate, become strong and healthy whilst they suckle. If a woman suffers much from milk fever, the application of the child to the breast is the best mode of relief.

The giving suck may be the means of preventing or of lessening the tendency to puerperal fever, by determining the blood to the breast for the secretion of milk, and withdrawing it from the uterus, peritoneum and iliac vessels; when it has commenced, fomentations to the breast should be employed.

Suckling also diminishes the disposition to malignant diseases of the breast, for although women who have had children are still liable to cancerous and fungoid diseases, yet it is undoubtedly true, that breasts which have been unemployed in suckling, in women who have been married, but are childless, and in those who have remained single, are more prone to malignant diseases than those of women who have nursed large families; and if it were only to lessen the probability of the occurrence of such horrible complaints and causes of dissolution, women ought not to refuse to suckle their offspring.

A woman who has children and suckles them, is undoubtedly a better insurable life than a married woman who has no children, or one who has remained single.

A female of luxury and refinement is often in this respect a worse mother than the inhabitant of the meanest hovel, who nurses her children, and brings them up healthy under privations and bodily exertions to obtain subsistence, which might almost excuse her refusal.

The frequent sight of the child, watching it at the breast, the repeated calls for attention, the dawn of each attack of disease and the cause of its little cries, are constantly begetting feelings of affection, which a mother who does not suckle seldom feels in an equal degree, when she allows the care of her child to devolve upon another, and suffers her maternal feelings to give place to indolence or caprice, or the empty calls of a fashionable and luxurious life.

It is, however, melancholy to reflect, that a life of high civilization and refinement renders the female less able to bear the shocks of parturition: it has a tendency to lessen her attention to her offspring, and really diminishes her power of affording it nourishment; so that she is often a worse mother in these respects than the female of the middle ranks of life, or even the meanest cottager.

Having thus stated the advantages of nursing to the mother, it is equally true that the child derives from it a multitude of advantages and comforts.

First. It may be observed that the first milk after parturition, and which is called the colostrum, and is the immediate production of the milk fever, is of a purgative nature, and has, therefore, when received into the child, a tendency to remove the quantity of meconium with which its bowels are loaded at the time of its birth.

Secondly. That medical man must be very presumptuous, who can believe that he can discover a food equally favourable to a child's digestive organs as a healthy mother's milk, or as well fitted to be acted upon by the gastric juice which is provided in the child, to digest the mother's milk.

Dr. Merriman informed me, that he tried to ascertain the average mortality of children brought up by hand, but found it difficult, for want of accurate data. The result was a conviction, taking the whole population of rich, the poor, and the middle classes, that not more than two in ten children so nourished, survived eighteen or twenty months, and the mortality of the children of those who go out as wet nurses is frightful.

Thirdly. The mother's bosom is the child's greatest comfort in sickness, and hence its sweetest repose. In the irritation attending the process of dentition, the child's only rest is upon the mother's bosom, and even the mother's anxiety contributes to the relief of the child; for it renders her milk a purgative, and thus acts usefully as an aperient, when the system is in a feverish state, and operates as its best medicine. In many other infantile diseases, the same principle may be observed to apply.

So soon, then, as the mother recovers from the fatigues of parturition, the child should be applied to the breast, for the advantage both of the infant and of the parent.

It must, however, be acknowledged, that there are many examples of women who are unable to perform this important duty, from weakness of constitution, and deficiency in the supply of milk; and when from any cause the mother is incapable of nourishing her offspring, the procuring a wet nurse is infinitely better for the child than bringing it up by hand, as is the common expression, as the food is so much more natural and congenial.

Of the Food of the Mother or Nurse.

It appears that the quantity and quality of the food taken by mothers and nurses is often greater than is absolutely necessary; indeed, absurdly and unnecessarily abundant. A mother who reared ten very healthy children, and never failed in her milk, adopted the following plan of diet:—

Her breakfast was café au lait with bread and butter. At one o'clock P.M., she took hot meat, and drank half a pint of porter. At six o'clock, she dined plainly upon meat, but drank half a pint of porter and two glasses of Port wine. At ten o'clock P.M., she took a slight supper of meat, and drank half a pint of porter. She suckled early in the morning, frequently in the day, and the last thing at night. During the night, the child was fed upon barley-jelly, gruel, flour and milk, milk and arrow-root if the bowels were relaxed. Her general food for the child was flour tied in a cloth boiled in water, dried and grated into milk with sugar.

It appears, however, that this diet for the mother is unnecessarily abundant and stimulating.

The Welsh women live, whilst they suckle their children, upon barley-bread, oat-cake, cheese, and oatmeal, and bacon with leeks, and other vegetables boiled together, into what they call cowl. No beer nor wine, but milk and water, or butter-milk, are their drinks. The woman is often moving about her house in the fourth or fifth day after parturition. They are affectionate mothers, and their infants are generally very healthy.

In Ireland, Dr. Woodroffe of Cork informed me, in reply to some questions I put to him:—

QUESTIONS.	ANSWERS.
What is the diet of the *poor* women in Ireland, whilst they are *suckling?*	Potatoes, milk, stirabout, and occasionally a little fish.
What work are they called upon to do whilst they are nurses?	They work in their fields and gardens, and are engaged in their domestic concerns.
How long do they generally *suckle*, and do you know of any individual cases of the child continuing to be suckled for a long period?	Never less than *twelve*, but more generally for *sixteen* or *eighteen* months. I have known many instances of children being suckled for *two* years, much to

QUESTIONS.	ANSWERS.
	the detriment both of mother and child. Amongst the lower classes, there is a strong prejudice in favour of weaning the child on particular days; and to accomplish this object, they often continue to nurse their child *five or six months* longer than they otherwise would.
Do they carry the child with them whilst at work, or do they go home to suckle?	The child is left at home; women do not go far from their own dwellings, but work in the adjoining fields and gardens.

In Scotland and in the north of England, where the women work hard, in a few days after parturition they occupy themselves with the business of the house, and even very soon go out into the fields to work. The child is also carried out by another child, and is placed under a hedge or wall, and if the mother hears the child cry, she suckles it, or does so, from her belief of its wants. The food of he mother is ground oatmeal and milk, flour and milk, potatoes sliced and fried in fat.

A lady who was much in the habit of visiting the poor for charitable purposes, states, however, that she observed that nurses who work hard, and are indifferently fed, are weak and exhausted, and appear old at an early period of life.

Dr. Merriman, to whose judgment, experience, and authority, every one would defer, informs me that a patient of his engaged a nurse who suckled her two following children, and altogether she was a nurse for nearly, if not quite, three years. The children were strong and healthy, but the nurse was reduced to such a state of weakness and ill health, as to be incapacitated from any useful labour. The family felt that she had ruined her health in their service, and they kept her, but no longer as an efficient servant.

Some kinds of food, in the better ranks of life, disagree with the mother and the child, by affecting the milk; as salads, pickles, sour fruit, cucumbers, melons, and acids. The lady to whom I alluded, who had nursed ten healthy children, had her own bowels irritated as well as those of the child she nursed, by drinking a glass of Champagne, or of any acid or fermenting wines or liquids.

In general the menstrual or sexual secretion ceases soon after gestation begins, and it does not reappear until after lactation has been nearly completed; the woman then finds that the quantity of milk lessens, and that which is secreted disagrees with the child, and is often refused by it from being disagreeable, and therefore the infant frequently weans itself.

But it sometimes happens that the sexual secretion continues during lactation, and women have assured me, that they and their children have been healthy. A woman who suckled sixteen months had the menstrual secretion during the last seven, yet her milk was abundant and the child healthy. These, however, must be considered as exceptions to general rules, for usually, if menstruation occurs during lactation, such a change is produced in the child's health and bowels, that a medical man is led to ask if the secretion has not returned; the woman also suffers from the great call upon her constitution which this double secretion produces, from the difficulty of supporting both at the same time.

On the Effects of the Mind upon the Secretion.

The influence of the mind upon the body generally affects the natural functions, and in this circumstance the human subject remarkably differs from other animals. A hurried circulation from over-exercise, or a deficiency of natural food and water, will affect the secretion of milk in all Mammalia, but mental and moral causes influence the production of milk in the human female; and it is this influence of the mind upon the body which operates to produce the fatal effects of injuries in man which other animals suffer with comparative impunity.

Lactation is one of those functions which are subject to great changes from mental impressions, for the milk becomes reduced in quantity, altered in quality, and sometimes suddenly arrested from mental agitation; but it generally suffers more in its quality than its quantity.

The secretion of milk proceeds best in *a tranquil state of mind* and with a cheerful temper; then the milk is regularly abundant and agrees well with the child. On the contrary, a *fretful temper* lessens the quantity of milk, makes it thin and serous, and it disturbs the child's bowels, producing intestinal fever and much griping, and a woman of a nervous, irritable, temperament, makes an indifferent nurse.

Fits of anger produce a very irritating milk followed by griping sensations in the infant, and green stools are produced, which are often indications of considerable nervous irritation on the part of the child.

Grief has great influence on lactation, and consequently upon the child. The loss of a near and dear relation, or a change of fortune, will so much diminish the secretion of milk, that a wet nurse often will be required to perform the office of suckling, or it will be necessary to give the child such food as is best adapted to its age and powers of digestion,

Anxiety of mind diminishes the quantity and alters the quality of the milk. The reception of a letter which leaves the mind in anxious suspense, lessens the draught, and the breast becomes empty, the lactiferous tubes and reservoirs ceasing to contain milk in the usual manner.

If the child be ill and the mother is anxious respecting it, she complains to her medical attendant that she has little milk, and that her infant is griped and has frequent green and frothy motions.

Fear has a powerful influence on the secretion of milk; I am informed by a medical man who practises much amongst the poor, that the apprehension of the brutal conduct of a drunken husband, will put a stop for the time to the secretion of milk. When this happens the breast feels knotted and hard, flaccid from the absence of milk, and that which is secreted is highly irritating, and some time elapses before a healthy secretion returns.

Terror, which is sudden and great fear, instantly stops this secretion.

A nurse was hired, and in the morning she had abundance of milk, but having to go fifty miles to the place at which the parents of the child resided, in a common diligence, the horses proved restive and the passengers were in much danger. When the nurse, who had been greatly terrified, arrived at her place at the end of the journey, the milk had entirely disappeared, and the secretion could not be reproduced, although she was stimulated by spirits, medicine, and by the best local applications a medical man could suggest. A lady in excellent health, and a good nurse, was overturned in her pony chaise, and when she returned home, pale, and greatly alarmed, she had no milk, nor did it return, and she was obliged to wean her child.

Those passions which are generally sources of pleasure, and which, when moderately indulged, are conducive to health, will, when carried to excess, alter, and even entirely arrest the secretion of milk.

On the Effects of Medicine on Lactation.

Medicine has great influence in changing the qualities of the milk. This is proved by those numerous cases with which our Hospitals teem, of mothers suffering under eruptions and other forms of disease supposed to be syphilitic, and their infants having eruptions upon the head, the feet, and the nates, with inflammation upon the tunica conjunctiva, and desquamation of the cuticle upon different parts of the body. The mother has mercury given to her by the stomach, or mercury is rubbed upon a good absorbent surface; no medicine is given to the child, but it continues to suck its diseased mother; both mother and child soon improve, and both completely recover, but the child through the influence of the milk alone. Such a number of instances have I seen of these diseases so cured, that there can be no doubt of the fact, and many children perish if the mother be not so treated.

Purgative remedies, if they be easily absorbed, when given to the mother, produce a similar effect upon the child, but sometimes it would seem that any disturbance of the mother's bowels will produce irritation in those of the child.

The medicines which affect the child the least, are olive oil, castor oil, confectio sennæ, and extractum colocynthidis compositum. The saline purges are apt to influence the child's bowels, or, as the nurses express it, to go to the milk. The best medicines to give to the child itself, are manna, magnesia, castor oil; injections are also very useful.

Iodine has been found in the milk by many persons. Dr. Rees writes:—" A woman in Guy's Hospital had been taking iodine for a fortnight three times per diem, with five grains of hydriodate of potash; her milk was tested with sulphuric acid and starch, and the strongest indications of iodine were obtained."

From the researches of Chevallier, Henry, and Peligot, on the milk of asses, to whom various medicines were administered, it appears that distinct traces of many remedial agents were readily detected in the lacteal secretion. Of these,—

Common salt was detected in abundance.

Sesqui-carbonate of soda passed in great quantity into the milk, rendering it alkaline.

Traces of sulphate of soda, when administered in doses of about two ounces, were readily detected.

Sulphate of quinine, although administered in large doses, did not appear to pass into the milk.

Iodide of potassium was readily detected, when administered in doses of a drachm and a half.

Oxide of zinc, tris-nitrate of bismuth, and sesqui-oxide of iron, were readily detected in the milk, when these substances were administered to the animal; but no traces of alkaline sulphurets, salts of mercury, or nitrate of potass, could be detected even after the ingestion of these drugs in considerable doses.

I have received the following letter from my nephew, Dr. Young, upon the subject of lactation in the black population of the West Indies.

"17, Woburn Place,
"19th July, 1838.

"My dear Uncle,

"I have much pleasure in answering the questions you have put, regarding the parturient negress. I trust the answers will be sufficiently explicit for your purpose;

but I regret they have been delayed so long, having received your note on the eve of my leaving town for a few days.

"1. Twin cases amongst the black women are not so frequent as with the whites. They breed earlier, and when they live an indolent life, they have a numerous offspring, not exceeding, however, the poorer classes of this country.

"2. It is a mistaken opinion, that their children are not black when born. Some are jet black, and others shades lighter, which continue so, or become in the course of a month or two dark, according to the complexion of the parents; following that hereditary law of nature, by either taking the stamp of the father or mother, or by participating in the characters of both.

"3. Parturition in the black, after the first child, is generally easy, and Nature is abundantly kind and successful where she is not interrupted by the officious and injurious interference of the black midwives, who attend in all ordinary cases. It is, however, of frequent occurrence, to meet with difficult labours on the births of the first children, where the individual has conceived at the tender age of from thirteen to sixteen years, before the pelvis and external parts have arrived to their full and mature growth. But considering the relaxing effects of the climate, the nature of the occupations which keep the women for hours every day in the erect posture, the vegetable diet on which they chiefly subsist, and their improper habits, lingering labours are more frequent than, à priori, you would have been led to believe, although very few cases prove of serious consequence.

"4. The second or third day after delivery, infusion of senna and Epsom salts are generally given; nor do these, or any other medicine, during the whole period of lactation, seem to affect the child more particularly than is sometimes observed amongst the whites. It not unfrequently happens, however, that the stomach and bowels of negro children are much disordered by the messes of greens and vegetables which the mothers take, cooked in a most savoury manner, but I would still maintain, not more so than would occur in the European under similar circumstances.

"5. Gruels and chocolate are allowed for the first week after parturition, and then the woman is permitted to enter on the diet she was accustomed to, composed chiefly of vegetables, containing large portions of pure fecula and sugar, and some farinaceous and albuminous matter; animal substances being taken in such quantity as only to act as a condiment. On this food, therefore, she subsists during the whole period of lactation, and it seems quite sufficient, both for her own support, and that of the child, for in few instances are finer and healthier children and mothers to be seen. To this simple and unexciting diet, in all probability, may be attributed the unfrequent occurrence of febrile disorders during the puerperal state, and the facility with which they are subdued, if they do occur. Puerperal fever and peritoneal inflammation seldom, if ever happen, nor does inflammation of the uterus, except in cases where the labours have been difficult. Milk abscesses and sore nipples never occur except in the young and robust, and then very occasionally; and puerperal convulsions after delivery are almost an anomaly. These facts may afford a wholesome lesson to the European women, for how very frequently are they sufferers under these disorders, with which they are so often afflicted from a too nutritious diet and stimulating regimen, during the month of their confinement.

"6. The negro woman is enjoined to lie in the horizontal posture, and to be at permanent rest for three weeks after delivery. To insure this as much as possible, a nurse is exclusively allowed to attend upon her. The fourth week she is permitted to move about her cottage and garden; and on the fifth weeks he presents herself and child to her employer. She is then put to some light employment, from which, in the course of three months, she gradually passes on to the accustomed duties of her class, as labourer or otherwise. These wise and humane measures are too often neglected by the individual herself, and connected with her other erroneous habits, she establishes that fluor albus, procidentia, and prolapsus uteri, which are so common amongst the blacks, distressing to them, and perplexing to the medical practitioner.

"7. The quality of her milk does not differ from that of the European's. Sugar is the predominating material. It nourishes and supports the white and black child equally well and the same. When the black woman is employed as nurse to the white child, which she will undertake, but never to the exclusion of her own, she is allowed a full share of animal food and fermented liquor, in cases where the employer is able to do so; but in no instance does this course seem to make any difference, except, perhaps, in prolonging the secretion in a full quantity, for a greater or more protracted period. This, however, is not altogether certain; for in the negress, when she is not employed in active labour, but is rather permitted to lead an indolent life, such as she does when she is engaged as a wet nurse, the milk is secreted as abundantly and as persistently under the one as the other course of diet. It is active bodily exertion which seems to shorten the period of abundant supply. Under a system of this kind, and with her ordinary habits of living, the secretion is sufficient for the entire support of the child during six or eight months, when the mother is strong and healthy. At this time, the child becomes a feeder, and the mother is allowed to suckle for six or eight months longer, should she continue in health, or not conceive in the mean time. She, however, always evinces the greatest reluctance in terminating it; for enjoying many indulgences and perquisites as a suckler, she will frequently, to the detriment of herself and child, prolong the time as much as possible for such enjoyments, and often the measure can only be obtained by either abridging or discontinuing those indulgences. It is always a question of difficulty, and often a source of bickering, between the woman and her employer.

"8. The children cut their teeth at the same ages, in the same order, and under similar influences, as the children of white parents. But disorders that arise during dentition are universally, in this class of people, most difficult to manage, and prove a great source of mortality; so irregular are the mothers in their diet and other habits, and so disobedient to those rules which can alone lead to a successful treatment.

"Malignant diseases of the uterus and mammæ are of very rare occurrence, and even those cases which I have witnessed in this class of people, have been among the better orders of them, whose habits of living have been assimilated to those of the European. These diseases show themselves in the hybrids of this people and the European, in proportion as there is more of the European blood. I would not, therefore, as seems to be the opinion of some, attribute the near exemption of the negro race from disorders of this kind to their simple habits of life; but rather look on the fact as one of those hidden and wise laws of the Ruler of the universe, who measures out our ills and enjoyments in such proportions and with that justice, which He alone can appreciate. Look to those diseases which seem almost peculiar to the African race, and which the European so seldom contracts, even under the influence of a tropical climate. Look into the universe of all living and animated nature, and you will find every class beautifully and fearfully created and fitted to fill and endure the situation in which the Maker of all things hath cast its lot, the individuals of each obeying the same laws, and governed by the same appetites which first stamped their classes, in whatever part of the world they shall, by art and the power of man, be transferred.

"I am,

"My dear Uncle,

"Very affectionately and sincerely yours,

"N. Lewis Young."

In another letter of reply from Dr. Young, he says:—

"Marchfield House, Bracknell, Berks,
"July 6, 1839.

"My dear Uncle,

"In every instance, in which the health of the mother and child will permit it, the negress is allowed to suckle for eighteen months, a period found best suited to the rearing of the child, and during which the secretion generally continues healthy. Many are the cases, however, in which the woman continues, in opposition to all control or advice, and to her own detriment and that of her child, to suckle for two, three, and sometimes even for four years. It is not uncommon to see an urchin trotting after and calling out to its mother for some *bubby*, (meaning the breast, as it is vulgarly called amongst the negroes,) and the mother to kneel down, even in the public road, and to submit to the operation as one of the animal instincts. I have frequently seen the child tied on her back, take the breast from over her shoulder, and indulge as heartily as if comfortably pillowed in her lap.

"An instance came under my observation in which a nursery woman, about fifty-five years old, and many years after she had borne a child, clandestinely allowed an infant which had been committed to her care to be weaned, to suck her for many months. A secretion was brought on, and it evidently afforded some nourishment to the child.

"I have seen some cases of enlarged and pendulous mammæ in the negro, bearing many of the external characters of those of the negress who had never borne children. And although I never witnessed an instance in which the gland secreted milk, yet I have heard related a well-authenticated case which occurred at Barbadoes, in which the man was known to take the care of one of his grandchildren, to tend, nurse and suckle it as a mother, which it had lost soon after its birth. The account is, that the child obtained nourishment from his breasts, lived and did well, but I suppose with the assistance of other food.

"I am, my dear Uncle,
"Very respectfully and sincerely your's,
"N. Lewis Young."

OF THE CHANGES FROM AGE.

After the cessation of menstruation from age, when pregnancy is no longer possible, the ducts of the breast still continue open, and loaded with mucus, which may be squeezed from the nipple.

When the ducts are cut open, the mucus, at an age of between fifty and sixty years, is in a fluid state, and the ducts are extremely distended by it.

I collected from the ducts of an old person a quantity of the inspissated mucus, and sent it to Dr. Prout, who found that it was united with oily matter, and with phosphate and carbonate of lime.

This state of the tubes arises from the mucous secretion still proceeding in the lining membrane of the ducts, and not being able to escape at their narrow orifices at the nipple, an absorption of the watery part ensues, and the more solid remains united with ossific matter.

Although the ducts in age are often very open when the woman has suckled several children, yet the milk cellules are generally incapable of receiving injection, and the ducts inject but imperfectly. The glandules are extremely diminished, and often become entirely absorbed, so that in old age only portions of the ducts remain.

The lactiferous tubes in old persons appear cellulous from their being increased where branches of ducts are entering the larger trunks.

But there is another and still more curious, but an almost invariable change in age, which is, that the arteries of the breast are ossified as they become useless; not only the larger branches of the mammary arteries, but their trunks also; so that they often become obliterated, and always very much diminished canals, and are with great difficulty injected; but it is not necessary to inject them to render them visible, as they are sufficiently apparent, from the load of earth which they contain, when they have been macerated and dried.

The veins of the breast are much diminished in age, but the nerves are more easily traced than when the gland is in its most developed state. The nipple becomes long, wrinkled, and relaxed, but in very old age it generally contracts, and resembles a warty excrescence.

It appears, then, that the effect of age is to absorb the glandular structure, to load the ducts with mucus, to obliterate the milk cells, to excessively ossify the arteries, and to thin and wrinkle the nipple, and at length in a great degree to absorb it.

But although the glandular structure, be thus absorbed adipose matter is deposited and occupies its place, and the general contour of the breast is in fat persons thus maintained.

OF THE

MAMMARY GLAND IN THE MALE.

THE male possesses a mammary gland like that of the female, but it is a miniature picture only of that of women.

It varies in size, and I think that I have observed that it is largest in those men who have rather an effeminate appearance, who have light complexions, and whose breasts are little covered with hair. The largest male glands which I have seen, were found in a man whose testes were remarkably small. I have given a delineation of the testis and mammary gland in *Plate* 2, to show the exact size of each of these parts; and it will be seen that the testis was so small, and the mammary gland so large, that it seemed as if nature had hesitated whether she should produce a male or a female.

Every person who has studied the profession, must have asked himself for what purpose the nipple and mammary gland are formed in man; and it has been thought that they were designed for the purpose of nourishing the offspring in the event of the mother's death, during the period of lactation.

It has been even asserted, that this has really happened, and I might quote the instances; but such examples are too few and imperfect to constitute a general law, and I do not believe that the male breast is destined for such a purpose, or that it was intended to perform the function of suckling. It is true that from the mammary gland a very small quantity of fluid may be sometimes expressed through the nipple, and the continued application of an infant's lips might slightly increase the quantity of the secretion, and the child might be gratified by sucking the nipple, as it is by sucking its finger, but the quantity of secretion is too small for the purpose of affording nutrition to the infant.

It appears to me that its use is to form an organ of sympathy with the other parts of the sexual system, which are influenced and excited by mental impressions, and by the direct irritation of the nipple. For this purpose, the organ possesses an erectile tissue of arteries and veins, and a high sensibility from several nerves which are devoted to the supply of the nipple and of the gland.

Upon a superficial examination of the breasts in the male, they present in some men much more resemblance to the breasts of women than others; but dissection proves that this results much more from an abundant formation of fat, than from an unnatural growth of the mammary gland.

The breasts of the male do, however, vary considerably, both in the adult and in age; and I have seen the gland very large in proportion in a man of seventy-three years*.

I injected these glands, and have given a view of them. (*See Plate* 2 *of the Male.*)

In a negro, I once saw the male breast of a very considerable size: but I have not had sufficient opportunity of comparing the character of the African, in this respect, with the inhabitants of Europe, to say at present any more upon the subject.

In some men, there is scarcely any appearance of a *gland* to be traced; for as the nourishment of the offspring is almost exclusively confided in the mother, it is in general in her only that the organs destined for the secretion of milk are largely developed, although the nipple and areola are generally considerably evolved in the male.

In the males of other animals, there is often a mammary gland at the base of the nipple.

* This circumstance, if it were general, would serve to show that as the virile power had declined, the gland had increased, and become largely developed.

OF THE STRUCTURE OF THE MAMMÆ IN THE MALE.

THE parts which constitute the breast of the male may, as in the female, be described under two heads; the *external* and the *internal* organs: the

First consisting of the nipple or mamilla, of the areola, and of tubercles and little cutaneous glands: the

Second, of the gland, and its particular and general organization.

Of the Nipple.

The nipple or mamilla is rounded in its circumference, and but slightly elevated. It is about a quarter of an inch in diameter in the adult, and in form somewhat conical.

Its surface appears wrinkled, and furnishes many points for a higher degree of sensibility and excitability.

In many subjects, both dead and living, a fluid can be expressed from a number of little orifices upon the point of the nipple; but this I have seen more in the dead than in the living, and it requires that the gland behind the nipple should be firmly compressed, to make the fluid escape, and to show those minute perforations.

The nipple is situated opposite to the space between the fourth and fifth ribs, upon the pectoralis major, a little above its inferior edge, the aponeurosis of that muscle being placed behind the nipple and the gland.

The point of the nipple is turned a little upwards, as in the female; but is somewhat less projected outwards than in women.

The nipple and the gland are connected to the parts behind by a fascia, which allows of some motion to elude injury, and so firmly connects the nipple, that I have never seen it torn off by any violence.

This projection has a covering of *cuticle*, easily raised and shown by putrefaction; but it adheres firmly to the point of the nipple, from entering between the wrinkling of the skin, and into the openings of the nipple, so that at that part it separates with much difficulty.

When it is separated, the orifices of the nipple may be seen.

The cuticle is thin and delicate, that it may not interfere with the sensibility of the part, or too densely cover the arteries and nerves.

Under the cuticle is the *rete mucosum*, which is in quantity and distinctness very different in different subjects, according to the darkness of colour of the nipple.

The *cutis*, which composes the nipple, is wrinkled into the form of lozenges. *Papillæ* may be seen upon its surface; but these are much more minute than in the female, as well as much less vascular. They are turned forwards from the basis to the point of the nipple, and to observe them well, the cuticle should be separated by putrefaction, when they will be seen in great numbers, and very distinctly.

When they are filled with arterial blood, their sensibility and excitability are increased, and the nipple admits of being in this way filled by irritation or mental excitement, and emptied in a great degree when that state is passed; and this is the great reason of its formation as it becomes a slightly erectile tissue.

Of the Areola.

This circle of skin, which surrounds the nipple, is, in the adult, in its diameter, from half an inch to an inch; so that each radius from the nipple to the circumference of the areola is from a quarter to half an inch in length.

The surface of the areola is smoother than that of the nipple, but like it is wrinkled, only that its wrinkles are smaller.

When the *cuticle* is separated by putrefaction, numerous papillæ appear upon the cutis, so that they exist in the areola of both sexes, but are much smaller in the male than in the female.

The cuticle is thin upon the areola over the papillæ for the same reason that it is so on the nipple; indeed, it is often so thin in the young, that the blood-vessels of the cutis can be seen meandering under it.

The rete mucosum exists in the male as well as in the female, but it is less in quantity in the generality of males. However, this depends upon the darkness of the colour of the skin, for if very dark, this pigment become abundant.

It has a reticulated appearance upon the inner side of the cuticle, because it is disposed on the edges or folds of its inner side, which is reticulated.

In the negro which I have examined, the rete mucosum of the cutis of the areola has great density; and where it is very thick upon the surface of the cutis, it does not appear reticulated, when highly magnified, but is spread as a pigment in flakes over the ridges of the cutis.

The areola is pink in youth, from the small quantity of rete mucosum. In the adult it becomes darker, or of a brownish red; in old age, of a brown colour.

The *cutis* of the areola has numerous papillæ, as I have mentioned; but in order to best observe them, the breast should be first injected, and then the cuticle be raised by putrefaction.

The use of the areola is to extend the surface of sensibility and irritability beyond the nipple.

Of the Cutaneous Glands and Tubercles.

The tubercles of the areola are little projections, which form sometimes one only, at others, two circles upon the areola, one at its circumference, and the other near the base of the nipple. *See Plate* 1 *of the Male*, fig. 2.

When these are examined with attention, a little aperture or apertures are seen in them, and sometimes through this aperture a hair projects.

These apertures lead to little glands in the skin of a mucous kind, and also to the glandular structure which secretes the hairs.

If the cuticle be raised by putrefaction, the orifices are very plain and distinct. They admit, both in the male and female, of receiving coloured injection, aud they are thus easily demonstrated.

The pore, or opening in the skin, in the centre of the tubercle, leads into from three to five branches of ducts. I have had them drawn, and they will be seen in *Plate* 3 *of the Female*.

In the female there are sometimes five orifices in a tubercle, but in the male generally only one.

The tubercles are formed to add to the sensibility of the areola, and the little glands are designed to produce a mucus to lubricate the surface of the areola. These glands in scrofulous subjects often inflame and secrete a diseased cuticle, which desquamates and leaves the areola red and bare of cuticle, which the use of the diluted nitrated mercurial ointment will reproduce.

These glands are very vascular, both in the male and female, as will be seen when the breast is minutely injected, and I have had some of the vessels drawn, and they will be seen in the plates.

The skin of the breast around the areola is covered with hairs in the male, (which are intended to prevent friction and to preserve the temperature of the part under exposure,) and when the cuticle is removed by putrefaction the hairs are seen to be drawn out with processes of cuticle from the cutis. These when filled with coloured injection show similar pores but of less size, and less arborescent than those which are situated at the areola.

The nipple and the areola although less vascular than in the female, are still freely supplied with arteries, which are principally derived from four sources,—the thoracica longa, the external mammary artery, which is sometimes a branch from the axillary artery, sometimes of the thoracica longa, and by the thoracica suprema, and by the fourth branch of the internal mammary. *See Plate* 14, fig. 5.

The veins of the breast pass in radii from the nipple to a circle behind the areola, and then they take their course to the axilla and to the anterior mediastinum, to terminate in the axillary and internal mammary veins; by the minute division of their extreme branches an erectile tissue is produced.

The absorbents pass from the nipple and areola to the gland in the axilla on the brachial side of the breast, and into the anterior mediastinum on the sternal side. *See Plate 3 of the Male.*

The nerves to the nipple are from the fourth and fifth dorsal posterior or direct, and from the fourth reflected dorsal anteriorly.

The third posterior and anterior nerves send filaments down upon the arteries towards the nipple and areola.

OF THE STRUCTURE OF THE GLAND IN THE MALE.

I SHALL next proceed to examine the minute structure of the mammary gland in the male, which, as far as I am informed, has not been hitherto closely investigated.

The gland is placed immediately behind the base of the nipple or mamilla.

It varies extremely in its magnitude, in some persons being only of the size of a large pea, in others an inch in diameter, and I have seen it two inches or rather more, and then it reaches even beyond the margin of the areola.

Its consistence is very firm, and it often bears a striking resemblance to an absorbent gland.

It is rounded at its basis where it sinks into the fibrous and adipose tissue, and gradually lessens at its apex, where it ends in the mamilla or nipple.

In its circumference it is rather lobulate, forming depressions, giving it a melon-like appearance.

The gland is constituted of two parts,—first, of very minute cells, and secondly, of small conical ducts which divide into numerous branches in the gland, and terminate in straight ducts which end in very minute orifices at the nipple. In their form, in their divisions, and in their course through the nipple, they all form a miniature resemblance of the gland and vessels of the mammary gland in the female.

In *Plate* 1, figs. 9, 10, 11, 12, 13, 14, and 15, are views of the injected ducts from my preparations.

Fig. 9 shows the minute cells from which a duct is springing, and it becomes larger as it approaches the nipple so as to be conical towards the basis of the gland. It then becomes conical in the other direction, terminating in a straight tube, but with its orifice turned towards the surface of the nipple.

In fig. 10, four ducts are seen injected from the cells in which they originate, to the nipple in which they terminate, and the same may be seen in fig. 11.

In fig. 12, two ducts are seen, and some of the branches of the ducts are placed at right angles with each other.

In fig. 13, four ducts and their cells are injected, and a section has been made of the gland from the apex of the nipple.

Fig. 14 shows the cells and three ducts injected, with two absorbent vessels, arising from the cells.

Fig. 15 has only one duct injected, and that only partially.

The gland is not situated loosely in the cellular membrane, but is confined by, and enclosed in, a fascia which renders it a separate organ from the surrounding parts.

This fascia, traced, as in the account of the female, from the sternum towards the breast, where it reaches the margin of the gland, divides into two portions, one of which passes upon the anterior surface of the gland, to reach the nipple, and from its anterior surface ligamenta suspensoria are seen in *Plate* 1, figs. 6, 7, and 8, to the inner side of the skin, upon which they spread, and are lost.

Between the ligaments, lobes of fat appear, interposed between the fascia and the skin, and covering the gland; and these lobes of fat are enclosed in their proper membrane, which forms minute cells, in which the fat is secreted.

Behind the gland, in *Plate* 1, figs. 7 and 8, the fascia is also seen crossing the back of the gland anteriorly to the aponeurosis of the pectoralis major muscle: in its course, it sends fibres into the gland, to connect its cells, lobules, and ducts; and it sends a fibrous structure backwards to the aponeurosis pectoralis, to fix the gland in its position. In *Plate* 1, fig. 8, lobes of fat will be seen in the substance of the gland, or rather between its cells and ducts; for there is a larger proportionate quantity of adipose membrane and fat in the male than in the female. Many lobes of adeps are also observable in the fibrous tissue behind the breast, and between it and the aponeurosis of the greater pectoral muscle. *Plate* 1, figs. 7 and 8.

It will therefore be seen that the gland in the male, like that of the female, is a regular organ, included and intersected by a fibrous tissue; that it is composed of cells and ducts, which are not too minute to be injected, although with difficulty.

The cells are placed in lobules, which do not communicate with each other but through the medium of branches of the principal ducts, but not by any lateral communication.

The ducts are not confined to the part of the gland at which they enter, but are spread out from the centre to the circumference, sometimes crossing each other, and they extend to the margin of the gland.

OF THE DEVELOPEMENT OF THE MALE BREAST.

In the fœtal state a gland exists behind the nipple, similar in appearance and structure to that in the female fœtus. *See Plate* 1, fig. 16. This plate shows the form of the gland, which is of a red colour in the fœtus, and is surrounded by a yellow fat, so that the contrast of colour renders it particularly conspicuous.

A cleft is formed where the future nipple is to be found, with a number of broken points about it, marking the situation of the future papillæ.

It contains ducts, from which a white and rather a solid matter may be squeezed which I have seen resembling curd in its appearance.

These ducts I have injected with mercury, and I have two good preparations of them. *Plate* 1, figs. 17 and 18.

At twelve months, the cleft of the nipple is filled up, and the broken papillæ are united.

At three years of age, fig. 4, when a section is made of it, the direction of the branches of ducts can be seen concentrated at the nipple, and diverging to the base of the gland and posterior fascia, in which they are fixed.

At seven years of age, fig. 5, the nipple is more evolved, and the gland is seen covered and united in its different parts by fascia.

At thirteen years, fig. 6, there is little difference of appearance.

From this time to twenty-one, the nipple grows, and forms a much larger cone; the gland becomes considerably increased; the hairs and the tubercles grow upon the surface of the areola, *Plate* 1, figs. 2 and 3; the voice becomes broken; the beard grows; and the figure denotes manhood.

In *Plate* 1, fig. 7, I have given the section of a male breast at twenty-nine, when it has been for a long time completely evolved; and in the same plate, fig. 8, I have given another section, to show its size at thirty-eight.

Fig. 1 of the same plate shows the size of the nipple at six years; fig. 2, at the age of forty-three years; in fig. 3, it is seen in age, with the hair by which it is covered.

In *Plate* 2, fig. 1, a male nipple with its tubercles, which form two circles, are displayed; and in fig. 2, a view is given of a gland of a moderate size. At fig. 15, the very large gland is seen which I have mentioned, connected with a small testis in the adult, as exhibited at fig. 16.

In old age the nipple is somewhat smaller than in the adult, but the gland is sometimes very large, as is seen in *Plate* 2, fig. 3, where the gland has been minutely injected in a man at seventy-three years, and makes a beautiful preparation. A large absorbent vessel proceeds from it to one of the absorbent glands in the axilla.

The fluid which the gland secretes is extremely small in quantity, passing from the orifices of the ducts in very small drops, and more frequently capable of being expressed in the dead than in the living body; but persons have told me, that they could press from their own breasts a fluid like white of egg; whether it is from the mucous membrane of the ducts, or from the cells of the gland, I cannot possibly say, but in the dead I have often expressed it from the nipple.

When I have filled the ducts with mercury I could by compressing the gland force globules from the gland at the orifices of the nipple.

The fluid, which looks like clear mucus, and which can be sometimes expressed from the nipple, is in part coagulated by alcohol.

Before the age of puberty I have not injected the male gland, excepting in the fœtal state, although I do not mean to deny the possibility of accomplishing it. But there is a great difference in the breast and testis in that respect. At two years of age I have injected the vas deferens, epididymis, vasa efferentia, rete, and beginning of the tubuli testis, and I have two beautiful preparations of these, showing the early developement of that organ, so that at two years the ducts are formed. If it be so also in the male mammary gland, I have not yet succeeded in injecting the ducts prior to the time of puberty except in the fœtus.

OF THE ARTERIES OF THE MALE BREAST.

In *Plate* 14 *of the Female*, the arteries of the male breast have been given, and they are as follow:—

They are posterior or axillary—anterior or sternal.

The posterior arteries which supply the nipple, areola, and gland, are principally two vessels, *viz.*, from the thoracica longa, and the external mammary artery, which is very often also a branch of the thoracica longa, and often arises directly from the axillary artery.

The clavicle in fig. 5, *Plate* 14, is seen crossing the subclavian artery, and the branches from the axillary artery appear beyond it. A portion of the pectoralis major and minor muscles is left to show their arteries, and generally branches of arteries penetrate the pectoralis major to pass to the nipple.

The first posterior artery which passed directly to the nipple in this dissection, was the external mammary, which arises from the axillary, sometimes before, at others, after the thoracica longa, and is often a branch of the thoracica longa itself.

This artery descends to the upper part of the nipple and divides into branches which supply it, and it anastomoses freely with the branches of the thoracica longa, and with the anterior arteries from the internal mammary. This artery is also well seen, in *Plate* 10, fig. 1, *a*, in the female, in whom the course and anastomosis is very similar, and at puberty and in lactation it becomes of very considerable size.

The thoracica longa arises from the axillary artery, and descending over the ribs behind the nipple and upon the outer side of the chest, it sends several branches to the nipple, but one or two of these larger than the rest, pass above and below the nipple and areola, and form a circle of arterial communication with the former artery and the anterior arteries around both of these parts, after which it is spent upon the serratus major muscle, upon the upper layers of the intercostal muscles, and it sends branches into the chest between the ribs, to unite with the aortic intercostal arteries.

The anterior arteries are derived from the internal mammary, which sends branches between the cartilages of the ribs.

There are four or sometimes five of these arteries, which pass upon the pectoral region.

The first is very small, and goes only to the pectoralis major and clavicular articulation.

The second is larger, and the third still larger, but neither of the above arteries pass directly to the breast itself.

But the fourth artery, passing from the internal mammary in the anterior mediastinum, between the fourth and fifth cartilages of the ribs, runs transversely to the nipple and areola, and by anastomosing with what I call the external mammary artery, and with the thoracica longa, it assists in forming a circulus arteriosus, or circle of communication around the nipple, areola, and gland, and it also sends branches to the breast above and below the nipple.

The fifth anterior artery is distributed below the breast, but some of its branches anastomose with the thoracica longa, and with the fourth anterior arteries which pass to the nipple, areola, and gland. *See Plate* 14.

Arteries from the mammary intercostal also pass into the posterior surface of the gland, the nipple, and the areola.

THE VEINS.

THE veins of the male breast form a circle around the nipple, areola, and gland, which receives branches that radiate from the point of the nipple and enter the circle. From this circle veins accompany the arteria thoracica longa and the external mammary branch of arteries to terminate in the axillary vein.

On the sternal side of the breast the veins principally enter the second and fourth anterior veins, which pass into the anterior mediastinum through the second and fourth layers of the intercostal muscles, and between those cartilages of the second and fourth, and they terminate in the internal mammary veins, and consequently carry the blood to the subclavian vein.

The deeper veins of the male breast pass to the intercostal veins.

And veins pass over the clavicle from the upper part of the breast to join those of the lower part of the neck.

OF THE ABSORBENT VESSELS.

But the most curious and extraordinary part of the structure of the breast of the male is its absorbent vessels.

I have delineated many of my preparations, which I have had in my private collection since the year 1825.

When the gland of the male breast is minutely injected with mercury or gelatine, absorbent vessels are seen to arise from its cells, and to pass in all directions: they very frequently communicate with each other, forming a very large plexus around the gland.

When the mercury is further pushed, large absorbent vessels are seen to spring from the cells, and to take different directions to enter the different absorbent glands in the vicinity.

In *Plate* 2, fig. 3, *of the Male*, these absorbents, as well as the gland of the breast, are seen minutely injected, and an absorbent vessel which arises from the plexus, taking its way to the first absorbent gland in the axilla, under the edge of the pectoral muscle.

Fig. 14 of the same plate shows the cells of the mammary gland filled; the absorbent vessels filled from them;

and those vessels accompanying the veins to the axilla, and upon the anterior veins towards the sternum.

In fig. 6, the minute ducts of the gland are shown, and in figs. 7, 9, and 11, the cells injected.

In fig. 10, a very minute injection of the gland has been made, and some vessels have been filled which are not absorbents, but which I believe to be veins.

In the other figures of the same plate, the absorbents will be seen very minutely divided, and forming a large plexus of vessels.

From this plexus, absorbent vessels arise, which encircle and cover the mammary gland, and then take the following courses.

The largest and the most readily injected are those which pass towards the axilla, and which terminate there in the absorbent glands, or as they were formerly called, lymphatic glands.

In *Plate 3 of the Male*, the first two of these vessels injected will be seen passing from the base of the nipple on the fourth rib. They then spread out, and reach from the upper part of the fifth rib to the third, entering several small absorbent glands, and form a considerable plexus.

This plexus ascends from the fourth to the third rib, and there forms large absorbents upon the inner side of the axillary vein, upon the second and first rib; and here these vessels take two courses. The first passes over the first and second rib, under the clavicle, and above the first rib, and thence through a little ring in the fascia, which has strong and determinate edges, and which aperture is formed under the costo-clavicular ligament, on the inner side of the subclavian vein; through this opening the absorbents proceed, to enter the angle of the jugular and subclavian veins; but prior to their doing so, they pass through several glands situated behind the clavicle.

The other course of the absorbents from the axilla is the following: they pass under the vein and artery, and behind the axillary plexus of nerves, and then crossing the axillary plexus, they enter at the angle between the jugular and subclavian veins.

These latter absorbents join those of the arm, enter absorbent glands, and in *Plate* 3, fig. 2, their termination in the veins is seen at a valve in the vein.

In the same plate, fig. 3, the plexus of absorbents from the nipple has been injected, and the vessel shown which passes from it to the axillary absorbent vessels, and their glands.

Those absorbents which take their course to the axilla, are placed upon that fascia of the thorax which forms the broad band of axillary fascia between the pectoralis major and the teres major and latissimus dorsi, and passing through one, and sometimes two apertures, to reach the glands in the axilla.

This broad band of fascia is placed on the outer side of the breast, and uniting the two axillary bands of muscle and tendon, or alæ, forms the floor of the axilla, shutting in its vessels, its glands, and its nerves.

After passing through this axillary fascia, and traversing the axillary space, the absorbents enter the ring or ellipse, under the costo-clavicular ligament, and on the left side terminate at the angle formed by the jugular vein with the subclavian, near where the thoracic duct also terminates; and upon the right side in the absorbent or cervical trunk, at the angle of the right jugular and subclavian veins.

Beside the absorbent vessels which I have described, there is another set taking its course from the sternal side of the breast to the cartilages of the ribs. These pass through the anterior mediastinum in two directions: the first and upper set enter the anterior mediastinum, between the second and third intercostal spaces; generally the second and lower pass into the anterior mediastinum between the fourth and fifth cartilages of the ribs: here they join the internal mammary artery and veins, enter an absorbent gland, and join with the absorbent vessels from the convex or anterior surface of the liver, which mount upon the suspensory ligament, and piercing the diaphragm, enter the anterior mediastinum.

The absorbents of the left breast, after passing through the anterior mediastinum, terminate near the thoracic duct on the left side. But upon the right side, from the anterior mediastinum, a part of these vessels pass into the junction of the right jugular and subclavian veins.

It appears from this account of the absorbent vessels of the male breast, that when any secretion proceeds in it, as there would be great difficulty in its escape at the small orifices of the nipple, the fluid is taken up by the absorbent vessels, and carried into the circulation. Whether this fluid is necessary or not to the blood, I have had no opportunity of ascertaining, but the structure is very curious, and the assemblage of absorbents is quite extraordinary.

OF THE NERVES OF THE MALE GLAND, AREOLA, AND NIPPLE.

The nerves of the male breast are divided into two sets; the axillary, direct, or posterior, and the sternal reflected or anterior nerves.

They are derived from the dorsal nerves, and are, like those of the female, composed of three parts, as to the sources from which they spring.

First, from the posterior roots of those originating from the spinal cord, and are called, from their possessing a ganglion, the ganglionic root.

Secondly, they arise from the fore part of the spinal cord, and these are the anterior roots.

Thirdly, the two roots unite, and are then joined by the grand sympathetic nerve, which crosses them opposite to the head of the ribs.

The dorsal nerves then pass forwards at the inferior edges of the ribs, in the grooves formed for them, and the intercostal arteries and veins; and about half-way forwards towards the sternum, they divide into two branches, the direct and the reflected branch.

The direct penetrate the intercostal muscles behind the breasts, at the inferior edges of the ribs, and they pass directly forwards.

The reflected are continued upon the inner side of the chest, in the grooves of the ribs, until they reach the sternum: here they penetrate the intercostal muscles, and are reflected back upon the fore-part of the chest, to distribute their branches upon the skin and muscles on the surface of the breast.

The nerves which principally supply the breast are the third, fourth, and fifth dorsal.

The third direct dorsal nerve sends a branch down upon the external mammary artery, which descends upon its coats towards the nipple. In its course it passes upon the pectoralis major muscle, and it sends branches forwards to the skin above the breast.

The fourth quits the inner part of the chest between the fourth and fifth ribs, in a line with the nipple, and joining the posterior or external mammary artery, it passes with its branches to the nipple, areola, and gland. It divides into numerous and large filaments, which will be seen in *Plate* 14, forming a plexus which is distributed to the mammary gland.

The fifth nerve passes out of the chest between the fifth and sixth rib, and being continued to the lower part of the mammary gland distributes its branches to it, and freely anastomoses with the fourth; they send their branches to the nipple and areola. These nerves also pass the nipple to supply in part its sternal side and that of the areola. The sixth nerve passes below the nipple upon the extreme branches of arteries which are distributed to the nipple.

The anterior or reflected nerve which supplies the breast is principally derived from the fourth dorsal. This nerve after sending its direct branch through the intercostal muscles to the outer part of the chest and to the gland of the breast, transmits its reflected branch forward in the groove of the fourth rib to the cartilage of that rib, and to an aperture between that rib and the fifth cartilage, by the side of the sternum. When it reaches that spot it penetrates the chest; it becomes reflected, and passing from the sternum to the base of the nipple with the anterior artery, it there distributes its branches to the areola and nipple, anastomosing with the fourth and fifth posterior on the sternal side of those parts.

The third reflected branch of the dorsal nerve send branches upon the anterior artery of the breast, which are continued upon that artery as it descends, until the fourth reflected is distributed upon that artery where it supplies the inner part of the areola and base of the nipple.

The fifth anterior nerve sends its filaments to the branches of arteries below the nipple, but this is a small nerve*.

* For the branches of the dorsal nerves which do not go to the breast, see SWAN *on the Nerves*.

OF THE FASCIA.

The gland of the breast is enclosed in a fibrous tissue, which, as in the female, should be traced from the sternum outwards. When it reaches the breast it divides into two portions, an anterior and posterior layer. The anterior passes upon the fore part of the gland, and sends forth its ligamenta suspensoria to unite the breast to the inner part of the skin, with which, indeed, it becomes incorporated. But it also sends tendinous or fascial fibres backwards into the fore part of the gland, which permeating its substance, unite and combine its different parts, strongly joining the nipple and areola to the gland, and being incorporated with the skin it is the source of its whiteness.

The posterior portion of the fascia proceeds behind the gland, and there gives off two sets of fibres. One set passing into its costal surface traverses its substance, uniting its several cells and ducts by a fibrous tissue.

The other fibres pass backwards to the aponeurotic covering of the pectoralis major, and consequently unite the back of the gland through this medium with the pectoral muscle.

In *Plate* 1 *of the Male*, I have given several sections showing the gland and its connections at different periods of life, *viz.*, in the fœtus, at three years, at seven, at thirteen, at twenty-nine, and at thirty-eight years; and in each of these the fascial covering is dissected so as to show its two layers. The ligamenta suspensoria of the anterior is shown, and the fat which is placed between these ligaments. The posterior layer of fascia; its fibrous junction with the aponeurosis, and the fat which it contains, will be also seen.

Some small lobules of fat appear in the gland itself.

Hairs are also to be observed growing upon the surface of the skin at twenty-nine and thirty-eight years.

After the two layers have passed the breast they again unite unto the superficial fascia. When the dissection is continued beyond the breast towards the axilla, a broad expansion of strong fascia is found to proceed from the aponeurosis of the pectoralis major, and that of the teres major and latissimus dorsi.

The axilla forms a triangular cavity, the anterior and posterior border of which are formed by the pectoralis major before, and the teres major and latissimus dorsi behind, by the serratus major anticus towards the scapula, and by this broad expansion of fascia at its base. It proceeds from the side of the thorax towards the bicipital groove of the humerus, and mounts on the deltoid and biceps muscles.

It sends out a process under the pectoralis minor muscle.

The absorbent vessels pass through it by one and sometimes more openings to the glands in the axilla, and these openings are generally cribriform; some branches of arteries and nerves also pass through it; the cavity of the axilla above it contains the axillary artery and vein and their branches, and the axillary plexus of nerves on the brachial side of the blood-vessels, and the absorbent vessels opening upon tne inner side, and these parts are also contained in a sheath from which processes go off to their branches*.

This broad expansion of fascia forming the base of the triangular cavity of the axilla, has often matter formed under it, and if it be not freely opened, the patient suffers extreme pain, and sloughs are apt to be produced in the loose cellular tissue of the axilla.

I have seen accumulations of matter under this fascia arising from a wound of the finger in dissection, occasion death; also in diseases of the breast, elevating the arm gives great pain from putting the fascia upon the stretch, and much motion of the superior extremity, in diseases of the breast, is very injurious.

* See Professor Harrison of Dublin on the Arteries.

OF THE FAT.

In old men there is abundance of fat deposited both before and behind the gland, and in age a large quantity of adeps is also found in the interstices of the gland itself, and in a cellular tissue which it contains. This accumulation of adeps often gives the character of the female breast to elderly men. The plates show the parts in which the fat is deposited. *See Plate* 1, figs. 6, 7, 8.

EXPLANATION OF THE PLATES

OF THE

FEMALE BREAST.

Plate I.

The Nipple in its Changes.

Fig. 1. Breast of a girl two years of age. Nipple, areola, and point of the nipple just evolving.

Figs. 2, 3, 4. The nipple larger, being much more evolved, at four, at six, and at nine years of age.

Fig. 5. At twelve years. Nipple, areola, and tubercles evolving.

Fig. 6. At fourteen years. Nipple wrinkled and papillous, areola more extended, tubercles enlarged.

Fig. 7. At fifteen years. Cleft in the nipple, where the orifices of the lactiferous tubes afterwards appear.

Fig. 8. At sixteen years. Nipple and areola papillous and much wrinkled.

Fig. 9. At seventeen years. Nipple with considerable papillæ, areola extended, tubercles of large size, hairs growing from the skin around the areola.

Fig. 10. At twenty years.—Nipple, areola, and tubercles shown.

Fig. 11. At twenty-four years. Woman who had borne a child. Nipple papillous, tubercles enlarged, areola contracted in its diameter, several hairs appearing.

Fig. 12. Age twenty-six. Pregnancy. Nipple very papillous, areola enlarged, tubercles increased, hairs appear.

Fig. 13. Lactation continued for nine months in a woman aged twenty-eight. Papillæ of the nipple smooth, areolar tubercles with their openings seen at the margin of the areola. The tubercles did not emit milk when pressed.

Fig. 14. At twenty-eight years. Lactation three weeks after delivery, nipple extremely papillous, areola much extended measuring two inches, tubercles appear upon various parts of the areola. Milk could not be pressed from the tubercles when the orifices of the nipple were closed and the breast compressed.

Fig. 15. At thirty-two years. Sterile woman. Nipple and areola wrinkled, the diameter of the latter small, cleft in the centre of the nipple.

Fig. 16. At forty years. After lactation. The woman has had nine children. Nipple with a cleft, areola considerably contracted, tubercles prominent, but huddled together.

Fig. 17. At forty-seven years. Nipple long and truncated, large tubercles at the margin of the areola. Has suckled several children.

Fig. 18. Old age. After having had children. Nipple elongated, orifices of numerous open tubercles, papillæ of the nipple large, and hanging in a kind of foliage.

Figs. 8, 15, 18, were drawn from the dead subject, all the others were delineated from the living.

Plate II.

Showing First the Size of the Gland at Different Ages.

Fig. 1. The gland at the age of eleven months.

Fig. 2. At three years.

Fig. 3. At four years.

Fig. 4. At six years.

Fig. 5. At nine years. The size of the gland rather decreased until the ninth year, in those subjects which I examined.

Fig. 6. At eleven years. Sudden increase.

Fig. 7. At twelve years. Larger gland.

Fig. 8. At thirteen years. Gland greatly enlarged, turned at its extremities, forming folds upon its surface.

Fig. 9. At fourteen years. Diameter of the gland greatly enlarged.

Fig. 10. At sixteen years. Gland very much increased. In all the preceding figures the fascia is removed.

Fig. 11. A section of the breast at twenty years of age, showing the skin, the fascia, the ligamenta suspensoria, and the fat between them.

Fig. 12. The papillæ of the nipple (magnified to double their natural dimensions,) showing their foliated appearance towards their summits, and the circles which they form towards the areola.

Fig. 13. The same in a front view of the nipple and areola, showing the foliated appearance of the papillæ, and the numerous, but smaller papillæ of the areola, magnified twice.

Fig. 14. The arteries of the nipple (twice magnified), terminating in veins in the papillæ.

Fig. 15. The branches of the veins in the papillæ twelve times magnified. They form an immense number of very minute branches, which pass into the larger branches of veins.

Fig. 16. The nipple, and the straight ducts, in number thirteen.

Fig. 17. The nipple and the straight ducts, twenty-one in number.

Fig. 18. Inside of the nipple with what appear to be ducts cut off, twenty-three in number.

Fig. 19. Section of the ducts, twenty-four in number, behind the nipple. I believe them to be ducts, but some of them may be follicles.

Plate III.

This Plate is intended to show the cutaneous structures of the Breast.

Fig. 1.—The inner side of the cuticle of the nipple, areola, and surrounding breast, and the folds which it forms to sink into the cutis. In the centre, under the areola, the reticular arrangement of the rete mucosum is seen on the inner side of the cuticle, and forming a circle.

Fig. 2.—Rete mucosum seen on the inner side of the *cuticle* of an African. (Fifteen times magnified.)

Fig. 3.—Rete mucosum on the *cutis* of the black (magnified fifteen times.)

Fig. 4. Rete mucosum on the nipple and areola of the black (natural size). The white cutis seen around it with dark spots where the rete mucosum enters the perspiratory pores.

Fig. 5. Nipple and areola, with numerous cutaneous glands, filled with yellow injection.

Fig. 6. Inner side of the nipple, areola, and skin of the breast. Around the nipple, placed in a circle, the glands of the tubercles appear on the inner side of the cutis vera of the areola, and which form openings through the skin upon the surface of the areola.

Fig. 7. The glands surrounding the nipple filled with yellow injection, and magnified six times.

Fig. 8. One of the glands magnified twenty times.

Fig. 9. A gland filled with blue injection, and showing the arteries passing to it.

Fig. 10. The tubercles surrounding the nipple injected and drawn of their natural size.

Fig. 11. A tubercle filled with yellow injection, and twenty-three times magnified.

Fig. 12. A tubercle filled with red injection, and magnified twenty times.

These are the tubercles which have been supposed by anatomists to produce milk, and to have communication with the lactiferous tubes, from which, however, they are entirely separate and distinct. They secrete a mucous fluid, which has more the appearance of gruel than milk.

Plate IV.

Ligamenta Suspensoria and Sections.

Fig. 1. A preparation made to show the ligamenta suspensoria supporting the folds of the breast to the inner side of the skin. The nipple is seen in the centre, a portion of skin in the circumference, and the folds of the breast are sustained by the ligamenta suspensoria, which are continued to the skin; but their connection with it is here cut off. Thus the surface of the breast is greatly increased, whilst its diameter remains the same.

Fig. 2. A view of the gland, dissected and unravelled, to show the ducts over bristles, the lobuli, and the glandules.

Fig. 3. A section of the mammary gland through the nipple, showing the ducts over a bristle, unravelled, and proceeding to the posterior part of the gland. The ligamenta suspensoria may be seen passing from the anterior surface of the gland to the skin, supporting the folds or processes of the former, and leaving considerable cavities between them, in which the fat is contained in its proper membrane. The fascia may be observed passing to each extremity of the gland, and dividing into two portions; the *anterior* proceeding upon the surface of the gland to form the ligamenta suspensoria; the *posterior* behind the gland, sending processes between which a smaller quantity of fat is contained; and both these layers assist in producing the fibrous tissue of the gland. It also sends processes of fascia backwards, to join the aponeurosis of the pectoral muscle, *b, b,* forming the line from one extremity of the gland to the other. The section, therefore, clearly shows the various cords by means of which the breast is slung, and sustained. *a, a,* the fascia.

Fig. 4. Shows the depressions of the nipple, in which the orifices of the lactiferous tubes are placed.

Fig. 5. A dried preparation of the nipple and areola, showing the papillæ of each: those of the nipple taking in this mode of preparing them rather a spiral direction, and those of the areola arranged in circles.

Fig. 6. The nipple and areola, after being placed in alcohol, by which they have been somewhat constringed. The nipple is placed near the centre, and the orifices of the lactiferous tubes are seen in it. Numerous orifices are also visible around it, placed in the tubercles of the areola. These orifices are from one to five, and sometimes more in number.

Fig. 7. Sixteen bristles in the orifices of the lactiferous tubes.

Fig. 8. Shows some of the larger glandules of the breast.

Fig. 9. Exhibit some of the smaller, with ducts unravelled.

Plate V.

Ducts, Reservoirs, and Glandules.

Fig. 1. Lactiferous tubes, injected with red wax, in a woman who died during the period of lactation. Twelve ducts have been filled and ligatures are placed on their orifices. The ducts are seen forming large reservoirs at the roots of the mamillary tubes; which reservoirs are seen to be produced by the union of numerous branches from the ducts. The ducts are perceived to terminate at the margin of the gland in branches, but in some parts, in glandules.

Fig. 2. Shows half the breast with the ducts injected with red wax. The ducts are seen dividing into branches, upon the ends of which numerous glandules are visible.

Fig. 3. Shows the glandules into which the gland is divided, with the ducts proceeding into them from the nipple. Some of the glandules are cut open, showing milk-cells in their interior.

Fig. 4. A single duct injected with wax. Its straight or mamillary duct is seen, a reservoir at its root, the branches of the duct proceeding from the reservoir and terminating in numerous glandules, which latter not having been cut open, the cells are not exhibited. I have added a plate to this without colour.

Plate VI.

Ducts and Glandules.

Fig. 1. Lactiferous tubes or ducts injected with red wax, showing their radiated direction, and, in some places, their inter-ramification.

Fig. 2. Mammary ducts injected with red, yellow, black, green, and brown, and seen less intermixed than the former.

Fig. 3. Ducts injected more minutely with yellow, red, green, blue, and black. This preparation shows two additional circumstances: —First, The glandules from which the ducts begin are seen filled with wax. Secondly, At the lower part of the preparation the separate ducts are seen passing above and beneath each other, to render the breast a cushion; whilst at the upper part the ducts are single.

Fig. 4. This preparation exhibits the anterior folds of the breast; some of the ducts are injected, and the glandules of the breast upon the surface of the folds are filled with wax. This is only a part, but the whole of the breast when well injected and dissected, has a similar appearance, of which I have three specimens. I have given a Plate of No. VI., without colour.

Plate VII.

Ducts, Glandules, and Cells.

Fig. 1. A view of a preparation of six milk tubes injected from the nipple.

a, *a*, *a*, The straight or mamillary tubes, proceeding from the apex of the nipple.

b, *b*, *b*, The reservoirs or dilatations of the ducts.

c, *c*, *c*, The branches of the mammary ducts.

d, *d*, *d*, *d*, Their glandules.

Fig. 2. Shows a single lactiferous tube, injected with red wax, and proceeding through the breast.

a, Its orifice.

b, Its reservoir.

c, *c*, *c*, The branches of the duct.

d, *d*, *d*, The glandules seen upon four folds of the anterior surface of the breast.

Fig. 3. The milk cells six times magnified.

a, *a*, *a*, Branches of the duct.

b, *b*, *b*, The milk cells.

This preparation has been injected with yellow wax, and sections of it were made to show the ducts and cells.

Fig. 4. Section of another preparation made to show the ducts and milk-cells (magnified six times by a simple lens).

a, *a*, The ducts.

b, *b*, *b*, The milk-cells.

Fig. 5. Shows the origin of the ducts from the milk-cells (injected with quicksilver and magnified four times).

Fig. 6. Also shows the ducts arising from the cells, but at the lower part minute branches of the duct may be seen passing into the cells (also injected with quicksilver, magnified four times). Another Plate is given without colour.

Plate VIII.

Gland, Blood-vessels, Ducts, and Cells.

Fig. 1. A boiled gland of a young adult female, exhibiting the rose-like folds of its anterior surface, naturally supported by the ligamenta suspensoria. The nipple is seen, but not in the centre of the gland.

Fig. 2. The breast of a woman of fifty-five years. The gland has been boiled, and shows its diminution in the size, some folds upon its surface, and the nipple not in the centre of the gland.

Fig. 3. The boiled gland of a very old person, showing the remarkable diminution of its substance when compared with fig. 1.

Fig. 4. Shows the arteries of the nipple in a section of the gland. These arteries proceed to the basis of the nipple and then send forth two sets of branches,—anterior, which go to the nipple—posterior, passing backwards to the gland, to meet arteries from the intercostals, which enter at its posterior surface.

Fig. 5. Shows minute divisions of the arteries on the glandules from which the milk is secreted, (thirteen times magnified).

Fig. 6. A lactiferous tube minutely injected with mercury, exhibiting the glandules and cells, which are very perceptible to the eye, but which are here magnified forty-seven times.

Fig. 7. Is taken from a preparation which shows a rare deviation from a general law, *viz.*, of two ducts communicating, of which this is the only instance I have seen. One of the ducts was injected from a branch near the circumference of the gland, and the injection was thrown towards the nipple, when, either by laceration or unusual communication, two ducts became filled.

Fig. 8. Shows a duct of great diameter in old age. It was filled with mucus, which I evacuated, and I then injected and preserved the duct, which sent forth a few branches, but the rest were obliterated.

Fig. 9. Is the breast of an old female, which exhibits the changes in age which I have described:—First, A duct injected to show how little of it remains pervious. Secondly, Two ducts and their branches filled with inspissated mucus, appearing like dried gum, but containing some carbonate and phosphate of lime. Thirdly, The arteries convoluted and ossified, as I generally find them in old age.

Plate IX.

Arteries and Veins.

Fig. 1. Shows the arteries going to the breast and nipple.

Fig. 2. The veins returning the blood from the nipple and breast.

The veins on the left pass to the internal mammary; those on the right, to the axillary vein.

The posterior or axillary branch may be seen to form a circle around the nipple, and a net-work with frequent communications upon the surface of the breast.

Fig. 3. A lactating breast, the arteries and veins of large size, and somewhat serpentine.

The veins returning the blood from the surface of the breast into the internal mammary and axillary veins, and they also form a circle around the nipple.

Plate X.

Arteries and Veins.

Fig. 1. The arteries and veins of the breast from their anterior and posterior sources.

6, The posterior or external mammary artery from the axillary or thoracica longa, sending branches over the ribs and intercostal muscles to the nipple.

1, 2, 3, 4, 5, The anterior arteries passing between the cartilages of the ribs, from the internal mammary.

The posterior artery, 6, and the third, fourth, and fifth anterior, may be seen to send branches to the nipple, *c*, and to the breast. A posterior mammary vein accompanies the artery, 6. An anterior vein accompanies an anterior artery, 2, and another vein accompanying artery 5, enters the chest between the cartilages of the ribs. The veins form a circle around the nipple, and radiated branches are seen terminating in that circle.

A vein is also seen ascending over *b*, the clavicle, and another vein passing to the subclavian above the first rib. *a*, denotes the sternum, *b*, the clavicle, *c*, the nipple.

Fig. 2. Shows a more minute distribution of the arteries upon the breast and around the nipple.

Fig. 3. Vein injected around the nipple. (From a dried preparation.) Radiated branches proceed from the circle to the nipple, where they divide with excessive minuteness, receiving the blood from the papillæ.

Fig. 4. A beautiful preparation of the veins injected in the areola and nipple, showing the capillary branches of the veins in the

papillæ, and exhibiting the erectile tissue of these vessels corresponding with that which exists in the arteries as seen in *Plate* 2, fig. 14, showing that the erectile tissue is composed (as I have said,) merely of minute branches of arteries terminating in minute branches of veins, which latter cannot convey away the blood so fast as the force of the heart and arteries propels it on their side.

The arteries are arborescent, the veins form a net-work.

Thus I have seen in the artery and vein of the tail of the tadpole, a pulsating aorta propelling the blood into the vena cava, by various streams; but upon dividing all the arteries but one, the vena cava began to pulsate, proving that the return of the blood in the vein was effected by the pulsation of the heart and artery: so that, (as I have mentioned,) as soon as one stream only is produced, a vein becomes an artery as to the motion of its blood.

Plate XI.

Absorbent Vessels.

Fig. 1. The absorbent vessels of the female breast from the nipple to the clavicle, with the artery, vein, and nerves.

a, The clavicle.

b, *b*, The sternum.

c, The nipple, with an absorbent vessel proceeding from it, and two others from the gland of the breast. They pass upon the intercostal muscles between the second and third ribs; then descend over the third rib to the intercostal muscles between the third and the fourth ribs. They then ascend to the second rib, and pass upon the inner side of the axillary vein; continuing over the intercostal muscles below the first rib, they form a trunk which proceeds under the clavicle, through the absorbent aperture, into the junction of the right jugular and subclavian veins.

e, The axillary artery, with the axillary vein, *f*, upon its inner side.

g, *g*, The axillary plexus of nerves.

Fig. 2. Absorbents of the nipple, and of the breast. Beginning at the root of the nipple, four of them being here injected, they pass over the surface of the breast towards the axilla, and there enter an absorbent gland; after which they pass as in fig. 1.

Fig. 3. The internal absorbents of the gland injected from various parts of the breast, and terminating in two absorbents in the axilla. The lactiferous tubes are also partially injected, and may be seen under the absorbent vessels.

Plate XII.

The Nerves and Blood-vessels of the Breast (in a dried preparation).

Fig. 1. An internal view of the dorsal nerves, 1, 2, 3, 4, 5, dividing into two branches,—*direct* and *reflected.*

The direct are the largest branches, which penetrate the intercostal muscles below each rib, and pass to the breast and nipple.

The reflected pass at the inferior edge of each of the ribs to the intercostal mammary artery and vein ; then send their branches through the intercostal muscles, between the cartilages of the ribs, by the side of the sternum, and appear upon the fore-part of the chest. They, in their course, give branches to the intercostal muscles.

Fig. 2. External view of the chest.

a, The clavicle.

b, The sternum.

c, The axillary artery.

d, The axillary vein.

e, The cephalic vein.

2, 3, 4, 5, Posterior or direct dorsal nerves passing through the intercostal muscles under the ribs, the second going to the branch of an artery which descends towards the nipple ; the third going to the external mammary artery, and descending towards the nipple.

The fourth goes to the nipple and areola ; the fifth, to the under part of the nipple and areola.

The reflected or anterior nerves are the first, second, third, fourth, and fifth.

The second and third send branches on an artery which descends towards the nipple. The fourth passes upon the branch of an artery which is distributed to the nipple. The fifth goes to the parts below the nipple, and on the branches of the arteries below it.

Plate XIII.

Fig. 1. The dorsal direct or posterior nerve going to the breast. **1**, Is the first nerve going to the pectoral muscle. **2**, The second nerve passing to the external mammary artery. This nerve in the subject before us sent a large branch to the mammary gland descending in the course of the arteria thoracica longa. **3**, The third nerve passing to the external mammary artery. **4**, The fourth nerve dividing into two branches, the upper branch passing on the external mammary artery to the breast; the lower branch proceeding upon the surface of the breast to the nipple. **5**, Passing to the gland of the breast and to the base of the nipple, joining the fourth. 6, In this subject two nerves, the upper going to the vessels below the breast, the lower to the skin below it. **7**, The seventh is distributed much below the breast.

Fig. 2. Shows the fourth posterior nerve coming out of the chest below the fourth rib, and proceeding to the gland of the breast and to the nipple.

Fig. 3. The fourth anterior or reflected nerve passing from the chest between the cartilages of the ribs, and turning back to the basis of the nipple, where it is distributed to the skin and upon the branches of arteries.

Fig. 4. The arteries and nerves of the breast of a child. Arteries: *a*, Thoracica longa. *b*, *b*, External mammary artery. *c*, *d*, *e*, *f*, *g*, Anterior arteries from the internal mammary. Nerves: Posterior or direct, **2**, **3**, **4**, **5**, **6**; the third, fourth, and fifth, going to the nipple and breast: **7**, **8**, **9**, **10**, **11**, point to the anterior or reflected nerves, of which fig. **10**, goes directly to the base of the nipple, fig. **9**, upon the artery which descends to the breast.

Fig. 5. Outline of a dorsal nerve proceeding from the spinal cord. *a*, Spinal cord. *b*, Anterior nerve. *c*, Posterior or ganglionic, joining with *b* to form the dorsal nerve. *d*, Sympathetic nerve and one of its ganglia. *e*, *e*, Two filaments from the grand sympathetic joining the dorsal nerve beyond the ganglion. *f*, The dorsal nerve. Upon this principle the dorsal nerves are formed.

Plate XIV.

Fig. 1. Female. Shows the anterior or reflected nerves of the breast, 1, 2, 3, 4, 5, 6. No. 1 emerging from between the cartilages of the first and second ribs, with a branch of the internal mammary artery, and descending with that artery towards the breast. No. 2 passing to the skin at the upper part of the chest. No. 3 dividing into two branches, one going to the skin above the breast, the other descending upon the anterior artery to the upper part of the breast. No. 4 forms two nerves, which pass upon the gland of the breast, towards the basis of the nipple, upon which its extreme branches are distributed. No. 5 joins the fourth. No. 6 goes to the skin below the breast.

Fig. 2. Shows the spinal cord, with the manner in which the dorsal nerves proceed from it. *a, a,* Spinal cord. *b,* Sheath of the dura mater. *c,* Anterior nerve. *d,* Posterior nerve with its ganglion. *e, e,* Grand sympathetic nerve, with its ganglion, from which proceed two filaments, *g, g, g,* to each of the dorsal nerves. *h, h, h,* The dorsal nerves.

Fig. 3. Male gland. *a,* An artery. *b,* Fourth nerve going to the gland. *c,* Fifth nerve: these are posterior nerves. *d,* The anterior or reflected fourth nerve, going to the basis of the nipple, and accompanied by an artery.

Fig. 4. Shows the fourth posterior nerve of the male gland, to which it is distributed.

Fig. 5. Shows the arteries of the male. The arteries and the nerves are so much connected in their distribution, that I have, in this plate, upon the nerves, given an outline of the arteries, from one of my preparations viewed posteriorly. *a, a,* The clavicle. *b,* Subclavian, and *c,* the axillary artery. *d,* Thoracica longa. *e,* External mammary artery, going to the nipple. *f,* Thoracica suprema. *g, h, i, k,* Branches of the internal mammary artery, of which *i* is going to the nipple.

EXPLANATION OF THE PLATES

OF THE

MALE BREAST.

Plate I.

This Plate is intended to show the external Appearance of the Nipple in the Male at different Ages; the internal Appearance of the Gland as covered by its Fascia at different periods of life; the Glands and the Ducts of the Male Gland injected, and the Gland and Ducts of the Fœtus.

Fig. 1. The nipple and areola at six years of age.

Fig. 2. The nipple, areola, and tubercles, with a few hairs, in a man aged forty-three.

Fig. 3. The nipple, tubercles, and hairs, of a man at seventy-three.

Fig. 4. Age, three years. Section of the male breast, showing the radiated disposition of the gland, its ligamenta suspensoria, and anterior and posterior fascia.

Fig. 5. Age, seven years. The gland, the anterior and posterior fascia, and the ligamenta suspensoria, with fat between them.

Fig. 6. Age, thirteen years. Section of the gland, ligamenta suspensoria, and fat.

Fig. 7. Age twenty-nine years. A section of the gland; the skin covered with hairs; fat and ligamenta suspensoria placed beneath it; the anterior and posterior fascia with the gland between them; fibrous and cellular tissue, with fat between the posterior fascia and the pectoral muscle; the latter appearing at the lower part of the figure.

Fig. 8. Age, thirty-eight. Its upper part shows the skin with hairs growing from it; under it, lobes of fat between ligamenta suspensoria; the nipple and gland of the breast enclosed in their fasciæ.

a, *a*, The posterior fascia passing behind the breast.

Between the posterior fascia and the pectoral muscle, cellular and fibrous tissue, *b*, *b*.

c, *c*, Some fat seen deposited in the fascia of the gland, and in the cellular and fibrous tissue, *b*, *b*.

d, *d*, The pectoral muscle.

Fig. 9. Duct of the male gland injected with quicksilver, exhibiting its ramifications and cells. The ducts divide in much the same manner as those of the female.

Fig. 10. Posterior view of the male gland, showing four ducts injected with quicksilver.

Fig. 11. Anterior view of fig. 10; four ducts seen passing to the nipple; the cells shown.

Fig. 12. Ducts injected in the male, with several ramifications.

Fig. 13. Five ducts injected with quicksilver, proceeding to small but distinct cells.

Fig. 14. Three ducts injected with quicksilver; their cells are filled, and absorbent vessels are seen arising from them.

Fig. 15. A single duct with its branches, partially injected with quicksilver.

Fœtal Gland.

Fig. 16. The gland of the fœtus at nine months, or full growth.

a, The gland.

b, The skin.

c, The cellular and adipose tissue.

d, The pectoral muscle.

Fig. 17. One of the ducts and its branches injected with quicksilver.

Fig. 18. Several ducts and their ramifications injected.

Figs. 16, 17, and 18, are placed in the opposite direction to the other drawings.

Plate II.

Fig. 1. Nipple, areola, and tubercles, shown in the adult male.

Fig. 2. Internal view of the gland.

Fig. 3. Ducts of the male gland injected from the nipple to the circumference, with an absorbent vessel springing from the mammary gland and passing to a gland in the axilla, from which other absorbent vessels are seen to arise. This is the most perfect preparation of the male gland which I possess.

Fig. 4. Absorbent vessels from the male gland, showing their number, their minute division, and the cellular appearance of their beginnings.

Fig. 5. A cluster of absorbents from the male breast.

Fig. 6. The same appearances, only the vessels are more numerous.

Fig. 7. Larger absorbents.

Fig. 8. A cluster of small and large absorbents.

Fig. 9. A cluster of absorbents arising from the nipple, and spread under the areola.

Fig. 10. Cells and vessels of the gland, with numerous absorbents.

Fig. 11. A cluster of minute absorbents.

Fig. 12. A cluster of absorbent vessels surrounding the nipple, and placed under the areola, two absorbents passing from them.

Fig. 13. A cluster of small absorbents from the nipple, with larger surrounding them

Fig. 14. Cells of the male gland injected; several absorbents arising from them accompany the veins, and sometimes cross them.

Fig. 15. A large male breast seen in posterior view on the inner side of the cutis.

Fig 16. The testis of the same subject of remarkably small size; all the drawings in this Plate being of the natural dimensions of the preparations.

Plate III.

Fig. 1. The absorbents from the nipple to the axilla, placed upon the axillary vein, whence they mount to the under part of the clavicle, passing through the absorbent aperture to terminate in the angle of the conjoined jugular and subclavian veins of the right side, at the lower part of the neck.

a, The nipple with two absorbents from it passing upon the fourth rib, and then dividing into numerous branches which cover the intercostal spaces up to the third and down to the fifth rib. They then mount to the third rib to the axillary vein, *b*, and pass on the inner side of that vein under the clavicle, *c*, where they are continued, through the absorbent aperture, into the angle of the jugular and subclavian veins.

d, The subclavian artery.

e, *e*, Axillary plexus of nerves.

Fig. 2. Shows the absorbent *a*, of fig. 1, passing under the blood-vessels, *b*, the axillary vein, *c*, the artery, across four of the upper ribs, joining with the anterior, entering the angle of the jugular and subclavian of the right side at *d*.

e, The axillary plexus of nerves.

Fig. 3. *a*, Absorbents from the nipple and areola passing into a cluster of absorbents in the axilla, to an absorbent gland there.

Fig. 4. A diagram of the termination of the absorbents of the arm and breast, *a*, thoracic duct and its termination, *b*, *b*, the absorbents of the neck on the left side, *c*, absorbents of the arm.

Fig. 5. This diagram shows the termination of the absorbents from the arm and neck on the right side, in the angle of the jugular and subclavian vein.

SECRETION OF MILK IN THE MALE.

"This case occurred in a robust, sanguine soldier, twenty-two years old. * * * * When eighteen years old, he often felt a pricking sensation in his breasts, and slight periodical colic. About a year later, he observed, after each occurrence of such symptoms, a slight swelling of, and milky discharge from, the mammæ; and during work, his shirt was several times a week wetted with it. When in the hospital for acute rheumatism, a considerable quantity of milk was found to be secreted. On examining the breast and nipples, the latter were found highly red, erectile, somewhat cracked at their apices, and much higher than in men generally, and surrounded by a somewhat darker areola, through which a subjacent vascular net-work could be seen. On pressing the papillæ, two or three fine streams of milk would jet out of minute orifices; it had a blueish-white colour, and a very sweet taste. The secretion was constant, but increased at various periods, especially at night, producing a somewhat painful sensation till it was evacuated. The usual quantity was from half an ounce to an ounce daily, but sometimes not more than two or three drachms. On one occasion, a wine-glass full was drawn off, and in the fortnight that he was under observation, ten or eleven ounces were secreted. After the evacuation of it, he said he always had head-ache, faintness, and sometimes pains in the abdomen. Diet had no material influence on the secretion. Collected in a glass, and left quiet, cream soon separated, and sometimes the milk at once coagulated. After some hours' standing, the butter separated, and floated at the top in yellow drops. The milk had a slightly alkaline reaction. Its specific weight was 1·024; and it contained, according to the analysis of Mayer, in 100 parts,—

Fat	1·234
Alcoholic Extract	3·583
Watery Extract	1·500
Insoluble	1·183
Total solid contents	7·500

[Dr. Schmetzer of Heilbronne, in Schmidt's *Jahrbucher*, Juli 1837.—From the *London Medical Gazette*, vol. xx. p. 846.]

ON THE COMPARATIVE ANATOMY

OF THE

MAMMARY GLAND.

It is not my intention to give an extended view of the Comparative Anatomy of this organ, as it would be foreign to my original design, and if minutely pursued in its details would be attended with little utility. Indeed, the ordinary duration of the life of man would be insufficient for the study of the mammary structure in all the Mammalia, and I shall, therefore, content myself with the description of the gland in the classes of Graminivora, Carnivora, and Omnivora, in comparison with that of the human subject.

The mammary gland in other Mammalia bears a great resemblance in its secretory structure to that of the human female.

Generally there is a prominent nipple with the exception of the whale tribe, and ornithorynchus so far as I am informed.

The straight or mamillary tubes vary considerably in number. The cow, the ewe, and the goat, have one tube in each teat, but in the rhinoceros there are twelve. The pig has two tubes in each teat; the guinea pig but one. The hare and rabbit several. In the cat and bitch there are several; in the porpoise only one.

The reservoirs in the Graminivora are enormously large; in the Carnivora, comparatively small. In the pig there is scarcely any reservoir; in the porpoise the great enlargement of the milk tube is a substitute for the reservoir.

The lactiferous tubes are arborescent, as in the human subject, in the guinea pig, the cat, the bitch, the pig, and the porpoise; but in many of the Graminivora there are reservoirs, cells, and canals, which form a foliage at their extremities where they terminate in the milk-cells. The rhinoceros is an exception.

In general, their *particular* organization is the same as in the human, *viz.*, mamillary tubes, reservoirs, ducts or canals, glandules, and milk-cells,

Their *common* organization consists of arteries, veins, absorbents, and nerves. The course of the arteries greatly varies. They are derived in the human subject from the subclavian and axillary. The first send the internal mammary artery to supply the breast; and the axillary, the thoracica longa, external mammary and thoracica suprema.

But in some Mammalia they spring from the epigastric, when the gland is pubic or inguinal; from the axillary, the internal mammary, the intercostal, lumbar, and epigastric, when the glands are pubic, ventral, and pectoral; and this circumstance leads me to observe, that if arterial blood reaches the gland, the source of its supply is of little importance; and the same observation applies to the veins, as they terminate variously.

The absorbents of the gland are in all classes numerous, but more easily injected in the Carnivora than in the Graminivorous animals.

The nerves differ in their distribution, but as to sources, they obey one law, *viz.*, that they are composed of the two spinal roots and of the grand sympathetic nerve, and hence the ready sympathy which exists between the ovaria, uterus, and mammary glands.

The physiology of the organ is the same in all excepting the opossum tribe, in which the young one hangs from the nipples in the carrying-pouch which contains them*.

The milk is formed from the arterial blood and secreted into the milk-cells, around which the arteries ramify with infinite minuteness; whether they terminate by open mouths, or secrete from their surfaces, I have not yet been able to determine positively; but they divide with extreme

* See Morgan, Professor Owen, &c.

minuteness upon the mucous membrane of the milk tubes, and under very minute injections of the arteries, the cells are sometimes found filled with injection, but it is doubtful whether this may not arise from rupture of the coats of the arteries.*

From the cells the milk is carried forwards by their elasticity into the ducts, and by the vis a tergo of the secretion to the reservoirs, and here it is retained until the process of sucking commences, when the draught impels it still more.

The absorbents are designed to improve the quality and, under accumulation, to lessen the quantity of milk.

The nerves sympathetically connect the nipple with the gland, and the gland with the uterus and ovaria.

The milk is very similar in all species of the human female, as the negress makes an excellent wet-nurse to the European, and the milk of several animals will sustain and nourish the infant, and may be substituted for human milk; and the milk of one species of animal will sustain the young of some others, as the lamb is often reared by the milk of the cow.

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* I intentionally postpone saying more upon the subject at present, as I am still pursuing this minute investigation; but it is certain that the cells and milk tubes are not continuous with the arteries, their internal structure entirely differing; the one being lined with a serous, and the other with a mucous membrane, and the arteries being infinitely more minute than the cells and ducts.

EXPLANATION OF THE PLATES

OF THE

COMPARATIVE ANATOMY

OF THE

MAMMARY GLAND.

Plate I.

Of the Cow. Fig. 1.

This Plate gives a view of the udder of the cow injected, showing the teats and some of the blood-vessels, and the gland entirely filled with injection, excepting a large reservoir.

There are generally six teats, but the two posterior lead to imperfectly formed glands.

The two anterior teats are much larger than the two posterior, and are directed forwards, and so are the two posterior, and their direction renders them more easy of access to the offspring.

Each teat contains only one tube, lined by a mucous membrane, having a vascular layer upon its outer surface, both arteries and veins being of considerable size. Next an elastic coat appears composed of a net-work of cellular fibres, which by crossing each other in all directions, render it elastic, so as to allow of a great increase of its diameter by the pressure of the milk, and when distended it contracts and assists in the expulsion of the fluid.

The common integuments next invest the elastic coat, and some condensed fibrous matter is added at the orifice so as to check its dilatation or expansion, and to force it to remain small under great extension of the tube.

The teat at its junction with the udder opens into a large reservoir, as is seen in the Plate, a bougie being passed through the tube into it. (*See Plate* I.) This reservoir will contain a quart of milk, and in very large cows considerably more. It is lined with a similar mucous membrane to the teat, and is, indeed, a continuation of it.

This reservoir opens into large cells, and these into canals rather than lactiferous tubes, which lead to the glandules and form the inequalities or waves upon the surface of the gland. In these glandules, which terminate in a foliated edge, are placed the milk cells.

Fig. 2. View of the glands in the fœtal calf.

a, The spinal marrow.

b, The aorta.

c, The vena cava.

d, The nerves derived from the lumbar plexus, and these are connected with the ganglia of the great sympathetic nerve, which crosses them, and is the medium of connection with the uterus and ovaria, and udder.

e, *e*, The epigastric artery and vein.

f, *f*, The glands.

Fig. 3. Udder of a small fœtal calf injected, to show the four teats and glands, filled with wax. The two imperfect teats were filled, but the wax passed only to a short distance.

Fig. 4. The milk-cells of the cow magnified three times.

Fig. 5. The milk-cells magnified twenty times.

Fig. 6. The milk-cells magnified fifty times.

The arteries and veins of the gland are seen in the depressions between the four portions of the udder in fig. 1.

Observations. A moderately good cow will give, when in full milk, from twelve to twenty quarts per diem, varying with its pasture.

A very large and good cow, milked three times per diem, has been known to yield thirty quarts.

At the close of each milking the milk is richer than in the beginning.

More milk is given by the cow in the morning than in the evening.

More cream is given out in winter than in summer.

The milk left by the calf is good.

The milk suffered to stand separates its cream or oily part, which being specifically lighter than the milk, rises to the surface: it is composed of numerous globules of unequal sizes, which may be entirely separated from the milk by frequent filtration.

The proportion of cream necessarily varies with the richness of the milk, the goodness of the pasture, and the period from calving.

1 month	Cream / Milk	$\frac{1}{8}$
2 "	Cream / Milk	$\frac{1}{7}$
3 "	Cream / Milk	$\frac{1}{6}$
4 "	Cream / Milk	$\frac{1}{4}$
5 "	Cream / Milk	$\frac{1}{8}$
6 "	Cream / Milk	$\frac{1}{8}$
8 "	Cream / Milk	$\frac{1}{8}$
9 "	Cream / Milk	$\frac{1}{7}$
10 "	Cream / Milk	$\frac{1}{6}$

If milk be skimmed again after twenty-four hours, the proportion of cream is larger.

This table shows that the variety is from one-fourth to one-eighth, but one-eighth is a frequent proportion, and eight quarts of milk produce a quart of cream.

The most cream is given out in a broad vessel from two to three inches deep.

The cream is thicker in cold than in warm weather.

Cream consists of butter and butter-milk. The butter is produced by agitation of the cream in an upright or turning churn, or by agitating the cream in a bottle.

A quart of cream produces a pound of butter.

If butter be melted, and some curd be removed from it, the butter will keep a great length of time.

The butter-milk, which remains when the butter is made, still contains some butter, curd, and sugar.

Oil separates from cream, if it be either heated, or kept long.

After the separation of the cream, another spontaneous change occurs, which is the formation of an acid (lactic), which separates the curd; or it may be separated by rennet.

The curd dried and pressed forms cheese.

It may be separated by acids and alcohol, to form cheese; and a kind of cheese may be formed from the serum of the blood by precipitating its albumen by acids.

When the curd is separated, the residue is whey.

The whey when evaporated deposits the sugar of milk.

Of the Colostrum.—The milk given for two or three days after calving is often bloody. In this state, the cream and milk are not properly separated, and there is a thick yellow substance, which looks like cream, occupying a considerable part of the fluid which has been drawn.

On the first day, this yellow substance occupied twenty measures out of twenty-four.

On the second day, the yellow matter was three in twenty-four measures.

On the fifth day, the yellow matter was cream 4, milk 20.

On viewing the colostrum with a magnifying glass, it showed, under the fourth of an inch lens, a net-work composed of numerous flakes; each flake containing milk globules in the progress of their formation, but not yet completely separated.

The particles of milk under the microscope appear oily. They are rounded, but not uniform in size. If the glass upon which they are placed is inclined, they roll down in a beautiful avalanche.

For the chemical history of cow's milk, see the *General Observations on the Composition of Milk.*

Plate II.

The Dug of the Ass.

Fig. 1. Shows the two teats of this animal's udder.

The teats at first sight appear single; but one in this injected dug contained three mamillary tubes, and the other contained only two.

The glands are injected with wax, and form a foliage upon their surfaces. Glandules appear upon every part of this foliage, and in these the milk-cells are readily traced.

At the roots of the teats are reservoirs, of large size, but not proportionably equal in magnitude to those of the cow, yet stil capable of containing many ounces of milk.

Fig. 2. Is the udder of a fœtal mare, in which there are two straight tubes in each teat, opening into the lactiferous canals. These canals or tubes terminate even in this young animal in cells, which are filled with mercury.

Milk.

The specific gravity of asses' milk is **1·033 to 1·0355.**

Composition.

Its sugar is larger in quantity than that of the cow, and it is, therefore, a most wholesome food.

Cream, 2·9.

Curd, 2·0.

Sugar, 4·5.

Allowed to stand, it divides itself into cream and whey.

$$\frac{\text{Cream } 3}{\text{Whey } 45} \quad \text{or} \quad \frac{1}{15}$$

It does not curdle so soon as cow's milk, but at length it deposits curd.

Alcohol precipitates curd from the whey.

Sugar is readily obtained from the whey by evaporation.

By agitation, it produces a loose butter in broken fragments.

The taste resembles somewhat the human milk.

Mare's Milk.

Specific gravity 1·045 to 1·0346.

It yields but little cream, but it separates abundance of sugar.

It readily undergoes the vinous formation.

Fig. 3. Shows the udder of the deer.

This animal has four teats.

Two of the teats are placed anteriorly, and two posteriorly.

Each teat has a milk tube in it, which I have injected with wax.

At the root of the teat, it opens into a considerable reservoir, which sends forth smaller reservoirs and canals to form a foliage upon the surface of the gland.

In this foliage the glandules are placed.

The milk-cells are contained in the glandules.

Fig. 4. A section of the gland has been made, to show its large reservoirs, and numerous cavities and canals, to receive and to convey the milk.

Plate III.

Shewing the Udder of the Ewe.

There are in the ewe two teats, leading into two large glands, and there are sometimes imperfect teats behind.

The teat is covered by the common integuments condensed at the orifice of the tube, to prevent its dilatation; the teat is covered by wool and little glands.

Under the integuments, an elastic structure is found, composed of cellular fibres, passing in a longitudinal, circular, and oblique direction, which yield to the pressure of the milk, so as to enable the tubes to retain it, and also by their elasticity to discharge and expel it.

Under this elastic tunic is a plexus of arteries and veins, the vessels of which are numerous.

The inner or lining membrane of the tube is of the mucous character, and it possesses a few small glands. The vascular plexus surrounds it, and the common integuments enter about a quarter of an inch into its tube.

The milk tubes of the teats open into a reservoir, capable of containing many ounces of milk, and a mucous membrane lines it, similar to that which lines the teat.

Milk canals begin from the reservoirs, and these form a foliage on the surface of the gland.

The foliage is turned in opposite directions in the two glands.

The foliage contains the glandules, and the milk-cells are capable of being filled with coarse injection.

Fig. 1. Shows the two teats and the vascular covering of the mucous membrane.

At the root of these are the reservoirs injected.

The whole surface of the two glands shows the foliage containing the glandules and cells.

Fig. 2. Shows the fœtal glands, with their arteries, veins, and nerves. The inner line of the three on each side is the artery; the second, the veins; and the third or outer, is the nerve.

Fig. 3. One gland from an ewe lamb of only six months, in which there was a considerable quantity of milk. A section shows several reservoirs in the interior of the gland in which the milk was contained, a year and an half before it is usually with lamb.

Fig. 4. The milk-cells magnified twenty times.

Fig. 5. The milk-cells magnified fifty times.

Of the Milk of the Ewe.

It is abundant, and is sometimes used as the food of children.

It forms a considerable quantity of cream.

Its butter retains a large quantity of curd, and therefore it easily becomes rancid.

Its cheese is rich but contains much oily matter.

According to Brande its specific gravity is 1·036 to 1·041.

Its composition—

Cream	11·5
Butter	5·8
Casein or Curd	15·3
Sugar	4·2

See Henry, Stiprian Luiscius, Bondt.

Plate IV.

Showing the Udder of the Goat and Mammary Gland of the Rhinoceros.

Fig. 1. The two glands in the goat forming its udder, filled with wax.

The teats are of large size, and smooth upon their surface.

They contain each a single tube.

They terminate in a reservoir.

From the reservoir the glandules proceed to form a foliage upon the surface of each gland, which foliage is in one gland turned to the right, on the other to the left.

In the foliage, not only the glandules, but the milk-cells are found.

The two glands are firmly united to each other by a fibrous tissue.

Fig. 2. The milk-cells of the goat magnified ninety-six times. They vary in form and in their size.

I kept a goat in my stable upon hay and oats, and it gave a pint of milk in the morning, and three-fourths of a pint in the evening; but under green food, and abundance of it, a large goat will yield a much greater quantity.

As the milk is very wholesome, and the animal is easily maintained, it is often kept on board ship to supply the wants of the crew and passengers. In the East Indies, goat's milk is much used for the children of European parents, as in that climate the pasture for cows is parched up in the intervals of the rainy season. In the West Indies, also, a great number of these animals are kept, as the milk in that climate agrees well with children.

The cream of the goat's milk is rich, but the butter is not so firm as that of cows. After the cream was agitated for two hours it produced butter of a white appearance.

Abundance of cream is produced after forty-eight hours, although at twenty-four hours it had been skimmed, and the cream removed.

In seven days abundance of curd or albumen was precipitated.
Alcohol also threw down abundance of curd.
The whey has a sweetish taste when the curd is separated.
The milk has sometimes both the taste and an odour of the animal.
Specific gravity, 1·036.

100 parts of the milk contains,—

Butter	4·08
Curd	4·52
Residue of Whey	5·86
Water	85·50

Luiscius and Bondt,—

Cream	7·05
Butter	4·56
Casein	9·12
Sugar	4·38

On the Mammary Gland of the Rhinoceros.

Professor Owen, to whose genius and labours the Royal College of Surgeons is so much indebted, gave me a portion of the mammary gland of the rhinoceros that I might investigate its structure, but upon condition that I returned a part of the preparation which I might make from it to the College.

The gland was placed under the skin of the abdomen, forming a thin and expanded substance.

Fig. 3. The teats, two in number, are shown, and each teat contained twelve mamillary orifices. These openings led into large lactiferous tubes, which became arborescent in the gland, and terminated in numerous milk-cells.

Fig. 4. Shows the ducts and the milk cells fifty-two times magnified. It did not contain milk as the animal was not in a state of lactation.

Plate V.

Mammary Glands of the Hare.

Fig. 1. Shows the general form and disposition of the glands. They reach from the pubes to the cervical extremity of the sternum, and are placed on each side of the linea alba.

There were six nipples to the glands of this hare, three on each side, and a gland to each nipple.

The ducts of one gland do not communicate with another, and the glands are only connected by a fibrous tissue.

Fig. 2. Three ducts injected with wax. A reservoir appears at the basis of the nipple. The various milk tubes and glandules are very perceptible.

Fig. 3. The duct injected with wax. The duct at the nipple is seen tied. The reservoir is large and distinct. The branches of the milk tubes are shown with numerous glandules on their extreme branches.

Fig. 4. Ducts injected with mercury, and around the beginning of the duct from the nipple the milk cells are filled with the injection, but it requires the aid of a lens to observe them distinctly.

Fig. 5. A duct and its milk cellules injected with mercury, and magnified twice, by which the cellules are rendered conspicuous.

Fig. 6. The milk cellules magnified twenty times.

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Plate VI.

Of the Mammary Gland in the Rabbit.

Fig. 1. Shows the general disposition of the glands in the rabbit.
There were in this animal eight teats. The glands extended from the neck to the pubes.
There were as many distinct glands as nipples as regarded their secretory structure, but they were united by a fibrous tissue.

Fig. 2. Four ducts injected, showing their reservoirs, which are very large, the lactiferous tubes terminating in them, and numerous glandules on the extreme branches of the duct.

Fig. 3. A single duct injected with wax, the duct tied at the nipple, and the large reservoir at its basis filled with wax. The ducts are seen proceeding from the reservoirs with glandules at their extremities.

Fig. 4. These lactiferous ducts and their cells injected with quicksilver.

Fig. 5. A lactiferous duct injected with mercury to show the cellules, twice magnified.

Fig. 6. Milk cellules injected with mercury, and twenty times magnified.

Plate VII.

The Guinea Pig and the Cat.

Fig. 1. The mammary glands of the guinea pig placed in each inguinal region.

They are injected with wax.

The substance of the glands is of a tender pulpy texture, which breaks down under the weight of mercury, but admits of being injected with size or wax.

A mamilla or nipple is connected, containing a tube by which the glands were injected. There is no distinct reservoir, only an enlargement of the tube.

The tube terminates in glandules containing milk cells.

Fig. 2. Shows the milk-cells of the guinea pig magnified twenty times.

Fig. 3. Exhibits the milk-cells magnified fifty-four times, appearing like Portugal grapes.

Fig. 4. The mammary glands of the cat, reaching from the axilla to the pubes on each side of the sternum and linea alba.

There were eight nipples in this animal, four on each side.

The nipple is appended to each gland. There were eight separate glands as to secretory structure, but united by a fibrous tissue to each other.

A branch of the epigastric artery may be seen going to the glands from the groin.

Fig. 5. One of the glands of the natural size injected with quicksilver. Near its centre is seen the nipple containing several tubes, one of which has been injected.

A reservoir appears at the base of the nipple, and the arborescent mammary glands are exhibited radiating through the gland, some of them terminating in glandules, and the milk-cells appear in them. This animal was near the termination of lactation. Some arborescent vessels were filled in injecting the gland, which looked like absorbents.

Fig. 6. The cells of a portion of the mammary gland in the cat injected with yellow wax, and magnified twenty times.

Plate VIII.

Of the Mammary Gland of the Bitch.

Fig. 1, gives a view of the general form and structure of the mammary glands in the bitch.

Divided into pubic, abdominal, and pectoral portions.

The number of teats in this subject was ten.

The epigastric arteries send branches into the gland at its pubic portion. The axillary artery at its pectoral, and the internal mammary at the posterior or abdominal end of the sternum to its middle portion.

Fig. 2. The duct and glandules of one gland injected.

Fig. 3. A duct with some of its glandules and cells injected.

Some arborescent vessels were also injected.

Fig. 4. A portion of the gland injected by the ducts with mercury, and the milk-cells are filled, and very minutely injected near the centre of the preparation.

Figs. 5 and 6, Exhibit injected milk-cells magnified twenty times.

Having succeeded in procuring the milk of a pointer bitch a few days after she had pupped, I sent a bottle of it to Dr. Golding Bird, who had the kindness to analyze it, and the following is his letter, for which I feel greatly obliged.

"*Dec.* 28, 1839.

"My dear Sir Astley,

"Anxious not to keep you waiting for an account of the chemical properties of the specimen of bitch's milk you favoured me with, I devoted a few hours yesterday to its examination.

"A bottle capable of containing 54·1 grains of water, held 55·4 grains of the milk; its specific gravity, consequently, was 1·024.

"By repose, a quantity of viscid cream separated, forming in the specimen you sent me, about one-sixth of the bulk of the whole.

"Carefully evaporated in a salt-bath, twenty-five grains left six grains of a yellowish greasy residue. This, when repeatedly boiled in strong alcohol, left 4·2 grains of matter insoluble in that menstruum; this residue consisted chiefly of curd, resembling in its physical and chemical properties the caseous matter of cow's milk; by incineration it left 0·25 grains of saline matter, consisting chiefly of the earthy phosphates.

"Not to weary you by a detail of the remaining steps of the examination, I content myself with subjoining the result of the analysis, calculated for 100 grains.

Butter, containing some common salt and sugar of milk	7·2
Caseous matter	15·8
Earthy saline matter, chiefly phosphate of lime . .	1·0
Water and volatile matter	76·0
	100·0

"From this examination it appears that the milk of the bitch differs from that of the cow, ass, and human female, rather in the different proportion in which its ingredients exist, than in any other particular.

"I remain, dear Sir Astley,

'Your's very faithfully,

"GOLDING BIRD."

"*Wilmington Square.*"

Plate IX.

Of the Mammary Gland of the Sow.

Fig. 1. The gland connected with one teat injected.

Two tubes are seen in the nipple, which proceed into the gland, and terminate in numerous glandules, which are perceptible over the whole surface, and are particularly distinct in this animal.

In the preparation, they are injected with yellow and red gelatine.

The two tubes or ducts are of unequal sizes; one with its glandules occupying one-third, and the other about two-thirds of the gland.

Fig. 2. Shows a portion of a lactiferous tube, injected with quicksilver to exhibit its minute ramifications through the substance of the gland. This is twice its natural dimension.

Fig. 3. A view of a portion of a preparation, with milk-cells of the gland very minutely injected, and twice magnified.

Figs. 4 and 5. Milk-cells twenty times magnified.

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Plate X.

The Mammary Gland of the Porpoise.

Fig. 1. View of the glands injected. Divided into two glands, one placed on the right, and the other upon the left side of the anus and vulva.

The extremities of the nipple have a ligature upon them.

The tube from each nipple opens into a large duct, which serves the purpose of a reservoir.

The tube entering into the substance of the gland, sends off at angles of different degrees, branches of lactiferous ducts.

At the terminations of the lactiferous tubes, the glandules appear.

In these glandules, small but numerous cells are found, which are drawn in fig. 5 magnified twenty times, and which were taken from another preparation of the gland in a state of lactation.

Mr. Erle, surgeon at Cromer, in Norfolk, had the kindness to send me, at my request, the posterior part of the abdomen of a porpoise, and I was so fortunate as to receive it in November last, in a lactating state.

The subject of fig. 1 he sent me twelve months before.

I have injected and preserved them both.

Fig. 2. Shows the situation of the clefts in the skin, which contain the mamillæ, and which are placed on each side of the anus and os externum vaginæ. They are considerably smaller than nature in this drawing, but figs. 1, 3, and 4, are of the natural size.

Fig. 3. One of the clefts a little open, to show the end of the mamilla buried in it.

Fig. 4. Shows the cleft more open, exhibiting the nipple and its orifice projecting into it. These clefts are placed in their natural direction in the long axis of the animal, but fig. 2 is not.

I have had no opportunity of comparing the milk of the porpoise with that of the whale: but in the latter animal it appears that the milk is very abundant. Mr. Watson observed that when whales were driven on shore in Scapay Bay, the young ones continued to swim round their dams until the returning tide left them also dry. During this interval, he noticed some of them hanging to the teats of their mothers; and when they separated, the milk flowed from the teats in considerable quantity. It was white, and as it flowed appeared of the consistence of cow's milk; but upon standing, it seemed to throw up cream, so as to become more thick in its appearance. As he walked around the animals, pools of milk were distinctly visible. The moans of the mothers, when the young were removed, were piteous: this induced one of his servants to lift a small whale, and to apply it to the mother's teat, of which it immediately laid hold.

To Dr. Golding Bird, to whom I have already very imperfectly stated my acknowledgements, I am indebted for an analysis of the milk of the porpoise. I obtained the fluid, by squeezing the breasts of the second porpoise which I received, and as it appeared to differ from any other milk that I had seen in the fatty matter which it contained, I sent a vial of it to Dr. Bird, who wrote to me the letter which I subjoin.

"*Dec.* 5, 1839.

"Dear Sir Astley,

"I have at length completed my examination of the porpoise's milk, or rather cream, for it did not betray the slightest inclination to separate into cream and skim-milk; and after keeping it for a few days, the whole, even in a closed vessel, solidified into a kind of cream-cheese.

"The quantity at my disposal was, as you are aware, but small, and consequently anything like an elaborate analysis was impracticable.

"The milk faintly reddened litmus paper, exposed to heat it did not coagulate, and hence contained no free albumen; but the addition of acetic acid caused a deposition of curd, as in the case of cow's milk.

The weight of the bottle and the milk was . .	406·9 grains.	
" " containing the same bulk of distilled water	406·0	"
The weight of the bottle itself was . . .	338·6	"

Hence the specific gravity of this milk was but 1·0044.

"13 grains of the milk, on being evaporated, left some curd or casein, but mixed with a large quantity of fluid yellow oil; an intolerable odour resembling that of putrid herrings was evolved during the evaporation.

"The extract thus left weighed 5·8 grains, from which ether dissolved 3 grains of oil; consequently, but 2·8 grains consisted of curd.

"The saline matters present were the alkaline chlorides and sulphates, soluble in water; and the phosphates of lime and magnesia, insoluble in that menstruum. From this examination, it appears that porpoise's milk, of specific gravity 1·0044, consists of—

Curd or casein mixed with small portions of saline matter	21·53
Fatty or oily matter, possessing a strong fish-like odour .	23·00
Water and volatile matters possessing a pungent odour (phocenic acid?)	55·47
	100

"The very low specific gravity of this milk in all probability arises from the large quantity of oil or fat present as compared to curd. The curd obtained from the specimen of milk you favoured me with, I have sent for your inspection: it still contains traces of fat."

Professor Owen informs me that some milk which he obtained from a porpoise felt like butter upon the tongue.

LONDON: HARRISON AND CO., PRINTERS, 45, ST. MARTIN'S LANE.

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:

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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.

PREFACE.

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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.

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

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 jusqua'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.

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.

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 substance 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 acknowledge; 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 ædematous 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.

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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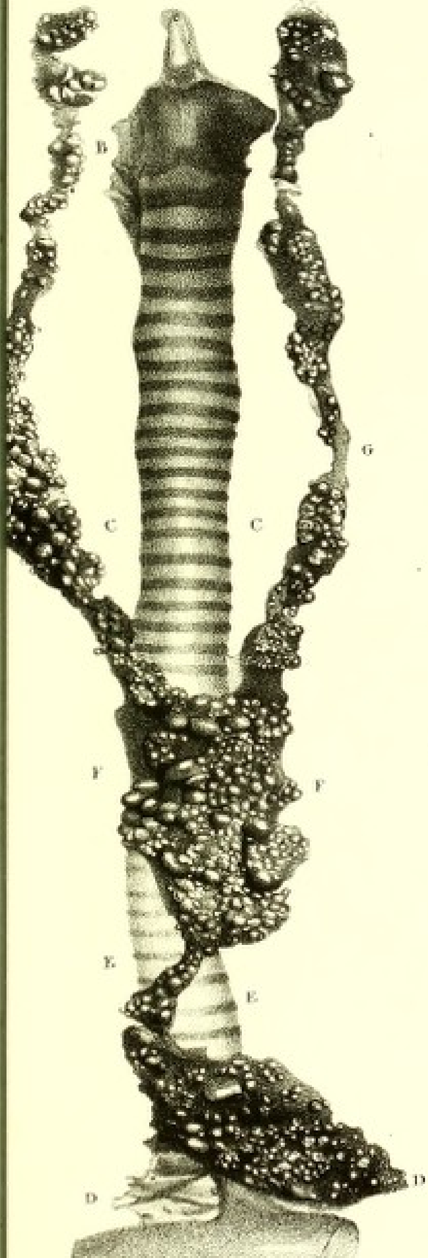

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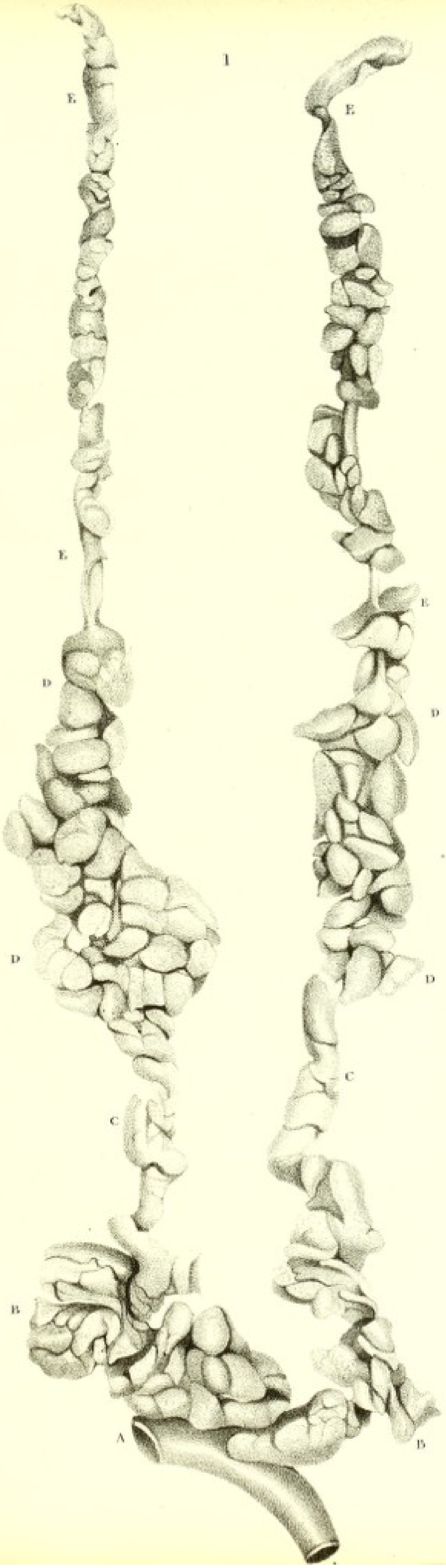

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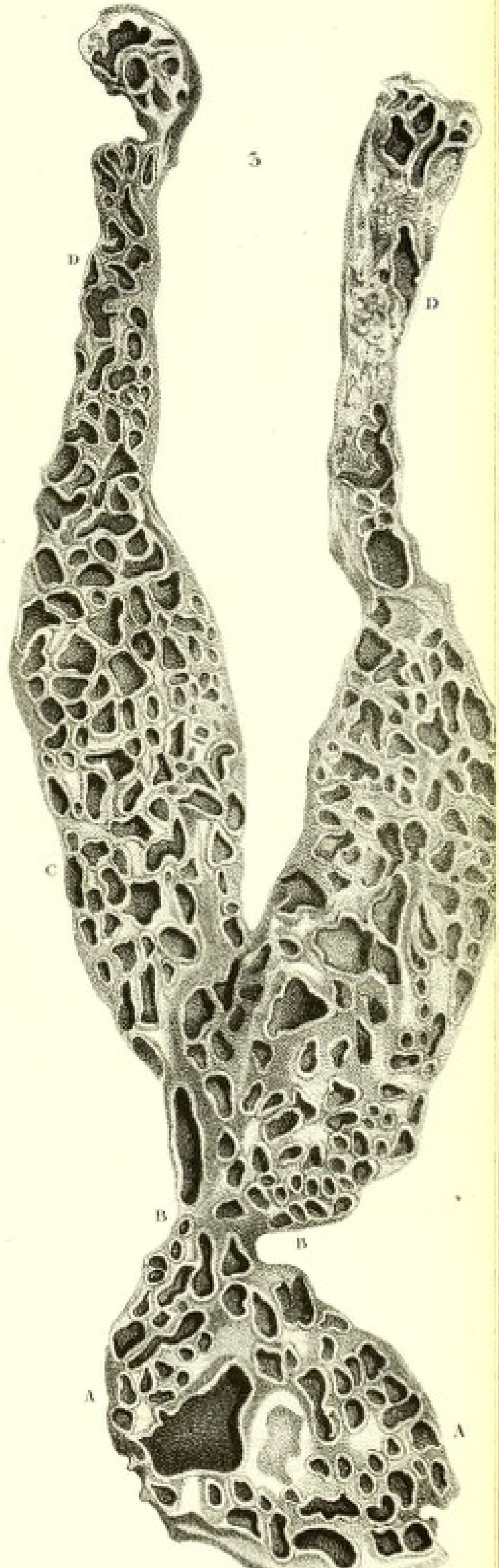

PLATE II.

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.

Plate 2.

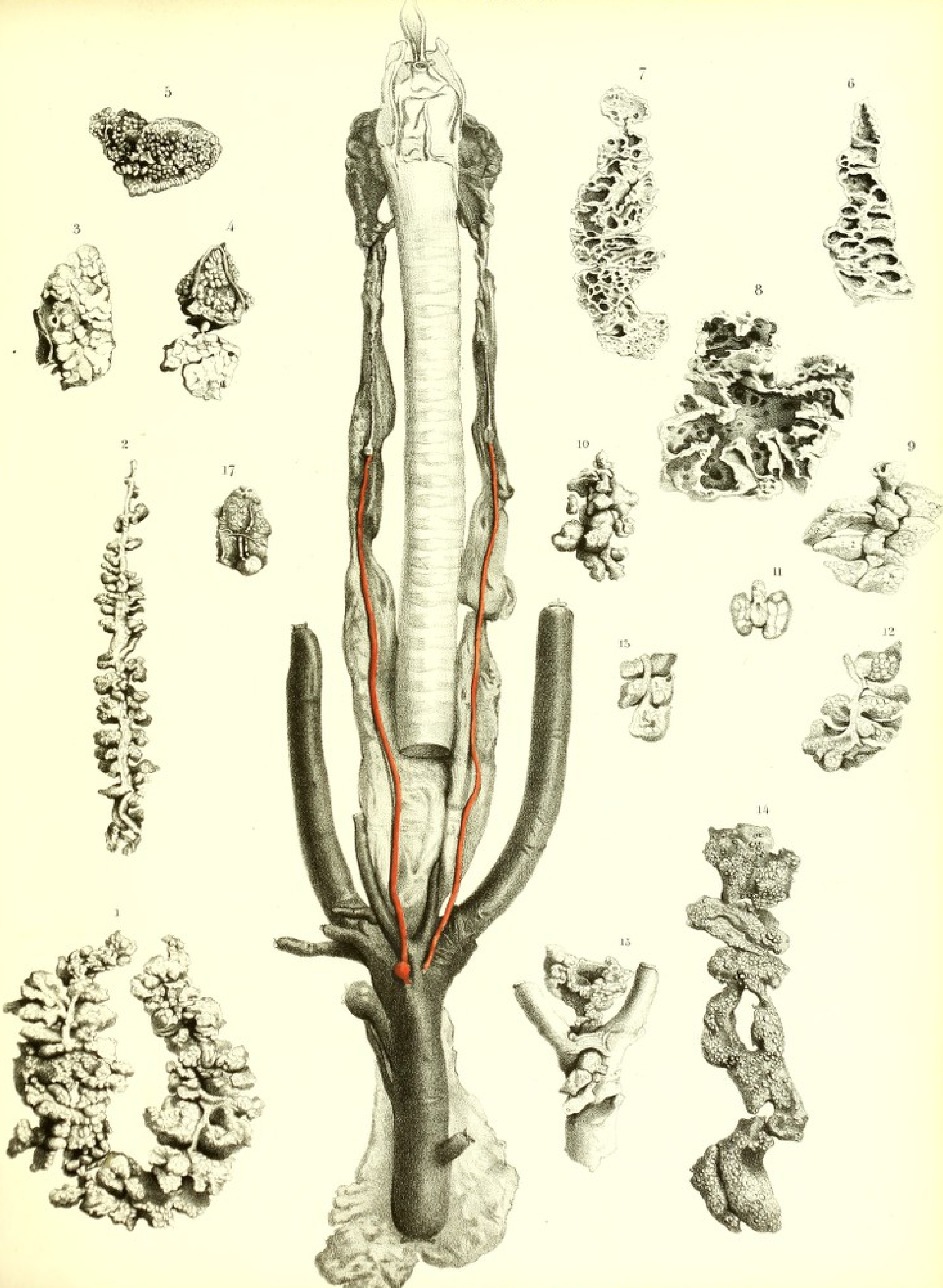

PLATE III.

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.

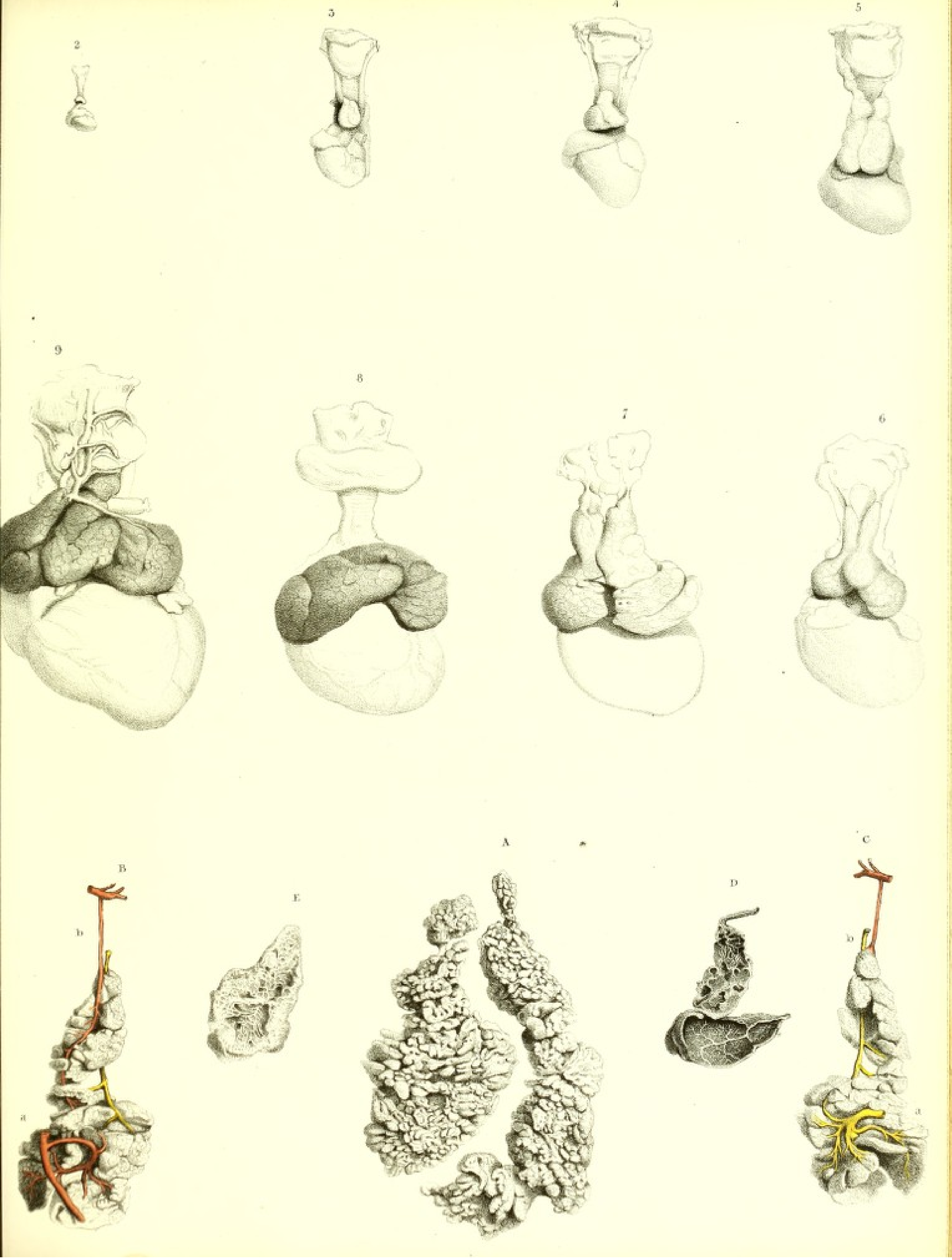

PLATE IV.

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.

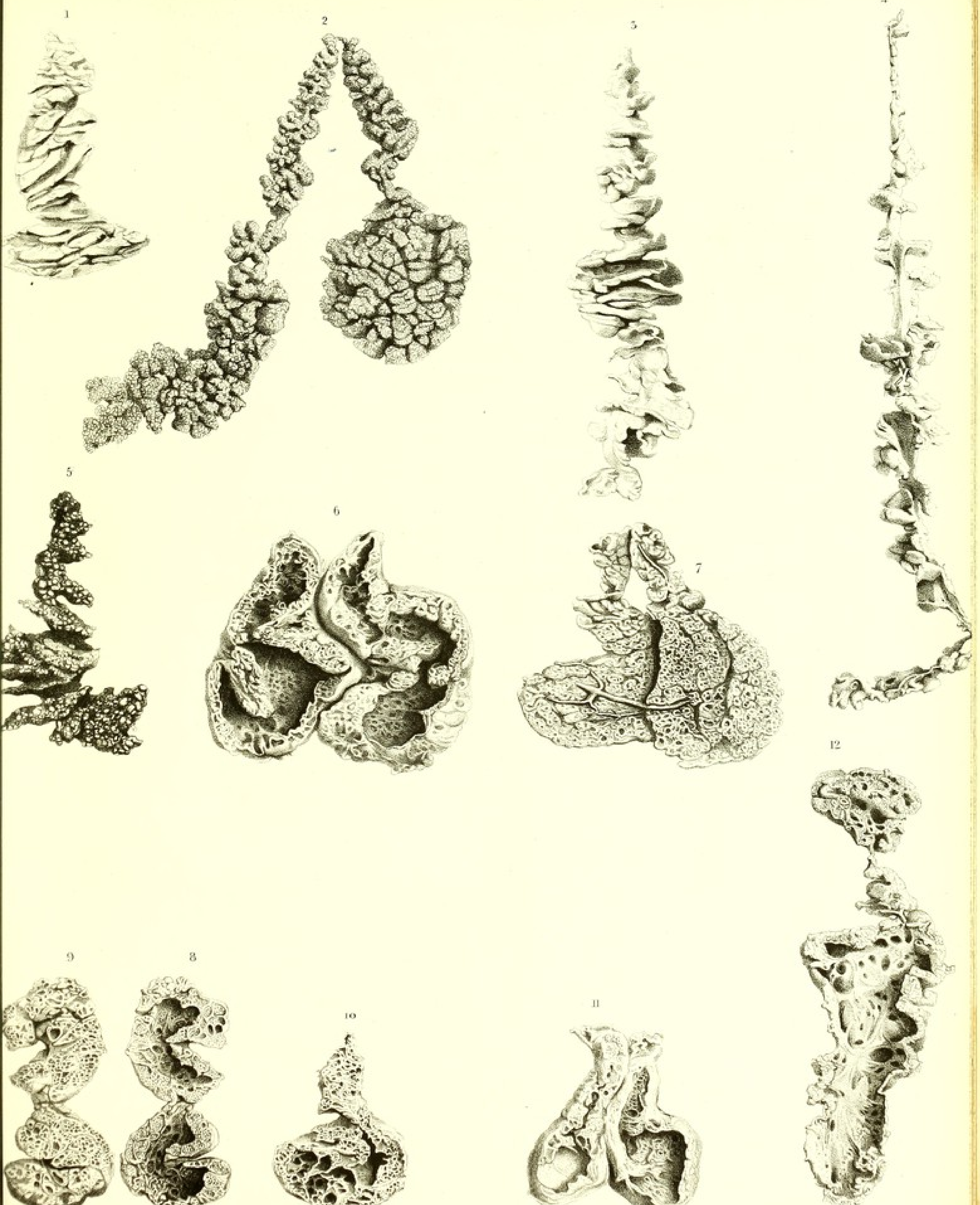

PLATE V.

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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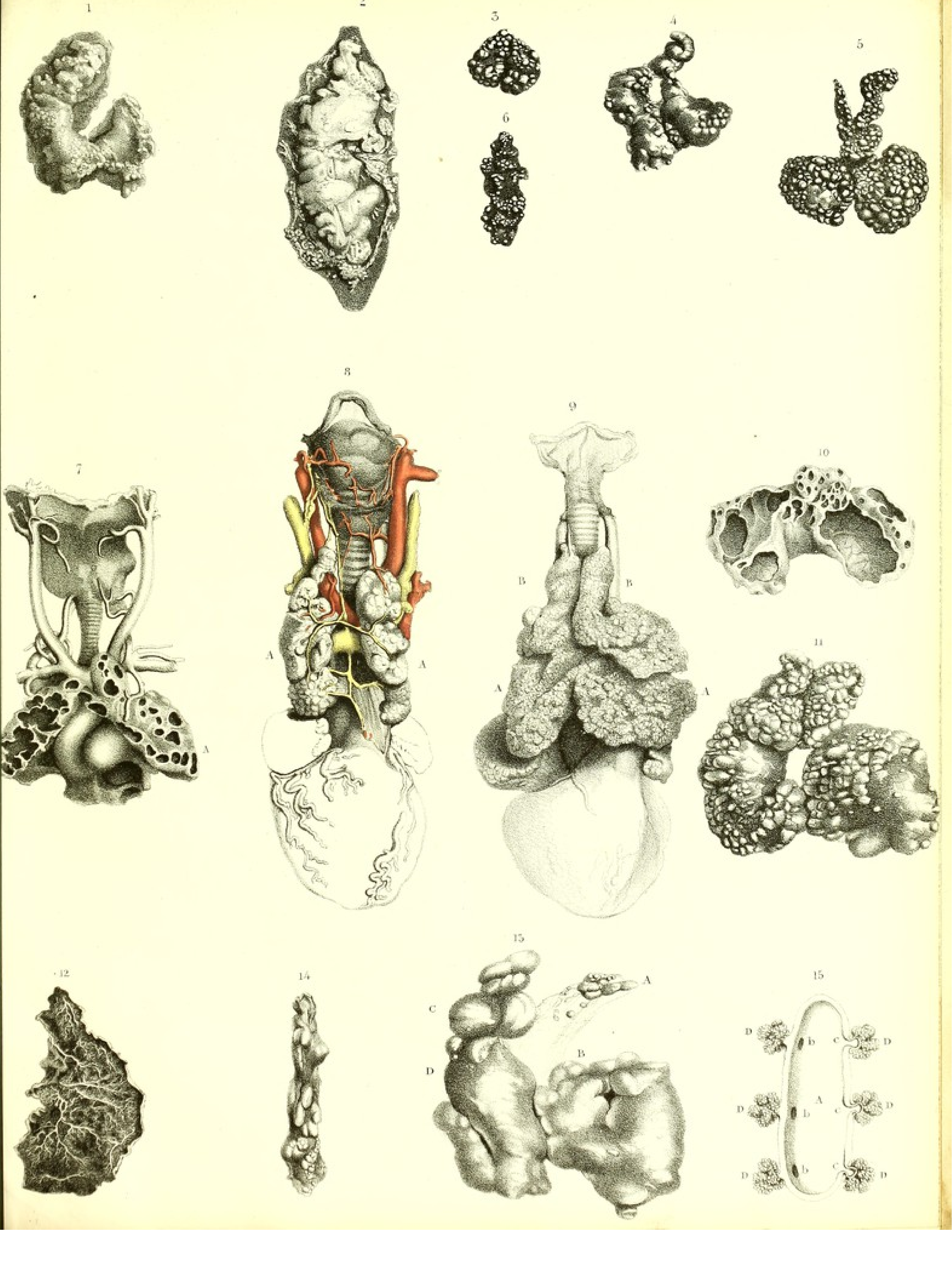
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